

# EVA Checklist

## STS-121 Flight Supplement

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

**Basic  
January 10, 2005**

### **NOTE**

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

National Aeronautics and  
Space Administration

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



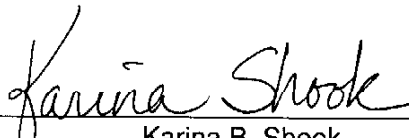


MISSION OPERATIONS DIRECTORATE

**EVA CHECKLIST  
STS-121 FLIGHT SUPPLEMENT**


BASIC  
January 10, 2005


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EVA CHECKLIST  
STS-121 FLIGHT SUPPLEMENT

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AIRLOCK  
CONFIG

## 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 lockers/wall Cooling Loop Jumper – stow in EMU Equipment Bag EMU Servicing Kit – temp stow Helmet Lights – remove covers EVA Bag
FDF Locker	Cuff Checklists (2) – stow in EMU Equipment Bag <u>DEPRESS/REPRESS</u> Cue Card

AW18A

1. ✓ Inner hatch Equal vlv (two) – OFF
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

### CAUTION

Do not stow EMU lights in locker with batteries installed

4. Stow Vol H Bags in Vol H
5. Transfer to airlock:  
EVA Bag – install on airlock wall  
DEPRESS/REPRESS Cue Card  
Helmet Lights
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 all helmets, temp stow
10. Remove comm caps from LTA restraint bags and connect to electrical harnesses
11. Remove LTA restraint bags
12. Disconnect waist rings; remove and stow any equipment stowed in HUT/LTA
13. Remove Drink Bag restraint bags – stow in EV1, EV2 mesh bags
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. ✓ Tether hook operation
19. Remove 20-g Crash Bag from middeck EMU, as reqd



## EMU PREP FOR ISS TRANSFER (60 min)

- BOTH EMUs
1. Configure/verify items stowed in table below
  2. √PWR – SCU
  3. √PURGE vlv – op (up)
  4. √O2 ACT – OFF
  5. √WATER – OFF, switch guard installed
  6. √Helmet sun visors down, cover installed

<b><u>EMU 3015 (L) (SI)</u></b>	<b><u>EMU 3003 (L) (Fs)</u></b>
<input type="checkbox"/> DIDB Restraint Bag installed	<input type="checkbox"/> DIDB Restraint Bag installed
<input type="checkbox"/> Comm Cap installed	<input type="checkbox"/> Comm Cap installed
<input type="checkbox"/> LCVG stowed in HUT	<input type="checkbox"/> LCVG stowed in HUT
<input type="checkbox"/> EMU Battery S/N 20XX	<input type="checkbox"/> EMU Battery S/N 20XX
<input type="checkbox"/> LiOH Cartridge S/N 20XX	<input type="checkbox"/> LiOH Cartridge S/N 20XX
<input type="checkbox"/> Helmet S/N XXXX	<input type="checkbox"/> Helmet S/N XXXX
<input type="checkbox"/> Helmet cover	<input type="checkbox"/> Helmet cover
<input type="checkbox"/> LTA (attached)	<input type="checkbox"/> LTA (attached)
<input type="checkbox"/> EV1 (SI) gloves	<input type="checkbox"/> EV2 (Fs) gloves
<input type="checkbox"/> Wrist Mirrors (2)	<input type="checkbox"/> Wrist Mirrors (2)
<input type="checkbox"/> ISS Waist Tethers (2)	<input type="checkbox"/> ISS Waist Tethers (2)
<input type="checkbox"/> Mesh Bag (EV Crew Options Kit) (SI)	<input type="checkbox"/> Mesh Bag (EV Crew Options Kit) (Fs)
<input type="checkbox"/> SI-1 Ziplock Bag	<input type="checkbox"/> Fs-1 Ziplock Bag
<input type="checkbox"/> MAG	<input type="checkbox"/> MAG
<input type="checkbox"/> TCU (top)	<input type="checkbox"/> TCU (top)
<input type="checkbox"/> TCU (bottom)	<input type="checkbox"/> TCU (bottom)
<input type="checkbox"/> Wristlets	<input type="checkbox"/> Wristlets
<input type="checkbox"/> Comfort gloves	<input type="checkbox"/> Comfort gloves
<input type="checkbox"/> Moleskin	<input type="checkbox"/> Moleskin
<input type="checkbox"/> Socks	<input type="checkbox"/> Socks
<input type="checkbox"/> SI-2 Bag (same as above)	<input type="checkbox"/> Fs-2 Bag (same as above)
<b><u>EVA Systems Mesh Transfer Bag</u></b>	
Vol H	<input type="checkbox"/> EMU Servicing Kit
Vol D	<input type="checkbox"/> EMU Middeck Battery Charger (10XX)
A16	<input type="checkbox"/> AA Batts - 1- 50 pack
Med Kit	<input type="checkbox"/> Aspirin
Locker	<input type="checkbox"/> REBA Battery
FDF Locker	<input type="checkbox"/> FDF EVA Checklists (1 of 2)
FDF Locker	<input type="checkbox"/> Exercise Prebreathe Cue Card
ODF Locker	(1 ODF, 1 FDF)
FDF Locker	<input type="checkbox"/> EMU Consumables Cue Card (1 of 1)
ODF Locker	<input type="checkbox"/> ISS EVA Systems Checklists (3 of 3)
ODF Locker	<input type="checkbox"/> ISS EVA Cuff Checklists (2 of 2)
ODF Locker	<input type="checkbox"/> ISS EVA Cuff Checklist - Enhanced (1 of 1)
ODF Locker	<input type="checkbox"/> Crewlock Depress/Repress Cue Card
	(1 of 1)

# PRE EVA 1 EMU TRANSFER AND RECONFIG

## PRE-EVA 1 TRANSFER

### NOTE

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

1. Transfer following EMU equipment to ISS:

Item	Destination	Transfer Status
EMU 3003 (Fs)	E-Lk fwd EDDA	
EMU 3015 (SI)	E-Lk aft EDDA	
EVA Systems Mesh Transfer Bag	E-Lk	

2. Report transfer status to MCC

## PRE-EVA 1 EMU RECONFIGURATION

3. Remove LCVG and Mesh Bag (EV Crew Options Kit) from EV1 and EV2 EMUs; temp stow
4. Install helmet lights/EMU TV on EV1 and EV2 helmets from ISS stowage/helmets

## REBA INSTALLATION INTO EMUs 3015 and 3003

- BOTH
5. Unstow two REBAs, report serial numbers to MCC
  6. Rotate EDDA to access back of EMUs
  7. Unzip TMG to access REBA pouch and power cable
  8. Remove REBA J1 connector cover
  9. Install REBA on EMUs
  10. Configure REBA pull tabs through slots in TMG
  11. ✓REBA sw – OFF, toward left arm of suit
  12. Connect EMU Power Harness to REBA (P1/J1)

## METOX INSTALLATION INTO EMUs 3015 and 3003

13. Unstow Metox canisters, report barcodes to MCC
14. Unzip thermal cover, affix to top of EMU with Velcro
15. Remove LiOH canisters from PLSS
16. Remove caps from new Metox canisters, place on LiOH ports
17. Cover hole in LiOH port caps with Kapton tape, temp stow LiOH for use on EVA 2
18. Install Metox using label on canister for proper orientation
19. Close thermal cover zipper
20. Rotate EDDA closed

## POST EVA 2 RECONFIG AND TRANSFER

### EVA TRANSFER BAG PREP

1. Configure/verify items in bags per table below

<b><u>EVA Systems Transfer Bag</u></b>	<b><u>EVA Tool Transfer Bag</u></b>
<input type="checkbox"/> Mesh Bag labeled 'EVA Systems Transfer Bag' <input type="checkbox"/> EMU Servicing Kit <input type="checkbox"/> FDF EVA Checklist (1) <input type="checkbox"/> EVA Prebreathe Cue Card (used FDF version) <input type="checkbox"/> Ergometer Shoes (1 pr, EV1 and EV2) <input type="checkbox"/> EMU Consumables Cue Card <input type="checkbox"/> ISS EVA Systems Checklist (return copy) <input type="checkbox"/> Aspirin	<input type="checkbox"/> Mesh Bag labeled 'EVA Tools Transfer Bag' <input type="checkbox"/> TBD

2. Perform PRE-UNDOCK EMU RECONFIGURATION, then go to POST EVA 2 TRANSFER

Cont next page

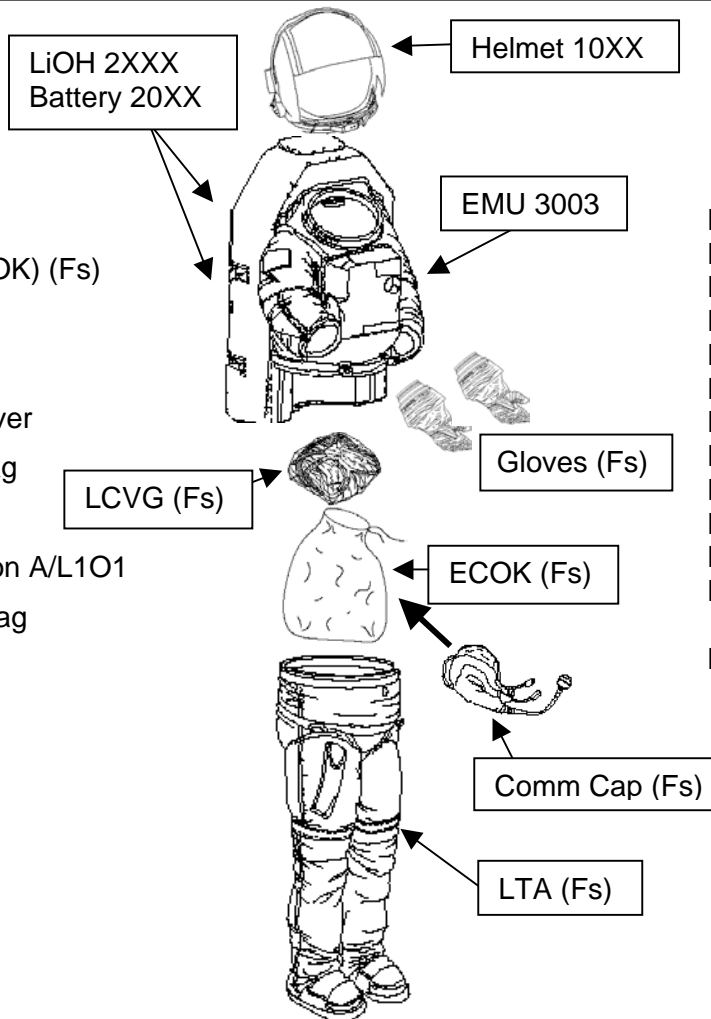
## POST EVA 2 RECONFIG AND TRANSFER (Cont)

### PRE-UNDOCK EMU RECONFIGURATION

- A 1. Perform reconfig of EMU 3003 (L) per figure below

#### EMU 3003 (L) RECONFIGURATION FOR RETURN

- 1. ←|→ Helmet, temp stow
- 2. ←|→ and stow Comm Cap in EV2 Mesh Bag (ECOK) (Fs)
- 3. √DIDB restraint bag installed
- 4. Transfer helmet lights/EMU TV to ISS EMU 3009
- 5. Install helmet with sun visors down and helmet cover
- 6. Remove ISS Cuff C/L; stow in EMU Equipment Bag
- 7. Install EV2 (Fs) gloves; √locked
- 8. Remove Metox (install caps); stow in Metox CTB on A/L101
- 9. Remove EMU Battery (S/N 20XX); stow in M-02 bag
- 10. Transfer REBA (S/N XXXX); stow in M-02 bag
- 11. Install EMU Battery (S/N 20XX)
- 12. Install used LiOH from EVA 2 (S/N 2XXX)
- 13. Stow LCVG (Fs) in HUT
- 14. Stow EV2 Mesh Bag (ECOK) (Fs) in HUT
- 15. Install LTA, √locked



#### EMU 3003 (L) FINAL RETURN CONFIG

- EMU 3003 – Lg
- EMU Battery 20XX
- LiOH 2XXX
- Comm Cap (Fs)
- Helmet S/N 10XX
- LCVG (Fs)
- Mesh Bag (ECOK) (Fs)
- Gloves (Fs)
- LTA (Fs)
- Patches, Stripes, Flag
- Wrist Mirrors
- No** EMU TV, Helmet Lights or REBA
- No** ISS Cuff Checklist

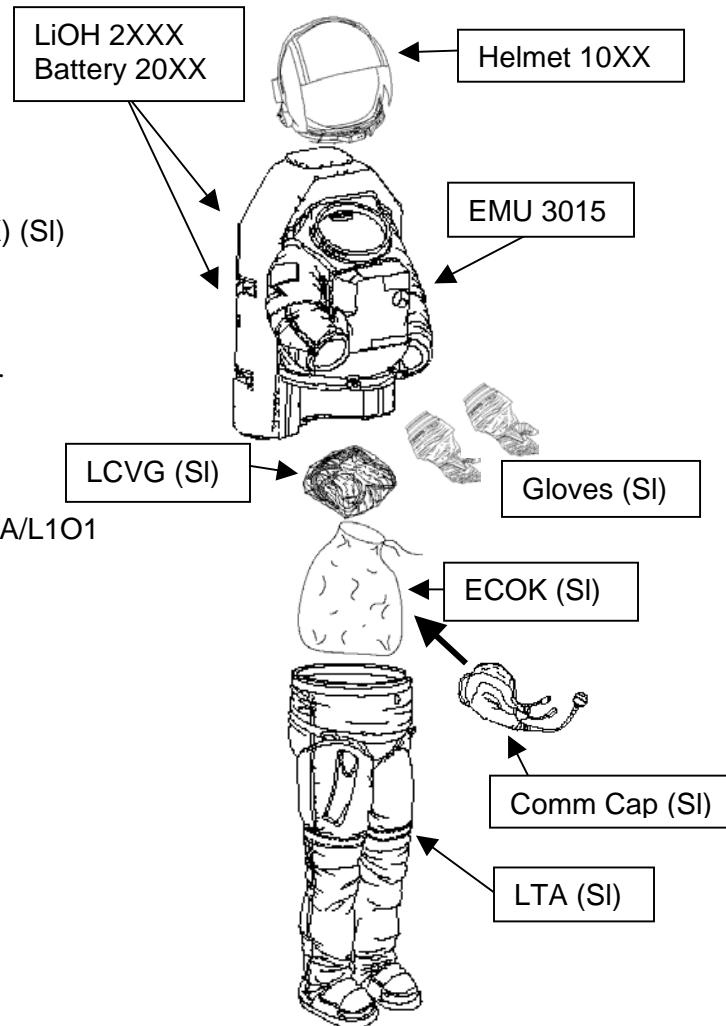
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## POST EVA 2 RECONFIG AND TRANSFER (Cont)

- B 1. Perform reconfig of EMU 3015 (L) per figure below

### EMU 3015 (L) RECONFIGURATION FOR RETURN

- 1. ←|→ Helmet, temp stow
- 2. ←|→ and stow Comm Cap in EV1 Mesh Bag (ECOK) (SI)
- 3. ✓DIDB restraint bag installed
- 4. Transfer helmet lights/EMU TV to ISS EMU 3010
- 5. Install helmet with sun visors down and helmet cover
- 6. Remove ISS Cuff C/L; stow in EMU Equipment Bag
- 7. Install EV1 (SI) gloves; ✓locked
- 8. Remove Metox (install caps); stow in Metox CTB on A/L101
- 9. Remove EMU Battery (S/N 20XX); stow in M-02 bag
- 10. Remove REBA (S/N XXXX); stow in M-02 bag
- 11. Install EMU Battery (S/N 20XX)
- 12. Install used LiOH from EVA 2 (S/N 2XXX)
- 13. Stow LCVG (SI) in HUT
- 14. Stow EV1 Mesh Bag (ECOK) (SI) in HUT
- 15. Install LTA, ✓locked



### EMU 3015 (L) FINAL RETURN CONFIG

- EMU 3015 – Lg
- EMU Battery 20XX
- LiOH 2XXX
- Comm Cap (SI)
- Helmet S/N 10XX
- LCVG (SI)
- Mesh Bag (ECOK) (SI)
- Gloves (SI)
- LTA (SI)
- Patches, Stripes, Flag
- Wrist Mirrors
- No** EMU TV, Helmet Lights or REBA
- No** ISS Cuff Checklist

Cont next page

## POST EVA 2 RECONFIG AND TRANSFER (Cont)

### POST EVA 2 TRANSFER

#### NOTE

This procedure assumes that transfer items were preconfigured per EVA TRANSFER BAG PREP and PRE-UNDOCK EMU RECONFIGURATION

1. Transfer following EMU equipment to shuttle:

Item	Destination	Transfer Status
EMU 3003 (L)	A/L port (EV2)	
EMU 3015 (L)	A/L stbd (EV1)	
EVA Systems Transfer Bag	Temp stow Middeck	
EVA Tool Transfer Bag	Temp stow Middeck	

2. Report transfer status to MCC-H

### POST UNDOCK TRANSFER STOW

1. Stow EVA Transfer Bag items post-undock

<u>EVA Systems Transfer Bag</u>	<u>EVA Tool Transfer Bag</u>
Vol H Bag "Prime" <input type="checkbox"/> EMU Servicing Kit labeled "Inc 6"	<input type="checkbox"/> Mesh Bag <input type="checkbox"/> TBD
FDF Locker <input type="checkbox"/> FDF EVA Checklist (1) <input type="checkbox"/> EVA Exercise Prebreathe Cue Card <input type="checkbox"/> EMU Consumables Cue Card <input type="checkbox"/> ISS EVA Systems Checklist	
Ergometer Shoe Bag <input type="checkbox"/> Ergometer Shoes (EV1 and EV2)	
Vol D <input type="checkbox"/> EMU Middeck Battery Charger (1002)	
Med Kit <input type="checkbox"/> Aspirin	

EVA PREP

MIDDECK PREP.....	TEMP FS 4-2
EVA PREP .....	TEMP FS 4-2
PREP FOR DONNING.....	TEMP FS 4-2
EMU DONNING .....	4-4
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CO2 RMVL SYS DEACT .....	4-9
CO2 RMVL SYS ACT .....	4-9
EVA PREBREATHE CUE CARD.....	FS CC 4-11

<p><b>WARNING</b></p> <p>Payload bay floods exceed EMU thermal limits during operation. If EVA crew will be operating in vicinity of PLB floods, floods must be turned off now. Cooldown time may be as long as 6 hr</p>
--

**MIDDECK PREP (30 min)**

- AW18A 1. LTG FLOOD (four) – ON
- 2. ✓EVA Bag installed in airlock
- 3. ✓REBA sw – OFF
- If EMU TV:
  - 4. Demate EMU TV power cable; connect ground plug
- 5. Disconnect helmets; Velcro to lockers
- HUT 6. Remove Drink Bag restraint bag
- 7. Fill Drink Bag from galley, remove gas and insert Drink Bag in restraint bag
- 8. Install Drink Bag restraint bag in HUT and dispose of fill tool in wet trash
- 9. Apply anti-fog (EMU Servicing Kit), wipe off:
  - Helmets (not Fresnel lens)
  - EV glasses, attach to comm cap
- 10. Stow EMU Servicing Kit
- 11. Install Helmets; lock
- 12. Attach Cuff C/L to EMUs

**EVA PREP (90 min)**

MET ____/____:____	MET ____/____:____	MET ____/____:____
--------------------	--------------------	--------------------

**PREP FOR DONNING (30 min)**

**EVA PREP**

- If internal airlock:
  - ML31C  1. ✓VAC VENT ISOL VLV CNTL tb – OP
  - ✓NOZ HTR – ON
- If external airlock:
  - BOTH DCM  2. Retrieve, position SCU; remove DCM cover
  - 3. Connect SCU to DCM, ✓locked
  - AW82B  4. EV-1, EV-2 O2 vlv (two) – op
  - MO13Q  5. ✓ARLK H2O S/O VLV – OP (tb-OP)
  - MD(flr)  6. ✓EMU O2 ISOL VLV – OP
  - ML86B:C  7. ✓cb MNC EXT ARLK HTR ZN 1,2 (two) – op
  - L2  8. ✓O2 XOVR SYS 1,2 (two) – OP
  - BOTH DCM  9. PWR – BATT

<p><b>CAUTION</b></p> <p>EMU must be on BATT pwr when airlock power supply turned on</p>
--

- AW18H  10. PWR/BATT CHGR EMU 1,2 MODE (two) – PWR
- BUS SEL (two) – MNA(MNB)
- DCM  11. PWR – SCU
- 12. Verify panels as shown next page

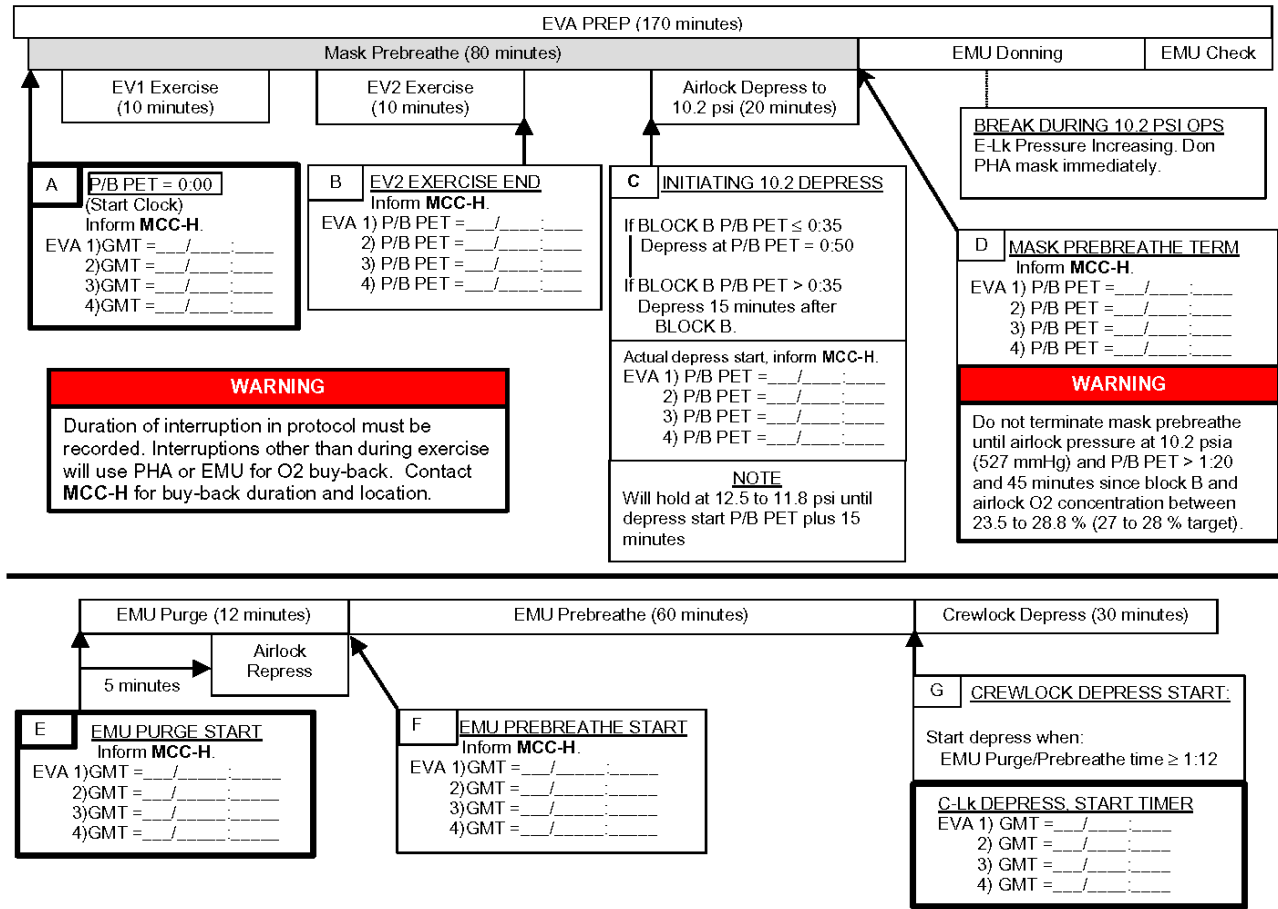


TOP

HOOK  
VELCRO

### EVA PREBREATHE CUE CARD

#### EVA PREBREATHE EVENTS



EVA-5a/121/O/A

(reduced copy)

TOP  
BACK OF 'EVA PREBREATHE CUE CARD'

HOOK  
VELCRO

**EVA PREBREATHE CUE CARD**

EVA EXERCISE PRESCRIPTION

Start Exercise Protocol	When Exercise Complete
<p><b>DON EXERCISE EQUIPMENT:</b></p> <ol style="list-style-type: none"> <li>Don Heart Rate Monitor chest strap and synchronize start of exercise with Heart Rate Watch and CEVIS. Refer to {<u>CEVIS ON LINE MODE OPERATIONS</u>}, steps 2 and 4.2 to 4.4 (SODF: MED OPS: NOMINAL: CM), then:</li> <li>Configure bungees on CEVIS.</li> </ol> <p><u>IF USING SHUTTLE O2, RECONFIGURE PHA TO 90 FT HOSE:</u></p> <ol style="list-style-type: none"> <li>90-ft hose from shuttle LEH Port → ← Special Tee Assembly</li> <li>60-ft hose from PBA port ← → Special Tee Assembly</li> <li>Temporarily stow 60-ft hose for use after CEVIS ops.</li> </ol> <p><b>INITIATE EXERCISE</b></p> <ol style="list-style-type: none"> <li>Perform exercise per prescription below. Synchronize start of Heart Rate Watch with exercise.</li> </ol>	<p><b>TERMINATE EXERCISE</b></p> <ol style="list-style-type: none"> <li>Press STOP on CEVIS display and stop heart rate watch.</li> <li>Record Exercise End PET (For EV2 record in Block B of Prebreathe Events).</li> <li>Momentarily pull mask away from face to verify positive O2 flow. If no O2 flow, contact <b>MCC-H</b>.</li> <li>If all EV crew have completed exercise                      Cycle ergometer Power Switch → OFF                      Remove PCMCIA card from CEVIS.                      Temporarily stow PCMCIA card.</li> </ol> <p><b>DOFF EXERCISE EQUIPMENT</b></p> <ol style="list-style-type: none"> <li>Doff Heart Rate Monitor chest strap. Clean with alcohol wipes (EMU Servicing Kit) avoiding electrodes.</li> <li>Doff Ergometer/CEVIS shoes</li> </ol> <p><u>IF USING SHUTTLE O2, RECONFIGURE PHA TO 60 FT HOSE</u></p> <p>When 5 minutes have elapsed after exercise completion</p> <ol style="list-style-type: none"> <li>60-ft hose from PBA port → ← Special Tee Assembly</li> <li>90-ft hose from Shuttle LEH Port ← → Special Tee Assembly</li> </ol>

NOTE

- Maintain > 60 rpm and match arm/leg cadence (pedaling effort at < 60 rpm becomes noticeably more difficult). Use table values for workload and record heart rate. If heart rate exceeds the maximum indicated at the top of the table, decrease workload by 25-watt increments until heart rate falls below the maximum.
- CEVIS timer will not increase while arrows remain displayed. Workload will change as soon as arrows are pressed.
- If an interruption of either exercise or mask prebreathe < 2 minutes occurs during the 10-minute exercise, extend the 75 % max VO2 portion of the table for a duration equal to the interruption.

EXERCISE PRESCRIPTION		EV 1			EV 2			EV 3			EV 4				
		Workload (watts)	Heart Rate (bpm) (Not to exceed = ____)			Workload (watts)	Heart Rate (bpm) (Not to exceed = ____)			Workload (watts)	Heart Rate (bpm) (Not to exceed = ____)			Workload (watts)	Heart Rate (bpm) (Not to exceed = ____)
Time	Max VO2		EVA#1	EVA#2	EVA#3		EVA#1	EVA#2	EVA#3		EVA#1	EVA#2	EVA#3		EVA#1
1 min	37.5 %														
1 min	50 %														
1 min	62.5 %														
7 min	75 %														
1 min	Cooldown														
Exercise End PET		:	:	:	:	:	:	:	:	:	:	:	:		

EVA-5b/121/O/A

(reduced copy)

FS CC 4-12

EVA/121/BAS

TIMELINES

EVA 1 ..... FS 7-3  
EVA 1 BRIEFING CARD ..... FS 7-4  
EVA 1 TOOL CONFIG..... FS 7-5  
EVA 1 INHIBIT PAD ..... FS 7-6  
EVA 1 NOTES, CAUTIONS, & WARNINGS ..... FS 7-7  
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EVA 1 INGRESS ..... FS 7-20  
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EVA 2 BRIEFING CARD ..... FS 7-22  
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TIMELINES

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# EVA 1

## EVA 1 BRIEFING CARD

EV1 \_\_\_\_\_  
EV2 \_\_\_\_\_  
IV \_\_\_\_\_

EVA Prep start (GMT) \_\_\_\_/\_\_\_\_ \_\_\_\_:\_\_\_\_ \_\_\_\_  
Depress to 10.2 \_\_\_\_ \_\_\_\_:\_\_\_\_ \_\_\_\_  
Start Purge \_\_\_\_ \_\_\_\_:\_\_\_\_ \_\_\_\_  
PET 00:00 \_\_\_\_ \_\_\_\_:\_\_\_\_ \_\_\_\_

### 1. EVA Prep

- Get-up Plan - clothing and EMU equipment bag
- Prebreathe protocol review
- Equipment lock activities - IV responsibilities
- Suit donning plan - special requests
- SAFER, MWS, tools, CL positions and bag stowage
- Airlock depress review
- EV/IV comm. protocol
- SRMS/SSRMS initial position

### 2. EV Crew Procedure Review

- Egress Plan
- Translations - tether swaps
- Order of tasks
- Ingress Plan

### 3. General Procedure Review

- Get ahead tasks
- Constraints - ground and flight
- Cautions and warnings review
- RMS operations - comm. protocol / clearances
- Contingency procedures - crib sheet

### 4. Emergencies Review

- Lost comm.
- EMU malfunctions
- Lost tools
- Lost crewmember
- DCS
- Abort and Terminate scenarios

### 5. Post EVA

- Suit doffing responsibilities
- Post EVA plan

Lessons learned from previous EVAs/Flights

## EVA 1 TOOL CONFIG

### Pre-EVA Tool Configuration

#### AIRLOCK

- C-Lk EVA Bag (stbd endcone)
- Spare PGT
- Wire Tie Caddy (with lg and sm RET)
- Connector Cleaner Tool Kit
- DCM plug
- EVA Camera w/ bracket
- D-Ring extender on EVA hatch d-ring
- Med ORU bag
- Adj equip tethers (2) - exterior
- Fishstringer
- Ret equip tethers (2)
- Digital camera w/ flash and mount
- PAD w/ WIF adapter (tether pt out)
- Load cell
- Safety tethers (2 - 85')

#### EV 1

- MWS
- Right swing arm
- T-Bar
- Wire ties (2)
- Small EVA trash bag
- Ret equip tether (sm-sm) w/ PIP
- Ret equip tether (sm-sm)
- Adj equip tether (2)
- BRT
- Ret equip tether (sm-sm)
- Waist tether (2)
- Spare safety tether (R-55')
- D-Ring extender (2)
- SAFER

#### EV 2

- MWS
- Right swing arm
- T-Bar
- Wire ties (2)
- Small EVA trash bag
- Ret equip tether (sm-sm) w/ PIP
- Ret equip tether (sm-sm)
- Adj equip tether (3)
- BRT
- Wire ties (2)
- Ret equip tether (sm-sm)
- Waist tether (2)
- Spare safety tether (R-55')
- D-Ring extender (2)
- SAFER

### Post-EVA Tool Configuration

#### AIRLOCK

- C-Lk EVA Bag (stbd endcone)
- Spare PGT
- Wire Tie Caddy (with lg and sm RET)
- Connector Cleaner Tool Kit
- DCM plug
- EVA Camera w/ bracket
- D-Ring extender on EVA hatch d-ring
- Med ORU bag
- Adj equip tethers (2) - exterior
- Fishstringer
- Ret equip tethers (2)
- Digital camera w/ flash and mount
- PAD w/ WIF adapter
- Load cell
- Safety tethers (2 - 85')

#### EV 1

- MWS
- Right swing arm
- T-Bar
- Wire ties (2)
- Small EVA trash bag
- Ret equip tether (sm-sm) w/ PIP
- Ret equip tether (sm-sm)
- Adj equip tether (2)
- BRT
- Ret equip tether (sm-sm)
- Waist tether (2)
- Spare safety tether (R-55')
- D-Ring extender (2)
- SAFER

#### EV 2

- MWS
- Right swing arm
- T-Bar
- Wire ties (2)
- Small EVA trash bag
- Ret equip tether (sm-sm) w/ PIP
- Ret equip tether (sm-sm)
- Adj equip tether (3)
- BRT
- Wire ties (2)
- Ret equip tether (sm-sm)
- Waist tether (2)
- Spare safety tether (R-55')
- D-Ring extender (2)
- SAFER

## EVA 1 INHIBIT PAD

<b>MCS</b>	
MCC-M	<ol style="list-style-type: none"> <li>1. √FGB Attitude Control Thruster Valves (80) – closed</li> <li>2. √FGB Attitude Control Manifold Valves – closed            К11К1, К11К2, К11К4, К11К5, К11К9, ОК03, ОКГ3,            ОК06, ОКГ6, ОК07, ОКГ7, ОК08, ОКГ8</li> <li>3. √FGB MCS unpowered</li> <li>4. √SOYUZ manifolds (ten) closed</li> <li>5. √SOYUZ MCS unpowered</li> </ol>

<b>RCS</b>	
	If EV crew < 27 ft from FRCS:
IV	1. √DAP: √FREE, LO Z
O14,15,16	2. √RJDF F1, F2, F3, F4 MANF DRIVER (four) – OFF
MCC	3. √Above RCS config

<b>Orbiter Antennas</b>	
	<u>NOTE</u> Possible loss of comm when forced LL FWD antenna
IV	If EV crew < 1.6 ft from S-Band antenna:
A1R	1. S-BAND FM ANT – XMIT LOWER/RCVR UPPER
O14,15,16	2. √MCC, lower antenna selected
	If no comm or on MCC call:
C3	3. S-BAND PM ANT – LL FWD
	When EVA crewmember at least 1.6 ft away from all S-Band upper antennas:
C3	4. S-BAND PM ANT – GPC
MCC-H	5. √KU-BAND Mask active

<b>FGB Antennas</b>	
MCC-M	<ol style="list-style-type: none"> <li>1. √TORU [TOPY] – Deactivate</li> <li>2. √TV System [TBC] – Deactivate</li> <li>3. √KURS P [Kurs] – Deactivate</li> <li>4. √KURS A [Kurs] – Deactivate</li> </ol>

<b>SM Antennas (MCC-M)</b>	
MCC-M	1. Global Timing Sys 1 & 2 [GTS] – Deactivate

<b>PCU</b>	
	<u>NOTE</u> PCUs may require up to 1 hr warm-up period before they are operational
MCC-H	1. √PCUs (two) operational, in discharge mode

<b>USOS Antennas</b>	
MCC-H	<ol style="list-style-type: none"> <li>1. SGANT (KU) – Mask for EVA Worksites</li> <li>2. MISSE #5 - TBD</li> </ol>



## EVA 1 NOTES, CAUTIONS, & WARNINGS

### CAUTION

Avoid inadvertent contact with:

- Grapple fixture shafts (have coating)
- Grapple fixture target pin
- SVS Targets
- Deployed TUS cable
- Deployed MISSEs (A/L)
- CETA Lights (Z-93 paint) (Node, S1, ETVCG)
- PMA 1 MDM sunshade
- EVA Crane (PMA 1)
- PMA 2 TCS Reflectors & APAS hardware
- SASA (Z1 and S1)– Antenna and Z-93 paint
- S0 Radiators (silver Teflon tape)
- S0 GPS Antenna (Z-93 paint)
- S1/P1 Radiators (Z-93 paint)

Thermal Constraints:

- PMA handrails may be hot. Limit handling if required

Keepout Zones:

- UHF Antenna (PLB (stbd), Lab, P1) = 1 foot
- S-BAND (SASA)
  - P6 - Do not go more zenith than IEA bulkhead to avoid S-band antenna keep-out zones (3.6 ft in high gain, 1.3 ft in low gain)
  - S1 - Stay away from S-band antenna horn 3.6 ft in high gain, 1.3 ft in low gain

### CAUTION (cont)

For structural reasons:

- Avoid vigorous body motions, quick grabs and kickoff tether restraints
- Avoid performing shaking motions (sinusoidal functions) more than four cycles

If any of these occur, wait 2-5 min to allow structural response to dissipate

### WARNING

Sharp Edges:

- PMA umbilical launch restraints exposed bolt threads
- Fish Stringer buckles stowed in Node Bag
- Inner edges of WIF sockets
- PRLA grounding wiper

Pinch Hazard:

- EV side of crewlock hatch during hatch operations (also snag hazard)

Hot Connector Hazard:

- ROEU Connector – remain clear

Contact Hazard:

- Lab window shutter during operation
- Remain clear of Lab window when open
  
- Handrails utilized for MISSE attachment may not be used as a safety tether attach point

## EVA 1 SUMMARY TIMELINE

TASK TIME (PET TIME) HR : MIN	IV/SSRMS	EV1	EV2
00:00 ---	SRMS: At SRMS EE Access posn	<u>POST DEPRESS and A/L EGRESS</u> (00:15)	<u>POST DEPRESS and A/L EGRESS</u> (00:15)
		<u>TOOL SETUP</u> (00:40)	<u>TOOL SETUP</u> (00:40)
01:00 --	SRMS: Mnvr to OBSS Setup	<u>OBSS SETUP - PART I</u> (00:45)	<u>OBSS SETUP - PART I</u> (00:45)
	SRMS: Mnvr to OBSS Ingress/Egress SRMS: Mnvr to High Rigidity posn	<u>SINGLE EV HIGH RIGIDITY LOAD EVAL</u> (00:45)	<u>SINGLE EV HIGH RIGIDITY LOAD EVAL</u> (00:45)
02:00 --			
	SRMS: Mnvr to OBSS Ingress/Egress	<u>OBSS SETUP - PART II</u> (00:30)	<u>OBSS SETUP - PART II</u> (00:30)
	SRMS: Mnvr to OBSS Ingress/Egress SRMS: Mnvr to High Rigidity posn	<u>TWO EV HIGH RIGIDITY LOAD EVAL</u> (00:55)	<u>TWO EV HIGH RIGIDITY LOAD EVAL</u> (00:55)
03:00 --			
	SRMS: Mnvr to Low Rigidity posn	<u>TWO EV LOW RIGIDITY LOAD EVAL</u> (00:55)	<u>TWO EV LOW RIGIDITY LOAD EVAL</u> (00:55)
04:00 --			
	SRMS: Mnvr to OBSS Ingress/Egress	<u>OBSS CLEANUP</u> (00:40)	<u>OBSS CLEANUP</u> (00:40)
05:00 ---	SRMS: Mnvr to SRMS EE Access SRMS: Mnvr to OBSS Pre-setup	<u>TOOL CLEANUP</u> (00:50)	<u>TOOL CLEANUP</u> (00:50)
06:00 ---			
	EVA Time 6:30	<u>A/L INGRESS and PRE REPRESS</u> (00:15)	<u>A/L INGRESS and PRE REPRESS</u> (00:15)



**SETUP (01:25)**

TASK TIME (PET TIME) HR : MIN	IV/SSRMS	EV1	EV2
00:00 (00:15)		<p><u>TOOL SETUP (00:40)</u></p> <ol style="list-style-type: none"> <li>1. Translate to PMA1 WIF 02; fairlead along the way</li> <li>2. Assist EV2; place TS/BRT into low profile configuration</li> <li>3. Provide clearance calls for EV2 as req'd</li> <li>4. After EV2: translate to Lab via ESP2 zenith path</li> <li>5. Fairlead to Lab HR 0274</li> <li>6. Translate to Lab WIF 09 (nadir/stbd)</li> <li>7. Configure APFR (--, FF, A, 6)</li> <li>8. Stow med ORU bag onto APFR via adj tethers</li> <li>9. Retrieve APFR w/ ingress aid and ORU bag; stow onto BRT</li> <li>10. Translate to PMA2</li> <li>11. Perform safety tether swap onto PMA2 HR 0401</li> <li>12. Verify safety tether crew hook slide lock - L</li> <li>13. Translate along stbd Orbiter sill</li> <li>14. Perform a fairlead using EV2's tether</li> <li>15. Translate to aft of OBSS</li> <li>16. Stow APFR and med ORU bag on sill</li> </ol>	<p><u>TOOL SETUP (00:40)</u></p> <ol style="list-style-type: none"> <li>1. After EV1: translate to PMA1 WIF 02</li> <li>2. Remove TS from APFR; stow onto BRT</li> <li>3. Translate to Lab via ESP2 zenith path</li> <li>4. Fairlead to TBD</li> <li>5. Wait for EV1</li> <li>6. Translate to PMA2</li> <li>7. Perform safety tether swap onto PMA2 HR 0402</li> <li>8. Verify safety tether crew hook slide lock - L</li> <li>9. Translate along stbd Orbiter sill</li> <li>10. Perform a fairlead onto stbd most handrail of Orbiter airlock truss (use adj tether)</li> <li>11. Translate to aft ICC</li> <li>12. Temp stow TS onto aft ICC handrails (1 adj on TS head, 1 ret on TS base)</li> </ol>
00:40 (00:55)		<p><u>OBSS SETUP - PART I (00:45)</u></p> <ol style="list-style-type: none"> <li>1. Retrieve own 85' safety tether from ORU bag</li> <li>2. Attach load alleviating end to left D-ring ext</li> <li>3. Verify safety tether crew hook slide lock - L</li> <li>4. Attach reel end onto black end of SRMS EE</li> <li>5. Verify safety tether crew hook slide lock - L</li> <li>6. Temp stow PMA2 safety tether to Orbiter sill handrail</li> <li>7. Retrieve EV2's 85' safety tether from ORU bag</li> <li>8. Attach reel end onto yellow end of SRMS EE</li> </ol>	<p><u>OBSS SETUP - PART I (00:45)</u></p> <ol style="list-style-type: none"> <li>1. Translate to SRMS EE/OBSS</li> </ol>



**SETUP (01:25)**

TASK TIME (PET TIME) HR : MIN	IV/SSRMS	EV1	EV2
01:25 (01:40)	posn	23. Retrieve EVA digital camera from ORU bag; stow on BRT 24. Perform soft APFR ingress - Quantify SRMS/OBSS rigidity  25. Perform soft APFR egress - Quantify SRMS/OBSS rigidity  <p style="text-align: center;"><u>NOTE</u></p> <p style="text-align: center;">If high reaction force required during              initial APFR ingress, EV2 physically              guide EV1's feet into APFR</p>  26. Perform soft APFR ingress - Quantify SRMS/OBSS rigidity	14. React ingress loads via APFR HR and sill HR - Quantify SRMS/OBSS reaction loads 15. React egress loads via APFR HR and sill HR - Quantify SRMS/OBSS reaction loads  <p style="text-align: center;"><u>NOTE</u></p> <p style="text-align: center;">If high reaction force required during              initial APFR ingress, EV2 physically              guide EV1's feet into APFR</p>  16. As req'd: react ingress loads via APFR HR and sill HR - Quantify SRMS/OBSS reaction loads 17. Clear OBSS for mnvr

## LOAD EVALUATIONS (03:05)

TASK TIME (PET TIME) HR : MIN	IV/SSRMS	EV1	EV2
00:00 (01:40)	<p>4. SRMS: To High Rigidity posn</p> <p>5. IV: Verify min 60 sec prior to Go for load evals A and B</p> <p>6. IV: Verify with MCC Go for load evals E and F</p> <p>7. IV: Verify with MCC Go for load evals G thru I.</p>	<p><u>SINGLE EV HIGH RIGIDITY LOAD EVAL (00:45)</u></p> <p style="text-align: center;"><u>NOTE</u></p> <ul style="list-style-type: none"> <li>- Minimize motion during mnvr</li> <li>- Minimize motion for a minimum of 60 sec between loads evaluations.</li> </ul> <p>1. Mnvr to high rigidity posn - Quantify SRMS/OBSS rigidity during mnvr</p> <p>2. Once mnvr complete, minimize motion for 60 sec</p> <p>3. On IV Go:</p> <ul style="list-style-type: none"> <li><b>A.</b> Cycle left and right helmet lights</li> <li><b>B.</b> Turn to page TBD of your cuff checklist</li> <li><b>C.</b> If req'd: Cycle sun visor</li> <li><b>D.</b> If req'd: Scroll thru DCM status list</li> <li><b>E.</b> Retrieve digital camera/BRT, take 2 duplicate photos; stow camera/BRT</li> <li><b>F.</b> Perform a back scratch for 3 sec</li> <li><b>G.</b> Perform a lay back</li> <li><b>H.</b> Using the ingress aid, remove one foot from APFR; re-insert</li> <li><b>I.</b> Using the ingress aid, perform an APFR yaw change in the CW direction</li> </ul>	<p><u>SINGLE EV HIGH RIGIDITY LOAD EVAL (00:45)</u></p> <ul style="list-style-type: none"> <li>1. Translate to TBD</li> <li>2. Quantify SRMS/OBSS motion and clearances during the evaluations</li> </ul>
00:45 (02:25)	<p>8. SRMS: To OBSS Ingress/Egress posn</p>	<p><u>OBSS SETUP - PART II (00:30)</u></p> <ul style="list-style-type: none"> <li>1. Mnvr to Orbiter sill</li> <li>2. Perform soft APFR egress</li> <li>3. Receive TS from EV2</li> <li>4. Install TS into APFR receptacle - Verify locking tabs black-on-black (dots)</li> </ul>	<p><u>OBSS SETUP - PART II (00:30)</u></p> <ul style="list-style-type: none"> <li>1. Once OBSS in posn: position self fwd of OBSS</li> <li>2. As req'd: react egress loads via APFR HR and sill HR</li> <li>3. Transfer TS to EV1</li> <li>4. React hardware installation loads via APFR HR and sill HR - Quantify SRMS/OBSS reaction loads</li> </ul>

# LOAD EVALUATIONS (03:05)

TASK TIME (PET TIME) HR : MIN	IV/SSRMS	EV1	EV2
01:15 (02:55)	<p>9. SRMS: To OBSS Ingress/Egress posn</p> <p>10. SRMS: To High Rigidity posn</p> <p>11. IV: Verify min 60 sec prior to Go for load evals A and B</p> <p>12. IV: Verify with MCC Go for load evals H thru J</p>	<p>- Perform gentle pull test - Quantify SRMS/OBSS motion</p> <p>5. Verify all tethers clear 6. Clear OBSS for mnvr</p> <p>7. Perform soft APFR ingress</p> <p><u>TWO EV HIGH RIGIDITY LOAD EVAL (00:55)</u></p> <p><u>NOTE</u> - Minimize motion during mnvr  - Minimize motion for a minimum of 60 sec between loads evaluations.</p> <p>1. Mnvr to high rigidity posn - Quantify SRMS/OBSS rigidity during mnvr</p> <p>2. Once mnvr complete, minimize motion for 60 sec</p> <p>3. On IV Go: <b>A.</b> Cycle left and right helmet lights <b>C.</b> If req'd: Turn to page TBD of your cuff checklist <b>D.</b> If req'd: Cycle sun visor <b>F.</b> If req'd: Scroll thru DCM status list <b>H.</b> Retrieve digital camera/BRT, take 2 duplicate photos; stow camera on BRT <b>I.</b> Retrieve digital camera from BRT; transfer to EV2</p>	<p>5. Retrieve 85' safety tether from OBSS handrail 6. Perform safety tether swap 7. Verify safety tether crew hook slide lock - L 8. Temp stow PMA2 safety tether on Orbiter sill handrail 9. Verify all tethers clear 10. Clear OBSS for mnvr 11. React ingress loads via APFR HR and sill HR 12. Translate onto TS</p> <p><u>TWO EV HIGH RIGIDITY LOAD EVAL (00:55)</u></p> <p><u>NOTE</u> - Minimize motion during mnvr  - Minimize motion for a minimum of 60 sec between loads evaluations.</p> <p>1. Mnvr to high rigidity posn - Quantify SRMS/OBSS rigidity during mnvr</p> <p>2. Once mnvr complete, minimize motion for 60 sec</p> <p>3. On IV Go: <b>B.</b> Cycle left and right helmet lights  <b>E.</b> If req'd: Cycle sun visor <b>G.</b> If req'd: Scroll thru DCM status list  <b>I.</b> Receive camera from EV1; stow on TS <b>J.</b> Translate along TS to OBSS tip and back to TS</p>



## LOAD EVALUATIONS (03:05)

TASK TIME (PET TIME) HR : MIN	IV/SSRMS	EV1	EV2
02:10 (03:50)	<p>13. IV: Verify with MCC Go for load evals N and O</p> <p>If time permits:            14. IV: Verify with MCC Go for worksite load eval            15. SRMS: To TBD posn</p> <p>16. SRMS: To Low Rigidity posn</p> <p>17. IV: Verify min 60 sec prior to Go for load evals A and B</p>	<p>K. Perform a back scratch for 3 sec            M. Perform a lay back            N. Assist EV2 as necessary</p> <p>O. Yaw TS 90 degrees</p> <p>On MCC Go - If time permits:            4. Mnvr to TBD structure access            5. Once mnvr complete, minimize motion for 60 sec            6. Verify APFR/TS clear of structure            7. Apply tile tamping force (~5 lbs) to TBD structure            - Quantify SRMS/OBSS motion</p> <p><u>TWO EV LOW RIGIDITY LOAD EVAL (00:55)</u></p> <p style="text-align: center;"><u>NOTE</u></p> <p>- Minimize motion during mnvr</p> <p>- Minimize motion for a minimum of 60 sec between loads evaluations.</p> <p>1. Mnvr to low rigidity posn            - Quantify SRMS/OBSS rigidity during mnvr            2. Once mnvr complete, minimize motion for 60 sec            3. On IV Go:  <b>A.</b> Cycle left and right helmet lights  <b>C.</b> If req'd: Turn to page TBD of your cuff checklist  <b>D.</b> If req'd: Cycle sun visor  <b>F.</b> If req'd: Scroll thru DCM status list</p>	<p>L. Perform a back scratch for 3 sec</p> <p><b>N.</b> Translate along TS; access EV1's PLSS near location of CIPAA valves, and translate back to TS  <b>O.</b> Translate to OBSS tip; assist EV1 as required</p> <p>On MCC GO - If time permits:            4. Mnvr to TBD structure access            5. Once mnvr complete, minimize motion for 60 sec            6. Minimize motion during loads eval</p> <p><u>TWO EV LOW RIGIDITY LOAD EVAL (00:55)</u></p> <p style="text-align: center;"><u>NOTE</u></p> <p>- Minimize motion during mnvr</p> <p>- Minimize motion for a minimum of 60 sec between loads evaluations.</p> <p>1. Mnvr to low rigidity posn            - Quantify SRMS/OBSS rigidity during mnvr            2. Once mnvr complete, minimize motion for 60 sec            3. On IV Go:  <b>B.</b> Cycle left and right helmet lights</p> <p><b>E.</b> If req'd: Cycle sun visor  <b>G.</b> If req'd: Scroll thru DCM status list</p>

**LOAD EVALUATIONS (03:05)**

TASK TIME (PET TIME) HR : MIN	IV/SSRMS	EV1	EV2
03:05 (04:45)	<p>18. IV: Verify with MCC Go for load evals H thru J</p> <p>19. IV: Verify with MCC Go for load evals N and O</p> <p>If time permits:                      20. IV: Verify with MCC Go for worksite load eval                      21. SRMS: To TBD posn</p>	<p><b>H.</b> Retrieve digital camera/BRT, take 2 duplicate photos; stow camera on BRT</p> <p><b>I.</b> Retrieve digital camera from BRT; transfer to EV2</p> <p><b>K.</b> Perform a back scratch for 3 sec</p> <p><b>M.</b> Perform a lay back</p> <p><b>N.</b> Assist EV2 as necessary</p> <p><b>O.</b> Yaw TS 90 degrees</p> <p>On MCC Go - If time permits:                      4. Mnvr to TBD structure access                      5. Once mnvr complete, minimize motion for 60 sec                      6. Verify APFR/TS clear of structure                      7. Apply tile tamping force (~5 lbs) to TBD structure                      - Quantify SRMS/OBSS motion</p>	<p><b>I.</b> Receive camera from EV1; stow on TS</p> <p><b>J.</b> Translate along TS to OBSS tip and back to TS</p> <p><b>L.</b> Perform a back scratch for 3 sec</p> <p><b>N.</b> Translate along TS; access EV1's PLSS near location of CIPAA valves, and translate back to TS</p> <p><b>O.</b> Translate to OBSS tip; assist EV1 as required</p> <p>On MCC GO - If time permits:                      4. Mnvr to TBD structure access                      5. Once mnvr complete, minimize motion for 60 sec                      6. Minimize motion during loads eval</p>

## LOAD EVALUATIONS - TASK DATA SHEET

### Estimated Task Duration:

	With SRMS/OBSS	Without SRMS/OBSS
One EV Crew Evals	0:45	N/A
Two EV Crew Evals	1:50	N/A

### Tools:

EV1	EV2
<ul style="list-style-type: none"> <li>BRT (Setup activities, Digital Camera)</li> <li>Spare safety tethers (2 - swap at PMA 2; swap onto OBSS)</li> </ul>	<ul style="list-style-type: none"> <li>BRT (Setup activities)</li> <li>Spare safety tethers (2 - swap at PMA 2; swap onto OBSS)</li> </ul>

### Foot Restraints:

Task	WIF	APFR Setting
OBSS Loads Evals	PAD/WIF Adapter on OBSS Tip	11, FF, A, 6

### Notes:

- If high reaction force required during initial APFR ingress, EV2 should physically guide EV1's feet into APFR during second and subsequent APFR ingresses
- Minimize motion during SRMS/OBSS mnvrs
- Minimize motion for a minimum of 60 sec between loads evaluations to allow for damping of load cell

### Cautions:

- Pump Module HR clearance from SHOSS-ED HR is ~1.5-in. Lift Pump Module in orbiter zenith 6-8 inches before moving it in any other direction

### Warnings:

- Minimize boom loads. Minor loads can cause SRMS joint brake slip and joint backdrive allowing contact between EMU and Orbiter structure

**CLEANUP (01:30)**

TASK TIME (PET TIME) HR : MIN	IV/SSRMS	EV1	EV2
00:00 (04:45)	<p>22. SRMS: To OBSS Ingress/Egress posn</p>	<p><u>OBSS CLEANUP (00:40)</u></p> <ol style="list-style-type: none"> <li>1. Mnvr to Orbiter sill</li> <li>2. Perform soft APFR egress</li> <li>3. Translate aft of OBSS</li> <li>4. Gently remove TS from APFR</li> <li>5. Transfer TS to EV2</li>   <li>6. Gently remove APFR</li> <li>7. Transfer APFR to EV2</li>   <li>8. Gently remove load cell</li> <li>9. Stow load cell in med ORU bag</li> <li>10. Gently remove PAD/WIF adapter</li> <li>11. Clear area for OBSS mnvr</li> <li>12. Verify no tether snags</li> <li>13. Stow PAD/WIF adapter in med ORU bag</li> <li>14. Once OBSS in posn, perform safety tether swap onto PMA2 tether</li> <li>15. Verify safety tether crew hook slide lock - L</li> <li>16. Retrieve own 85' safety tether; stow in med ORU bag</li> <li>17. Receive EV2's 85' safety tether; stow in med ORU bag</li> <li>18. Clear area for OBSS mnvr out of PLB</li> </ol>	<p><u>OBSS CLEANUP (00:40)</u></p> <ol style="list-style-type: none"> <li>1. Translate onto Orbiter sill (fwd of OBSS)</li> <li>2. As req'd: react egress loads via APFR HR and sill HR</li> <li>3. As req'd: react hardware removal loads via APFR HR and sill HR</li> <li>4. Receive TS from EV1; temp stow on ICC</li> <li>5. As req'd: react hardware removal loads</li> <li>6. Receive APFR from EV1; stow on ICC               <ul style="list-style-type: none"> <li>- Verify locking collar black-on-black</li> <li>- Perform pull test</li> </ul> </li> <li>7. As req'd: react hardware removal loads</li>   <li>8. As req'd: react hardware removal loads</li>   <li>9. Clear area for OBSS mnvr</li> <li>10. Verify no tether snags</li>   <li>11. Once OBSS in posn: perform safety tether swap onto PMA2 tether</li> <li>12. Verify safety tether crew hook slide lock - L</li> <li>13. Retrieve own 85' safety tether</li> <li>14. Transfer 85' safety tether to EV1</li>   <li>15. Clear area for OBSS mnvr out of PLB</li> </ol>
00:40 (05:25)	<p>24. SRMS: To OBSS Pre-setup posn</p>	<p><u>TOOL CLEANUP (00:50)</u></p> <ol style="list-style-type: none"> <li>1. Retrieve med ORU bag</li> <li>2. After EV2: translate to ICC</li> <li>3. Stow med ORU bag onto APFR</li> <li>4. Retrieve APFR/bag; stow onto BRT</li> <li>5. Verify EV2's TS in low profile posn</li> <li>6. Translate to Lab WIF 9 (nadir/stbd); stow APFR               <ul style="list-style-type: none"> <li>- Verify locking collar black-on-black</li> </ul> </li> </ol>	<p><u>TOOL CLEANUP (00:50)</u></p> <ol style="list-style-type: none"> <li>1. Translate to ICC</li> <li>2. Retrieve TS; stow onto BRT in low profile</li> </ol>

**CLEANUP (01:30)**

TASK TIME (PET TIME) HR : MIN	IV/SSRMS	EV1	EV2
01:30 (06:15)		<ul style="list-style-type: none"> <li>- Perform pull test</li> <li>7. Retrieve med ORU bag; stow onto BRT</li> <li>8. Translate to PMA2 HR 0401</li> <li>9. Provide clearance calls for EV2 as req'd</li> <li>10. Perform tether inventory</li> <li>11. Perform safety tether swap onto airlock safety tether</li> <li>12. Verify safety tether crew hook slide lock - L</li> <li>13. Translate to airlock; stow med ORU bag</li> <li>14. Translate to PMA1 WIF 02</li> <li>15. Assist EV2 as req'd</li> </ul>	<ul style="list-style-type: none"> <li>3. After EV1: translate to PMA2 HR 0402</li> <li>4. Retrieve fairlead from Orbiter sill HR</li> <li>5. Perform tether inventory</li> <li>6. Perform safety tether swap onto airlock safety tether</li> <li>7. Verify safety tether crew hook slide lock - L</li> <li>8. Wait for EV1</li> <li>9. Translate to PMA1 WIF 02</li> <li>10. Stow TS into APFR in TBD orientation               <ul style="list-style-type: none"> <li>- Verify locking tabs black-on-black (dots)</li> <li>- Perform pull test</li> </ul> </li> </ul>

**EVA 1 INGRESS (00:15)**

TASK TIME (PET TIME) HR : MIN	IV/SSRMS	EV1	EV2
00:00 (06:15)		<p><u>INGRESS (00:10)</u></p> <ol style="list-style-type: none"> <li>1. Translate to airlock</li> <li>2. Perform tool inventory</li>   <li>3. Receive safety tether from EV2</li> <li>4. Stow EV2 safety tether on airlock handrail (fwd pos'n), verify tether reel is in "UNLOCK"</li> <li>5. Transfer left waist tether to EV2</li> <li>6. Detach safety tether from right D-ring extender</li> <li>7. Stow safety tether on airlock handrail (aft pos'n), verify tether reel is in "UNLOCK"</li> <li>8. Ingress airlock</li> <li>9. Remove SCU from stowage pouch</li> <li>10. Remove DCM cover; Velcro to DCM</li> <li>11. Connect SCU to DCM; ✓ locked</li> <li>12. WATER - OFF (fwd)</li> <li>13. Close hatch thermal cover; attach Velcro strap</li> </ol> <div style="border: 1px solid black; padding: 5px; text-align: center;"> <p><b>CAUTION</b> Do not close hatch until EMU water - OFF for 2 min</p> </div>	<p><u>INGRESS (00:10)</u></p> <ol style="list-style-type: none"> <li>1. Translate to airlock</li> <li>2. Perform tool inventory</li> <li>3. Open thermal cover</li> <li>4. Ingress airlock</li> <li>5. Attach right waist tether to fwd UIA tether point</li> <li>6. Detach safety tether from right D-ring extender and transfer to EV1</li>   <li>7. Attach EV1's waist tether to EVA hatch D-ring</li>   <li>8. Remove SCU from stowage pouch</li> <li>9. Remove DCM cover; Velcro to DCM</li> <li>10. Connect SCU to DCM; ✓ SCU locked</li> <li>11. WATER - OFF (fwd)</li> </ol> <div style="border: 1px solid black; padding: 5px; text-align: center;"> <p><b>CAUTION</b> Do not close hatch until EMU water - OFF for 2 min</p> </div>
00:10 (06:25)		<ol style="list-style-type: none"> <li>14. Verify outer hatch clear of hardware; hatch - close and lock</li> <li>15. Go to PRE-REPRESS (DEPRESS/REPRESS Cue Card) - Steps 5-7 not required</li> </ol>	<ol style="list-style-type: none"> <li>12. Go to PRE-REPRESS (DEPRESS/REPRESS Cue Card) - Steps 5-7 not required</li> </ol>

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## EVA 2

### EVA 2 BRIEFING CARD

EV1 \_\_\_\_\_  
EV2 \_\_\_\_\_  
IV \_\_\_\_\_

EVA Prep start (GMT) \_\_\_\_/\_\_\_\_ \_\_\_\_:\_\_\_\_ \_\_\_\_  
Depress to 10.2 \_\_\_\_ \_\_\_\_:\_\_\_\_ \_\_\_\_  
Start Purge \_\_\_\_ \_\_\_\_:\_\_\_\_ \_\_\_\_  
PET 00:00 \_\_\_\_ \_\_\_\_:\_\_\_\_ \_\_\_\_

#### 1. EVA Prep

- Get-up Plan - clothing and EMU equipment bag
- Prebreathe protocol review
- Equipment lock activities - IV responsibilities
- Suit donning plan - special requests
- SAFER, MWS, tools, CL positions and bag stowage
- Airlock depress review
- EV/IV comm. protocol
- SRMS/SSRMS initial position

#### 2. EV Crew Procedure Review

- Egress Plan
- Translations - tether swaps
- Order of tasks
- Ingress Plan

#### 3. General Procedure Review

- Get ahead tasks
- Constraints - ground and flight
- Cautions and warnings review
- RMS operations - comm. protocol / clearances
- Contingency procedures - crib sheet

#### 4. Emergencies Review

- Lost comm.
- EMU malfunctions
- Lost tools
- Lost crewmember
- DCS
- Abort and Terminate scenarios

#### 5. Post EVA

- Suit doffing responsibilities
- Post EVA plan

Lessons learned from previous EVAs/Flights



## EVA 2 TOOL CONFIG

### Pre-EVA Tool Configuration

#### AIRLOCK

- C-Lk EVA Bag (stbd endcone)
- Spare PGT
- Wire Tie Caddy (with lg and sm RET)
- Connector Cleaner Tool Kit
- DCM plug
- EVA Camera w/ bracket
- D-Ring Extender on EVA hatch d-ring
- Med ORU Bag (w/ lg-sm ret on HR)
- 2-Adj Equip Tether on bag
- Fish Stringer
- Ret Equip Tether (3 - sm-sm)
- EVA Ratchet
- 2-Ext 7/16
- Socket caddy
- Right Angle Drive
- WIF adapter
- EVA Camera w/ bracket
- ETVCG w/ Thermal Cover
- Round Scoop at 8 o'clock
- Adj Tether around backside of cover
- RET (lg-sm) on camera tether point
- PRD w/ carrier (2) - Get Ahead

#### STBD LW TSA

- Empty

#### EV 1

- MWS
- Right Swing Arm
- PGT
- Ret Equip Tether (sm-sm)
- 6-Ext 7/16
- T-Bar
- Wire Ties for MME (2)
- Small EVA Trash Bag
- Ret Equip Tether (sm-sm) w/ PIP
- Ret Equip Tether (sm-sm)
- Adj Equip Tether (3)
- BRT
- Ret Equip Tether (sm-sm)
- Waist Tether (2)
- Spare Safety Tether (85')
- D-Ring Extender (2)

#### EV 2

- MWS
- Right Swing Arm
- PGT
- Ret Equip Tether (sm-sm)
- 6-Ext 7/16
- T-Bar
- Wire Ties for MME (2)
- Small EVA Trash Bag
- Ret Equip Tether (sm-sm) w/ PIP
- Ret Equip Tether (sm-sm)
- Adj Equip Tether (3)
- BRT
- Wire Ties (2)
- Ret Equip Tether (sm-sm)
- Waist Tether (2)
- Spare Safety Tether (85')
- D-Ring Extender (2)

### Post-EVA Tool Configuration

#### AIRLOCK

- C-Lk EVA Bag (stbd endcone)
- Spare PGT
- Wire Tie Caddy (with lg and sm RET)
- Connector Cleaner Tool Kit
- DCM plug
- EVA Camera w/ bracket
- D-Ring Extender on EVA hatch d-ring
- Med ORU Bag (w/ lg-sm ret on HR)
- 2-Adj Equip Tether on bag
- Fish Stringer
- Ret Equip Tether (sm-sm)
- EVA Ratchet
- 2-Ext 7/16
- Socket caddy
- Right Angle Drive
- WIF adapter
- EVA Camera w/ bracket
- Ret Equip Tether (sm-sm)
- Round Scoop
- Ret Equip Tether (sm-sm)
- Dummy Box
- Ret Equip Tether (sm-sm)
- ETVCG Thermal Cover
- EVA Camera w/ bracket
- PRD w/ carrier (2) - Get Ahead

#### STBD LW TSA

- ESP2 FRGF

#### EV 1

- MWS
- Right Swing Arm
- PGT
- Ret Equip Tether (sm-sm)
- 6-Ext 7/16
- T-Bar
- Wire Ties for MME (2)
- Small EVA Trash Bag
- Ret Equip Tether (sm-sm) w/ PIP
- Adj Equip Tether (3)
- BRT
- Ret Equip Tether (sm-sm)
- Waist Tether (2)
- Spare Safety Tether (85')
- D-Ring Extender (2)

#### EV 2

- MWS
- Right Swing Arm
- PGT
- Ret Equip Tether (sm-sm)
- 6-Ext 7/16
- T-Bar
- Wire Ties for MME (2)
- Small EVA Trash Bag
- Ret Equip Tether (sm-sm) w/ PIP
- Ret Equip Tether (sm-sm)
- Adj Equip Tether (3)
- BRT
- Wire Ties (2)
- Ret Equip Tether (sm-sm)
- Waist Tether (2)
- Spare Safety Tether (85')
- D-Ring Extender (2)

## EVA 2 INHIBIT PAD

<b>MCS</b>	
MCC-M	<ol style="list-style-type: none"> <li>1. √FGB Attitude Control Thruster Valves (80) – closed</li> <li>2. √FGB Attitude Control Manifold Valves – closed KШK1, KШK2, KШK4, KШK5, KШK9, OKO3, OKГ3, OKO6, OKГ6, OKO7, OKГ7, OKO8, OKГ8</li> <li>3. √FGB MCS unpowered</li> <li>4. √SOYUZ manifolds (ten) closed</li> <li>5. √SOYUZ MCS unpowered</li> </ol>

<b>RCS</b>	
If EV crew < 27 ft from FRCS:	
IV	1. √DAP: √FREE, LO Z
O14,15,16	2. √RJDF F1, F2, F3, F4 MANF DRIVER (four) – OFF
MCC	3. √Above RCS config

<b>Orbiter Antennas</b>	
<u>NOTE</u>	
Possible loss of comm when forced LL FWD antenna	
If EV crew < 1.6 ft from S-Band antenna:	
IV	1. S-BAND FM ANT – XMIT LOWER/RCVR UPPER
A1R	2. √MCC, lower antenna selected
O14,15,16	If no comm or on MCC call:
C3	3. S-BAND PM ANT – LL FWD
When EVA crewmember at least 1.6 ft away from all S-Band upper antennas:	
C3	4. S-BAND PM ANT – GPC
MCC-H	5. √KU-BAND Mask active

<b>FGB Antennas</b>	
MCC-M	<ol style="list-style-type: none"> <li>1. √TORU [TOPY] – Deactivate</li> <li>2. √TV System [TBC] – Deactivate</li> <li>3. √KURS P [Kurs] – Deactivate</li> <li>4. √KURS A [Kurs] – Deactivate</li> </ol>

<b>SM Antennas (MCC-M)</b>	
MCC-M	1. Global Timing Sys 1 & 2 [GTS] – Deactivate

<b>PCU</b>	
<u>NOTE</u>	
PCUs may require up to 1 hr warm-up period before they are operational	
MCC-H	1. √PCUs (two) operational, in discharge mode

<b>USOS Antennas</b>	
MCC-H	<ol style="list-style-type: none"> <li>1. SGANT (KU) – Mask for EVA Worksites</li> <li>2. MISSE #5 - TBD</li> </ol>

## EVA 2 NOTES, CAUTIONS, & WARNINGS

### NOTE

- Bolt install: report torque and turns
- Bolt release: report torque and turns if different from published range
- EVA connectors: verify bend radius, free of FOD, pin and EMI band integrity after disconnection and prior to connection
- Toolbox doors must be closed with one latch per door if EV crew is not in the immediate vicinity

### CAUTION

Avoid inadvertent contact with:

- Grapple fixture shafts (have coating)
- Grapple fixture target pin
- SVS Targets
- Passive UMAs
- SSRMS/MBS operating cameras & lights (heat source)
- MBS VDU, MCU, CRPCMs & Cameras (silver Teflon tape radiative surface)
- Deployed TUS cable
- Deployed MISSEs (A/L)
- CETA Lights (Z-93 paint) (Node, S1, ETVCG)
- PMA 2 TCS Reflectors & APAS hardware
- SASA (Z1 and S1)– Antenna and Z-93 paint
- S0 Radiators (silver Teflon tape)
- S0 GPS Antenna (Z-93 paint)
- S1/P1 Radiators (Z-93 paint)

### CAUTION (cont)

Thermal Constraints:

- EVA connectors may become hot if left uncovered. Limited handling may be needed
- PMA handrails may be hot. Limit handling if required

Keepout Zones:

- When  $\geq 130$  inches from center of P1/S1 rad beam = 2 feet from edge of beam
- UHF Antenna (PLB (stbd), Lab, P1) = 1 foot
- S-BAND (SASA)  
S1 - Stay away from S-band antenna horn 3.6 ft in high gain, 1.3 ft in low gain

For structural reasons:

- Avoid vigorous body motions, quick grabs and kickoff tether restraints
  - Avoid performing shaking motions (sinusoidal functions) more than four cycles
- If any of these occur, wait 2-5 min to allow structural response to dissipate

For fiber optic cables:

- Avoid bend radii less than 10 times cable diameter
- Avoid pulling on cable during mate/demate

### WARNING

Sharp Edges:

- PMA umbilical launch restraints exposed bolt threads
- Inner edges of WIF sockets
- Mating surfaces of EVA connectors. Avoid side loads during mating
- PRLA grounding wiper
- 6B box outer bolt springs

Pinch Hazard:

- EVA connector linkage. Use caution when mating/locking
- EV side of crewlock hatch during hatch operations (also snag hazard)

Hot Connector Hazard:

- ROEU Connector – remain clear

Contact Hazard:

- Lab window shutter during operation
- Remain clear of Lab window when open
- Handrails utilized for MISSE attachment may not be used as a safety tether attach point

## EVA 2 SUMMARY TIMELINE

TASK TIME (PET TIME) HR : MIN	IV/SSRMS	EV1	EV2
00:00 ---	SSRMS - Pump Module Pre-Grapple	<u>POST DEPRESS/EGRESS</u> (00:15)	<u>POST DEPRESS/EGRESS</u> (00:15)
		<u>FRGF REMOVAL</u> (00:40)	<u>APFR SETUP</u> (00:25)
			<u>PREP PM FOR FGB</u> (00:15)
01:00 ---	SSRMS: Mnvr in for pump module grapple SSRMS: Close snares and then rigidize SSRMS: To Pump Module Install posn	<u>FGB TO PM INSTALLATION</u> (00:20)	<u>FGB TO PM INSTALLATION</u> (00:20)
		<u>PUMP MODULE RETRIEVE</u> (00:25)	<u>PUMP MODULE RETRIEVE</u> (00:25)
		<u>FGB S1 ATA INSTALL</u> (00:45)	<u>FGB S1 ATA INSTALL</u> (00:45)
02:00 ---			
	SSRMS: Pump Module Hand Off position SSRMS: Release SSRMS: Mnv away from pump module	<u>PUMP MODULE INSTALLATION</u> (00:40)	<u>PUMP MODULE INSTALLATION</u> (00:40)
03:00 ---	SSRMS - Mnv to SHOSS-ED Pre-Grapple SSRMS: Close snares and then rigidize SSMRS: Mnv to SHOSS-ED Install posn	<u>SHOSS-ED RETRIEVE</u> (00:40)	<u>SHOSS-ED RETRIEVE</u> (00:40)
		<u>CP9 CAMERA GROUP INSTALLATION</u> (02:05)	<u>CP9 CAMERA GROUP INSTALLATION</u> (02:05)
04:00 ---			
05:00 ---			
06:00 ---	SSMRS: SHOSS-ED Hand Off posn SSRMS: Release SSRMS: Mnv away from SHOSS-ED	<u>SHOSS-ED INSTALLATION</u> (00:35)	<u>SHOSS-ED INSTALLATION</u> (00:35)
06:35 --	SSRMS - EVA OPS Complete EVA = 6:40	<u>INGRESS/PRE REPRESS</u> (00:15)	<u>INGRESS/PRE REPRESS</u> (00:15)

**EVA 2 EGRESS (00:15)**

TASK TIME (PET TIME) HR : MIN	IV/SSRMS	EV1	EV2
00:00 (00:05)		<p><u>Initial Config:</u> Left waist tether on EVA hatch D-ring extender. Spare safety tether (85') on right D-ring ext.</p> <p><u>EGRESS (00:10)</u></p> <ol style="list-style-type: none"> <li>1. Thermal cover - open</li> <li>2. Egress airlock</li> <li>3. Retrieve aft airlock safety tether; inspect load alleviating strap for damage</li> <li>4. Attach aft airlock safety tether to right D-ring ext</li> <li>5. Engage safety tether crew hook slide lock - L</li> <li>6. ✓ safety tether reel unlocked</li> <li>7. Receive left waist tether; stow</li> <li>8. Receive med ORU EVA bag from EV2; stow on BRT</li> <li>9. Retrieve fwd airlock safety tether; inspect load alleviating strap for damage</li> <li>10. Transfer safety tether to EV2</li> </ol>	<p><u>Initial Config:</u> Right waist tether on fwd UIA tether point. Spare safety tether (85') on right D-ring ext</p> <p><u>EGRESS (00:10)</u></p> <ol style="list-style-type: none"> <li>1. Release EV1 waist tether; transfer to EV1</li> <li>2. Transfer med ORU EVA bag to EV1</li> <li>3. Receive fwd airlock safety tether from EV1</li> <li>4. Attach fwd airlock safety tether to right D-ring ext</li> <li>5. Engage safety tether crew hook slide lock - L</li> <li>6. ✓ safety tether reel unlocked</li> <li>7. Retrieve spare waist tether; stow</li> <li>8. Egress airlock</li> <li>9. Close thermal cover</li> <li>10. Check EV1 tether &amp; SAFER config</li> </ol>
00:10 (00:15)		<ol style="list-style-type: none"> <li>11. Check EV2 tether &amp; SAFER config               <ul style="list-style-type: none"> <li>- ✓ SAFER MAN ISOL vlv – Open (dn)</li> <li>- ✓ SAFER HCM – Closed (dn)</li> </ul> </li> </ol>	<ol style="list-style-type: none"> <li>10. Check EV1 tether &amp; SAFER config               <ul style="list-style-type: none"> <li>- ✓ SAFER MAN ISOL vlv – Open (dn)</li> <li>- ✓ SAFER HCM – Closed (dn)</li> </ul> </li> </ol>

**FRGF REMOVAL (00:40)**

TASK TIME (PET TIME) HR : MIN	IV/SSRMS	EV1	EV2
00:00 (00:15)		<p><u>FRGF REMOVAL</u> (00:25)</p> <ol style="list-style-type: none"> <li>1. Translate to ESP2 FRGF via nadir path - fairlead A/L HR 0501</li> <li>2. Temp stow med ORU bag on fwd/nadir VSSA FSE FRAM handrail</li> <li>3. BRT to HR 8011 (stbd)</li> <li>4. <b>EVA Ratchet, 2-Ext 7/16 (22 lbs expected)</b></li> <li>5. Release ESP2 FRGF stbd bolts (2), 12 turns</li> <li>6. BRT to HR 8012 (port)</li> <li>7. Tether to FRGF</li> <li>8. <b>EVA Ratchet, 2-Ext 7/16 (22 lbs expected)</b></li> <li>9. Release ESP2 FRGF port bolts (2), 12 turns</li> <li>10. Stow FRGF on BRT</li> <li>11. Stow EVA ratchet in med ORU bag</li> <li>12. Preposition ret from ORU bag for stanchion dummy box (fwd/zenith stanchion)</li> </ol>	<p><u>APFR SETUP</u> (00:25)</p> <ol style="list-style-type: none"> <li>1. Translate to Lab WIF 9 (nadir/stbd); fairlead w/ adj tether on Lab HR 229</li> <li>2. Remove ingress aid; temp stow</li> <li>3. Retrieve APFR</li> <li>4. Translate to PMA2 (stbd side)</li> <li>5. Perform safety tether swap to spare safety tether onto PMA2 HR 0402</li> <li>6. Temp stow airlock safety tether</li> <li>7. Translate to orbiter stbd; fairlead w/ adj equip tether</li> <li>8. Translate to ICC</li> <li>9. Configure APFR into ICC WIF 1 (fwd/port) <b>[9,QQ,G,2]</b> <ul style="list-style-type: none"> <li>- Verify locking collar black-on-black</li> <li>- Perform pull test</li> </ul> </li> </ol>
00:25 (00:40)		<p><u>FRGF STOW</u> (00:15)</p> <ol style="list-style-type: none"> <li>1. Translate to PMA2</li> <li>2. Perform safety tether swap to spare safety tether onto PMA2 HR 0401</li> <li>3. Temp stow airlock safety tether</li> <li>4. Translate to Orbiter stbd TSA</li> <li>5. Open TSA, 4 latches</li> <li>6. Stow FRGF</li> <li>7. Close TSA, 4 latches</li> <li>8. Translate to orbiter port; fairlead w/ adj equip tether</li> <li>9. Translate to ICC</li> </ol>	
00:40 (00:55)			

# FRGF - TASK DATA SHEET

## Estimated Task Duration:

	With SSRMS	Without SSRMS
One EV Crew	N/A	00:40

## Tools:

EV1	EV2
<ul style="list-style-type: none"> <li>EVA Ratchet w/ 7/16, 2-in extension</li> <li>BRT</li> <li>Spare safety tether</li> </ul>	

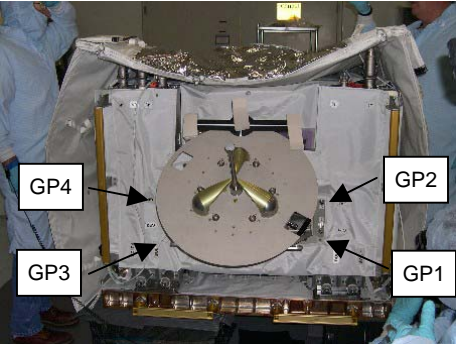
## EVA Fasteners:

Fastener Name	Head Size	Qty	Install Torque (ft-lb)	Release Torque (ft-lb)	Failure Torque (ft-lb)	Turns
ESP-2 FRGF bolts	7/16	4	20.8	22.0	40.0	12



ESP2 FRGF Worksite

# FGB TO PM INSTALLATION (00:20)

TASK TIME (PET TIME) HR : MIN	IV/SSRMS	EV1	EV2
00:00 (00:55)		<p><u>FGB 1 RETRIEVAL</u> (00:10)</p> <ol style="list-style-type: none"> <li>Ingress APFR installed in ICC WIF 1 (fwd/port)</li> </ol> <p style="text-align: center;"><u>NOTE</u> Do not touch SRMS target or grapple pin shaft on FGB</p> <ol style="list-style-type: none"> <li>Tether to FGB</li> <li>Receive FGB from EV2</li> </ol>	<p><u>FGB 1 RETRIEVAL</u> (00:25)</p> <ol style="list-style-type: none"> <li>Translate to Pump Module; fairlead to fwd ICC handrail</li> <li>Release PM MLI tent Velcro straps (2); reattach Velcro</li> <li>Open fwd MLI tent flap; Velcro open</li> <li>Open GRAPPLE BOLTS COVER</li> <li><b>PGT [B1 (10 ft-lb), CCW 2, 30.5], 6-Ext 7/16</b></li> <li>Disengage Pump Module FGB Bolts (4), 20 turns</li> <li>Disengage Velcro from PM MLI surrounding GRAPPLE BOLTS COVER</li> </ol> <p style="text-align: center;"><u>NOTE</u> Do not touch SRMS target or grapple pin shaft on FGB</p> <ol style="list-style-type: none"> <li>Translate to nadir ICC surface</li> <li><b>PGT [B1 (10 ft-lb), CCW 2, 30.5], 6-Ext 7/16</b></li> <li>Disengage FGB launch bracket mounting bolts (4), TBD turns</li> <li>Remove FGB; present to EV1</li> <li>Transfer FGB to EV1; release own tether</li> </ol>
00:10 (01:05)		<p><u>FGB 1 INSTALL</u> (00:10)</p> <ol style="list-style-type: none"> <li>Pull port side PM MLI away from grapple bolts</li> <li>Soft dock FGB to Pump Module (RMS target closest to top of box - grapple pin points zenith)</li> </ol> <p style="text-align: center;"><u>NOTE</u> GP2 must be the first bolt torqued Remaining bolts are torqued in a star pattern</p>	<p><u>FGB 1 INSTALL</u> (00:10)</p> <ol style="list-style-type: none"> <li>Translate to Pump Module</li> <li>Pull stbd side PM MLI away from grapple bolts</li> <li>Assist EV1 as req'd</li> </ol> <p style="text-align: center;"><u>NOTE</u> GP2 must be the first bolt torqued Remaining bolts are torqued in a star pattern</p>



### FGB TO PM INSTALLATION (00:20)

TASK TIME (PET TIME) HR : MIN	IV/SSRMS	EV1	EV2
00:20 (01:15)	1. Record turns and torque: GP2 _____ turns _____ ft-lb GP3 _____ turns _____ ft-lb GP4 _____ turns _____ ft-lb GP1 _____ turns _____ ft-lb	3. <b>PGT [B2 (15.4 ft-lb), CW 2, 30.5], 6-Ext 7/16</b> 4. Engage Pump Module FGB Bolt GP2, 10-11 turns 5. Engage Pump Module FBG Bolt GP1, 10-11 turns	4. <b>PGT [B2 (15.4 ft-lb), CW 2, 30.5], 6-Ext 7/16</b> 5. After bolt 2: Engage Pump Module FGB Bolt GP3, 10-11 turns 6. Engage Pump Module FGB Bolt GP4, 10-11 turns

# FGB TO PM INSTALLATION - TASK DATA SHEET

## Estimated Task Duration:

	With SSRMS	Without SSRMS
Two EV Crew	N/A	00:35

## Tools:

EV1	EV2
<ul style="list-style-type: none"> <li>Retr tether (FGB)</li> <li>PGT w/ 7/16, 6-in extension</li> <li>Spare safety tether (swap at PMA 2)</li> </ul>	<ul style="list-style-type: none"> <li>Retr tether (FGB)</li> <li>PGT w/ 7/16, 6-in extension</li> <li>Spare safety tether (swap at PMA 2)</li> </ul>

## EVA Fasteners:

Fastener Name	Head Size	Qty	Install Torque (ft-lb)	Release Torque (ft-lb)	Failure Torque (ft-lb)	Turns
FGB launch mount bolt release	7/16	4	---	10	TBD	20
FGB launch mount bolt install *	7/16	4	15.4	---	TBD	20
PM FGB GP bolt release	7/16	4	---	10	TBD	20
PM FGB GP bolt install	7/16	4	15.4	---	TBD	10-11

\* Bolt data present here for contingency FGB re-installation

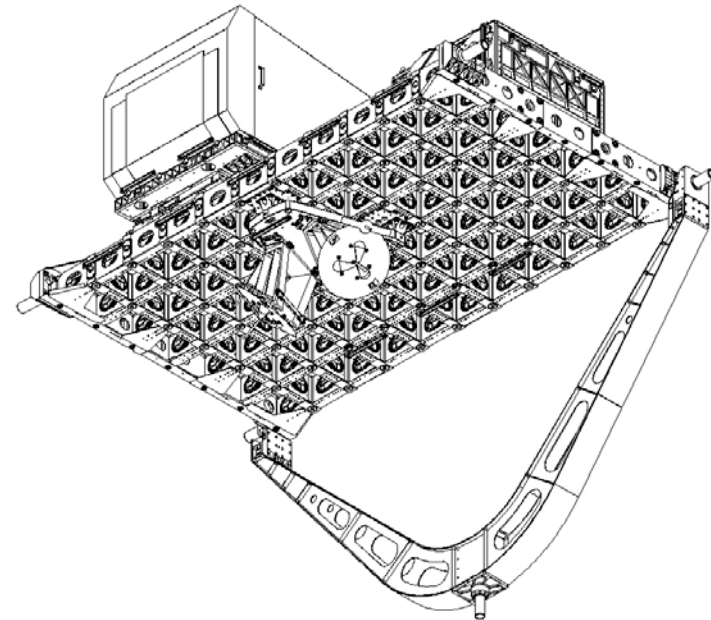
## Foot Restraints:

Task	WIF	APFR Setting
FGB Retrieval **	ICC WIF 1 (fwd/port)	9,QQ,G,2

\*\* APFR is not required for FGB installation, but is used since it is present for the PM transfer

## Notes:

- Do not touch SRMS target or grapple pin shaft on FGB
- GP2 must be the first bolt torqued. Remaining bolts are torqued in a star pattern



ICC Launch Configuration

**PUMP MODULE RETRIEVE (00:25)**

TASK TIME (PET TIME) HR : MIN	IV/SSRMS	EV1	EV2
<p>00:00 (01:15)</p> <p>00:25 (01:40)</p>	<p>1. SSRMS: Pump Module Pre-Grapple posn</p> <p>2. SSRMS: Mnvr in for pump module grapple</p> <p>3. SSRMS: On EV1 Go - close snares and then rigidize</p> <p>4. SSRMS: To Pump Module Install posn</p>	<p><u>PUMP MODULE RETRIEVAL (00:25)</u></p> <p><u>NOTE</u> FRAM has a 5.5 lb magnetic soft dock at fwd 2 corners and a 3.5 lb soft dock at aft 2 corners</p> <div data-bbox="804 469 1352 646" style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p><u>CAUTION</u> Pump Module HR clearance from SHOSS-ED HR is ~1.5-in. Lift Pump Module in orbiter zenith 6-8 inches before moving it in any other direction.</p> </div> <p>1. Tether to Pump Module with RET</p> <p>2. Hold PM onto FRAM while EV2 repositions 3. Remove Pump Module 4. Mnvr Pump Module orbiter stbd ~1 ft 5. Present Pump Module for SSRMS grapple 6. Inform SSRMS operator when SSRMS EE over 3/4 of grapple pin (Stop Motion)</p> <p><u>NOTE</u> Pump module will be pulled during SSRMS rigidization</p> <p>7. Notify SSRMS operator Go for grapple 8. Once grapple confirmed - release Pump Module 9. Release Pump Module RET; verify tethers clear 10. SSRMS mnvr to ESP2 11. Verify Pump Module clear</p>	<p><u>PUMP MODULE RETRIEVAL (00:25)</u></p> <p><u>NOTE</u> FRAM has a 5.5 lb magnetic soft dock at fwd 2 corners and a 3.5 lb soft dock at aft 2 corners</p> <div data-bbox="1428 469 1976 646" style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p><u>CAUTION</u> Pump Module HR clearance from SHOSS-ED HR is ~1.5-in. Lift Pump Module in orbiter zenith 6-8 inches before moving it in any other direction.</p> </div> <p>1. On EV1 Go: 2. <b>PGT [A7 (10 approved), CCW 2 , 30.5], 6-Ext 7/16</b> 3. Release primary FRAM bolt to hard stop, 11 turns (IV: notify SSRMS operator) 4. Reposition self to aft ICC location 5. Assist EV1 as directed</p> <p><u>NOTE</u> Pump module will be pulled during SSRMS rigidization</p> <p>6. Once grapple confirmed - release Pump Module 7. Verify tethers clear</p>

## PUMP MODULE RETRIEVE - TASK DATA SHEET

### Estimated Task Duration:

	With SSRMS	Without SSRMS
Two EV Crew	01:20	TBD

### Tools:

EV1	EV2
<ul style="list-style-type: none"> <li>Retr Tether (PM)</li> <li>BRT (ATA FGB pre-positioning)</li> <li>2 - Adj Tethers (ATA FGB pre-positioning)</li> <li>Spare safety tether (swap at PMA 2)</li> </ul>	<ul style="list-style-type: none"> <li>PGT w/ 7/16, 6-in extension</li> <li>Spare safety tether (swap at PMA 2)</li> </ul>

### EVA Fasteners:

Fastener Name	Head Size	Qty	Install Torque (ft-lb)	Release Torque (ft-lb)	Failure Torque (ft-lb)	Turns
Primary FRAM bolt release	7/16	1	---	10	TBD	11
Primary FRAM bolt engage	7/16	1	10	---	TBD	11

### Foot Restraints:

Task	WIF	APFR Setting
PM Retrieval	ICC WIF 1 (fwd/port)	9, QQ, G, 2
PM Install	ESP-2 WIF 5 (fwd face)	3, PP, F, 11

### Connector Inhibits:

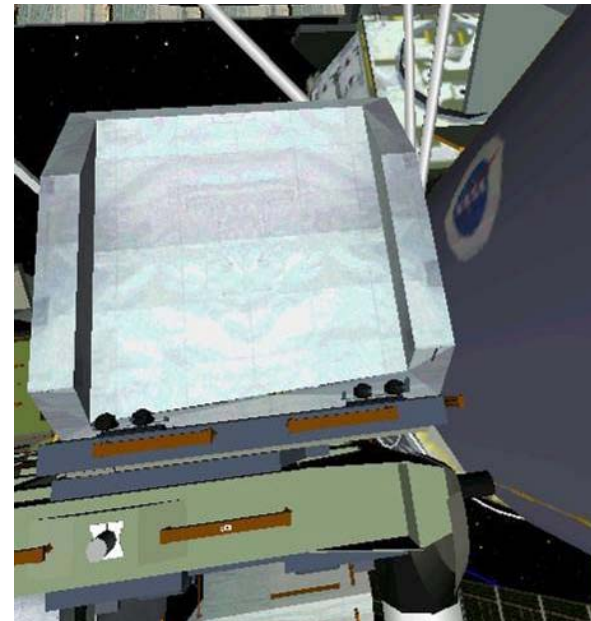
Task	Inhibit
Blind Mate Connector	RPCM N1-RS2-B, Channel 6 RPCM S0-4B-F, Channel 10

### Notes:

- FRAM has a 5.5 lb magnetic soft dock at fwd 2 corners and a 3.5 lb soft dock at aft 2 corners
- Do not touch SRMS target or grapple pin shaft on FGB


### Cautions:

- Pump Module HR clearance from SHOSS-ED HR is ~1.5-in. Lift Pump Module in orbiter zenith 6-8 inches before moving it in any other direction



Pump Module Photo Closeout

# FGB S1 ATA INSTALLATION (00:45)

TASK TIME (PET TIME) HR : MIN	IV/SSRMS	EV1	EV2
00:00 (03:15)		<p><u>FGB 2 RETRIEVAL</u> (00:15)</p> <p><u>NOTE</u> Do not touch SRMS target or grapple pin shaft on FGB</p> <ol style="list-style-type: none"> <li>1. Tether and BRT to FGB</li> <li>2. Position BRT into low profile</li> <li>3. Egress APFR</li> </ol>	<p><u>FGB 2 RETRIEVAL</u> (00:15)</p> <p><u>NOTE</u> Do not touch SRMS target or grapple pin shaft on FGB</p> <ol style="list-style-type: none"> <li>1. Translate to nadir ICC surface</li> <li>2. <b>PGT [B1 (10 ft-lb), CCW 2, 30.5], 6-Ext 7/16</b></li> <li>3. Disengage FGB launch bracket mounting bolts (4), TBD turns</li> <li>4. Remove FGB; present to EV1</li> <li>5. Transfer FGB to EV1; release own tether</li> <li>6. Assist EV1 w/ BRT positioning</li> </ol>
00:30 (03:45)	<div style="text-align: center;">  </div> <ol style="list-style-type: none"> <li>1. IV: Record turns and torque:            GP2 _____ turns _____ ft-lb            GP3 _____ turns _____ ft-lb            GP4 _____ turns _____ ft-lb            GP1 _____ turns _____ ft-lb</li> <li>2. IV: Photo Close-out; WVS-EV2, center cam (FGB on ATA overview)</li> </ol>	<p><u>FGB INSTALL</u> (00:30)</p> <ol style="list-style-type: none"> <li>1. Translate to S1 outboard ATA zenith face via CETA spur; fairlead at A/L HR 0547 and top of CETA spur</li> <li>2. <b>PGT [B1 (10 ft-lb), CCW2, 30.5], 6-Ext 7/16</b></li> <li>3. Disengage S1 ATA Grapple Bolts 1 - 4, 20 turns</li> <li>4. Soft dock FGB to ATA (RMS target closest to top of box)</li> </ol> <p><u>NOTE</u> GP2 must be the first bolt torqued Remaining bolts are torqued in a star pattern</p> <ol style="list-style-type: none"> <li>5. <b>PGT [B2 (15.4 ft-lb), CW2, 30.5], 6-Ext 7/16</b></li> <li>6. Engage ATA Grapple Bolt 2, 10-11 turns</li> <li>7. Engage ATA Grapple Bolts 3 and 4, 10-11 turns</li> <li>8. Engage ATA Grapple Bolt 1, 10-11 turns</li> <li>9. Provide WVS survey of FGB on S1 ATA</li> </ol>	<p><u>APFR RECONFIG</u> (00:30)</p> <ol style="list-style-type: none"> <li>1. Retrieve APFR from ICC WIF 1 (fwd/port)</li> <li>2. Install APFR into ICC WIF 2 (aft/stbd)</li> <li>3. Configure APFR [3,LL,E,12]            - Verify locking collar black-on-black            - Perform pull test</li> <li>4. Translate to A/L stbd toolbox (release PLB fairlead)</li> <li>5. Retrieve APFR</li> <li>6. Install APFR into ESP2 WIF 5 (fwd face)</li> <li>7. Configure APFR [3,PP,F,11]            - Verify locking collar black-on-black            - Perform pull test</li> <li>8. Assist EV1 as req'd</li> </ol>

# FGB S1 ATA INSTALLATION - TASK DATA SHEET

## Estimated Task Duration:

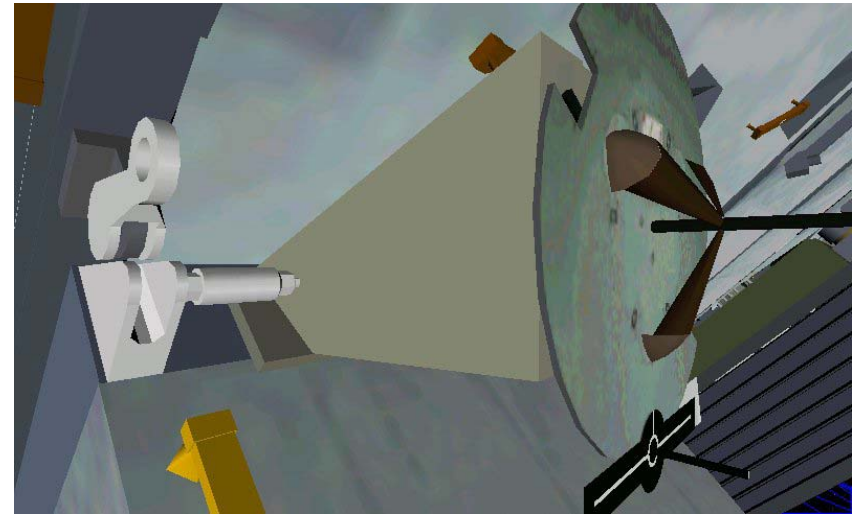
	With SSRMS	Without SSRMS
One EV Crew	N/A	00:30

## Tools:

EV1	EV2
<ul style="list-style-type: none"> <li>Retr tether (FGB)</li> <li>PGT w/ 7/16, 6-in extension</li> <li>BRT</li> </ul>	<ul style="list-style-type: none"> <li>PGT w/ 7/16, 6-in extension</li> <li>BRT</li> </ul>

## EVA Fasteners:

Fastener Name	Head Size	Qty	Install Torque (ft-lb)	Release Torque (ft-lb)	Failure Torque (ft-lb)	Turns
ATA FGB GP bolt release	7/16	4	---	10	TBD	20
ATA FGB GP bolt install	7/16	4	15.4	---	TBD	10-11



**FGB onto S1 ATA Photo Closeout**

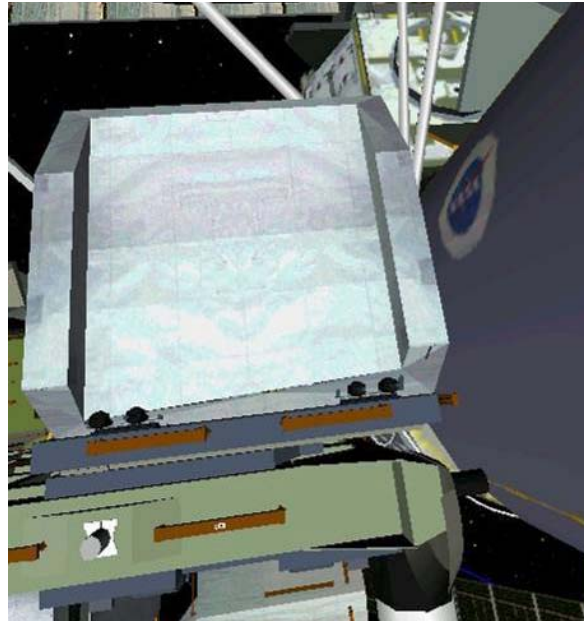
## Notes:

- Do not touch SRMS target or grapple pin shaft on FGB
- GP2 must be the first bolt torqued. Remaining bolts are torqued in a star pattern

## PUMP MODULE INSTALLATION (00:40)

TASK TIME (PET TIME) HR : MIN	IV/SSRMS	EV1	EV2
00:00 (00:15)	<ol style="list-style-type: none"> <li>1. SSRMS: Pump Module Hand Off position</li> <li>2. IV: Verify w/ MCC inhibits in place for PM install                             <ul style="list-style-type: none"> <li>- RPCM P11A A RPC 1 and 15</li> <li>- RPCM P12B A RPC 2 and 16</li> </ul> </li> <li>3. SSRMS: On EV1 Go - release</li> <li>4. SSRMS: On EV1 Go - mnvr away from pump module</li> </ol>	<p><u>PUMP MODULE INSTALLATION (00:40)</u></p> <ol style="list-style-type: none"> <li>1. Translate to ESP2 fwd face</li> <li>2. Ingress APFR</li> <li>3. GCA SSRMS; tether to Pump Module</li> <li>4. Notify SSRMS operator Go to prep for ungrapple</li> <li>5. When prompted by SSRMS operator: Hold Pump Module for release</li> <li>6. Notify SSRMS operator Go for release</li> <li>7. Notify SSRMS operator when SSRMS EE clear of grapple pin</li> <li>8. Guide Pump Module into FRAM</li> <li>9. Give EV2 Go to release PM; engage primary FRAM bolt</li> <li>10. Egress APFR</li> <li>11. Deploy PM MLI tent; attach Velcro restraints</li> <li>12. Configure APFR for ETVCG [12, QQ, F, 12]                             <ul style="list-style-type: none"> <li>- Verify locking collar black-on-black</li> <li>- Perform pull test</li> </ul> </li> <li>13. Provide WVS survey of pump module                             <ul style="list-style-type: none"> <li>- As req'd, translate to Lab HR 0296, for WVS survey</li> </ul> </li> </ol>	<p><u>FGB 2 PUMP MODULE INSTALLATION (00:40)</u></p> <ol style="list-style-type: none"> <li>1. As req'd: translate to ESP2</li> <li>2. Poorman fairlead aft/port ESP2</li> <li>3. Position self on aft/zenith face of ESP2; BRT to HR 8018</li> <li>4. Pre-configure PGT [A7, CW 2, 30.5]</li> <li>5. Assist EV1 as directed</li> <li>6. Reposition self for primary FRAM bolt access</li> <li>7. <b>PGT [A7 (10 approved), CW 2 , 30.5], 6-Ext 7/16</b></li> <li>8. Engage primary FRAM bolt to hard stop, 11 turns</li> <li>9. Deploy PM MLI tent; attach Velcro restraints</li> </ol>
00:25 (00:40)	<p>IV: Photo close-out; WVS: EV1 - center cam (PM overview, MLI tent fwd face)</p>		

**PUMP MODULE INSTALLATION (00:40)**



**Pump Module Photo Closeout**



# SHOSS-ED RETRIEVAL (00:40)

TASK TIME (PET TIME) HR : MIN	IV/SSRMS	EV1	EV2
00:00 (02:35)	<ol style="list-style-type: none"> <li>1. SSRMS: SHOSS-ED Pre-Grapple posn</li>   <li>2. SSRMS: Mnv in for SHOSS-ED grapple</li>   <li>3. SSRMS: On EV2 Go - close snares and then rigidize</li>   <li>4. SSMRS: On EV2 Go – mnvr to SHOSS-ED Install posn</li> </ol>	<p><u>SHOSS-ED RETRIEVAL (00:40)</u></p> <ol style="list-style-type: none"> <li>1. Translate to ICC fwd face (redo fairlead)</li> <li>2. BRT to fwd ICC handrail</li>   <li style="text-align: center;"><u>NOTE</u> FRAM has a 5.5 lb magnetic soft dock at fwd 2 corners and a 3.5 lb soft dock at aft 2 corners</li>   <li>3. <b>PGT [A7 (10 approved), CCW 2 , 30.5], 6-Ext 7/16</b></li> <li>4. Release primary FRAM bolt to hard stop, 11 turns (IV: notify SSRMS operator)</li> <li>5. Reposition self to GCA position</li> <li>6. Assist EV2 as directed</li>   <li style="text-align: center;"><u>NOTE</u> SHOSS-ED will be pulled during SSRMS rigidization</li>   <li>7. Once grapple confirmed - release SHOSS-ED</li> <li>8. Verify tethers clear</li> <li>9. Retrieve fairlead from Orbiter port</li> <li>10. Perform tether inventory</li> <li>11. Translate to PMA2 HR 401</li> <li>12. Perform safety tether swap to airlock safety tether</li> <li>13. Engage safety tether crew hook slide lock - L</li> </ol>	<p><u>SHOSS-ED RETRIEVAL (00:40)</u></p> <ol style="list-style-type: none"> <li>1. Translate to ICC WIF 2 (aft/stbd) (redo fairlead)</li> <li>2. Fairlead to zenith/fwd/stbd ICC handhold</li> <li>3. Ingress APFR</li> <li>4. Tether to SHOSS-ED with RET</li>   <li style="text-align: center;"><u>NOTE</u> FRAM has a 5.5 lb magnetic soft dock at fwd 2 corners and a 3.5 lb soft dock at aft 2 corners</li>   <li>5. Remove SHOSS-ED</li> <li>6. Present SHOSS-ED for SSRMS grapple</li> <li>7. Inform SSRMS operator when SSRMS EE over 3/4 of grapple pin (Stop Motion)</li>   <li style="text-align: center;"><u>NOTE</u> SHOSS-ED will be pulled during SSRMS rigidization</li>   <li>8. Notify SSRMS operator Go for grapple</li> <li>9. Once grapple confirmed - release SHOSS-ED</li> <li>10. Release SHOSS-ED ret; verify tethers clear</li> <li>11. Give SSRMS operator Go for mnvr to ESP2</li> <li>12. Verify SHOSS-ED clear</li> <li>13. Egress APFR</li> <li>14. Retrieve APFR</li> <li>15. Retrieve fairlead from Orbiter stbd</li> <li>16. Perform tether inventory</li> <li>17. Translate to PMA2 HR 402</li> <li>18. Perform safety tether swap to A/L safety</li> </ol>

**SHOSS-ED RETRIEVAL (00:40)**

TASK TIME (PET TIME) HR : MIN	<b>IV/SSRMS</b>	<b>EV1</b>	<b>EV2</b>
00:40 (03:15)			tether 19. Engage safety tether crew hook slide lock - L 20. Translate to Lab WIF 9 (nadir/stbd) 21. Stow APFR - Verify locking collar black-on-black - Perform pull test

## SHOSS-ED - TASK DATA SHEET

### Estimated Task Duration:

	With SSRMS	Without SSRMS
Two EV Crew	01:15	TBD

### Tools:

EV1	EV2
<ul style="list-style-type: none"> <li>PGT w/ 7/16, 6-in extension</li> <li>Spare safety tether (swap at PMA 2)</li> </ul>	<ul style="list-style-type: none"> <li>Spare safety tether</li> <li>Retr tether (SHOSS-ED)</li> <li>Spare safety tether (swap at PMA 2)</li> </ul>

### EVA Fasteners:

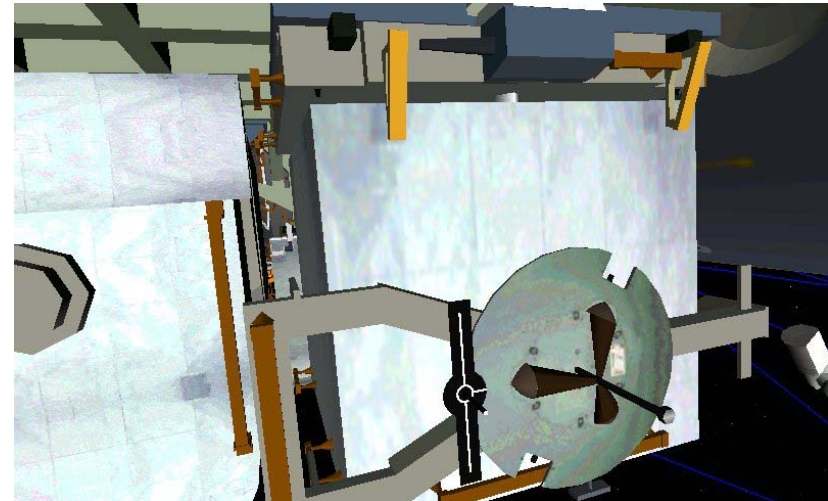
Fastener Name	Head Size	Qty	Install Torque (ft-lb)	Release Torque (ft-lb)	Failure Torque (ft-lb)	Turns
Primary FRAM bolt release	7/16	1	---	10	TBD	11
Primary FRAM bolt engage	7/16	1	10	---	TBD	11

### Foot Restraints:

Task	WIF	APFR Setting
SHOSS-ED Retrieval	ICC WIF 2 (aft/stbd)	3, LL, E, 12
SHOSS-ED Install	ESP-2 WIF 5 (fwd face)	4, OO, H, 12

### Connector Inhibits:

Task	Inhibit
Blind Mate Connector	RPCM N1-RS2-B, Channel 6 RPCM S0-4B-F, Channel 10



SHOSS-ED Photo Closeout



**CP9 ETVCG INSTALLATION (02:05)**

TASK TIME (PET TIME) HR : MIN	IV/SSRMS	EV1	EV2
00:30 (04:50)		<p><u>ASSEMBLY RELOCATION TO CP9 (00:25)</u></p> <ol style="list-style-type: none"> <li>1. Translate to ESP2 fwd face (between EV2 and Lab)</li> <li>2. Tether to base of camera group assy (BRT ret to upper race track tether point)</li> <li>3. Stow camera group assy onto BRT</li> <li>4. Translate to Lab handrail TBD; fairlead</li> <li>5. Translate up along Lab gap spanners</li> <li>6. Perform safety tether swap at Lab HR TBD</li> <li>7. Verify safety tether crew hook slide lock - L</li> </ol>	<p><u>ASSEMBLY RELOCATION TO CP9 (00:25)</u></p> <ol style="list-style-type: none"> <li>1. Present stanchion base to EV1</li> <li>2. Remove tether from scoop</li> <li>3. Assist EV1 as req'd</li> <li>4. Follow EV1; provide clearance calls</li> <li>5. Perform safety tether swap at Lab HR TBD</li> <li>6. Verify safety tether crew hook slide lock - L</li> <li>7. Assist EV1 as req'd</li> </ol>
00:55 (05:15)	3. IV: Verify MCC Go for VSSA connector mates	<p><u>ASSEMBLY INSTALLATION INTO CP9 (01:10)</u></p> <ol style="list-style-type: none"> <li>1. Translate to CP9 managing light end of assy</li> <li>2. Transfer camera group to EV2</li> <li>3. Tether to lower race track tether point; release BRT and ret</li> <li>4. BRT to P1 handrail 3686; feet outboard</li> </ol> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p style="text-align: center;"><b>CAUTION</b></p> <p style="text-align: center;">If thermal clock PET &gt; TBD, perform connector mates prior to stanchion installation (pick-up at EV1 step 11)</p> </div> <ol style="list-style-type: none"> <li>5. Rotate stanchion for installation (alignment pin inboard)</li> <li>6. Install stanchion</li> </ol>	<p><u>ASSEMBLY INSTALLATION INTO CP9 (01:10)</u></p> <ol style="list-style-type: none"> <li>1. Translate to CP9 managing stanchion end of assy</li> <li>2. BRT to P1 handrail 3679; feet inboard</li> <li>3. Receive camera group; hold</li> <li>4. Assist EV1</li> <li>5. Install stanchion</li> </ol>

**CP9 ETVCG INSTALLATION (02:05)**

TASK TIME (PET TIME) HR : MIN	IV/SSRMS	EV1	EV2
	<p>4. IV: Notify MCC camera group connector mates complete - Go for pwr up</p> <p>5. IV: Stop ETVCG thermal clock</p> <p style="text-align: center;">_____:_____:_____</p> <p>5. IV: Photo Close-out; WVS-EV1, center cam (overview of camera group assy)</p>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px; text-align: center;"> <p><b>CAUTION</b></p> <p>J2 connector contains fiber optic cables. 3.5 inch minimum bend radius</p> </div> <p>7. Reposition self for bolt driving</p> <p>8. <b>PGT [B6, CW2 , 30.5], 6-Ext 7/16</b></p> <p>9. Engage stanchion bolt until it drops out of launch position, ~9 turns</p> <p>10. Engage stanchion bolt into P1 structure, ~21 turns</p> <p>11. Release aft TA clamps (2)</p> <p>12. Demate connectors from stanchion deadface</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> J2-P2</li> <li><input type="checkbox"/> J3-P3</li> <li><input type="checkbox"/> J4-P4</li> </ul> <p>13. Receive dust cap and deadface connectors from EV2; install onto stanchion:</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> J2-P2</li> <li><input type="checkbox"/> J3-P3</li> <li><input type="checkbox"/> J4-P4</li> </ul> <p>14. Remove thermal cover from luminaire assy</p> <p>15. Unlock camera pan and tilt unit</p> <p>16. Retrieve scoop; stow on MWS</p> <p>17. Cleanup cables and TA clamps as required</p> <p>18. Perform photo closeout</p> <p>19. Translate to Lab HR TBD</p> <p>20. Perform safety tether swap onto airlock safety tether</p> <p>21. Engage safety tether crew hook slide lock - L</p> <p>22. Translate to ESP2 VSSA FSE</p>	<p style="text-align: center;"><u>NOTE</u></p> <p>1. Do not remove PGT socket from stanchion bolt head once bolt has engaged into structure.</p> <p>2. Once bolt has dropped from launch position, a 6 lb push force is required to allow for stanchion bolt engagement into structure.</p> <p>6. Hold stanchion for EV2</p> <p>7. Remove dust cap and deadface connectors from P1 panel A100:</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> J2-P2</li> <li><input type="checkbox"/> J3-P3</li> <li><input type="checkbox"/> J4-P4</li> </ul> <p>8. Transfer dust cap and deadface connectors to EV1</p> <p>9. On IV Go: Inspect and mate stanchion connectors to P1 panel A100 (in listed order):</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> J2-P2</li> <li><input type="checkbox"/> J3-P3</li> <li><input type="checkbox"/> J4-P4</li> </ul> <p>10. Translate to Lab HR TBD</p> <p>11. Perform safety tether swap onto airlock safety tether</p> <p>12. Engage safety tether crew hook slide lock - L</p> <p>13. Translate to ESP2</p> <p>14. Reconfigure APFR on ESP2 WIF 05 [4, OO, H, 12]</p> <ul style="list-style-type: none"> <li>- Verify locking collar black-on-black</li> <li>- Perform pull test</li> </ul>

**CP9 ETVCG INSTALLATION (02:05)**

TASK TIME (PET TIME) HR : MIN	IV/SSRMS	EV1	EV2
02:05 (06:25)	<p>6. IV: Once crew clear of worksite - Give MCC-H GO for video camera / camera llluminate heater power up</p> <p>* If NO COMM perform: *</p> <p>* US_SODF; Communications and Tracking *</p> <p>* Group: C &amp; T: Activation &amp; Checkout: *</p> <p>* Video; 1.607 VDS External TV Camera *</p> <p>* Group Initial Checkout: Steps 1-6 (step 4: *</p> <p>* only need to get the telemetry page, not *</p> <p>* required to verify all of the parameters list) *</p>	<p>23. Stow bag inside med ORU bag; tether dummy box to outside of med ORU bag</p>	

## CP9 ETVCG INSTALLATION - TASK DATA SHEET

### Estimated Task Duration:

	With SSRMS	Without SSRMS
Two EV Crew	N/A	02:10

### Tools:

EV1	EV2
<ul style="list-style-type: none"> <li>PGT w/ 7/16, 6-in extension</li> <li>BRT</li> <li>Round Scoop</li> <li>Adj Eq tether</li> </ul>	<ul style="list-style-type: none"> <li>PGT w/ 7/16, 6-in extension</li> <li>BRT</li> <li>Retr tether</li> </ul>

### EVA Fasteners:

Fastener Name	Head Size	Qty	Install Torque (ft-lb)	Release Torque (ft-lb)	Failure Torque (ft-lb)	Turns
Zenith/fwd VSSA launch bolts	7/16	2	16.7	16.7	50.1	8.5
Dummy box outer bolts	7/16	2	---	6.2	38.8	10
Dummy box center jacking bolt	7/16	1	---	6.2	38.8	28
Camera center jacking bolt	7/16	1	6.9	---	31.0	28
Camera outer bolts	7/16	2	5.0	---	31.0	10
Stanchion bolt	7/16	1	23.0	---	37.5	30

### EVA Connectors:

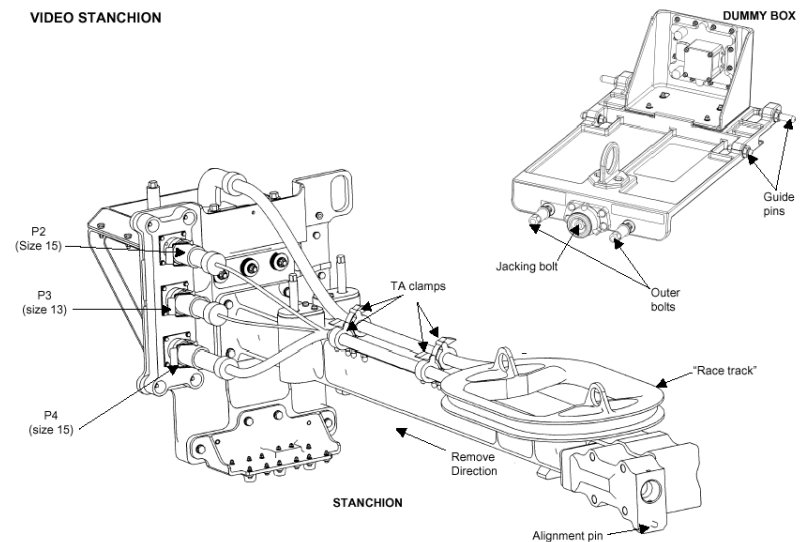
Harness	From	To	Conn Size	Function
VSSA P2	VSSA J2	S1 J2	15	Video, ETVCG Pwr, luminaire pwr
VSSA P3	VSSA J3	S1 J3	13	ETVCG heater pwr, luminaire heater pwr
VSSA P4	VSSA J4	S1 J4	15	Data

### Connector Inhibits:

Task	Inhibit
P2/J2	RPCM P11A A RPC 1 and 15
P3/J3	RPCM P12B A RPC 2 and 16
P4/J4	TBD

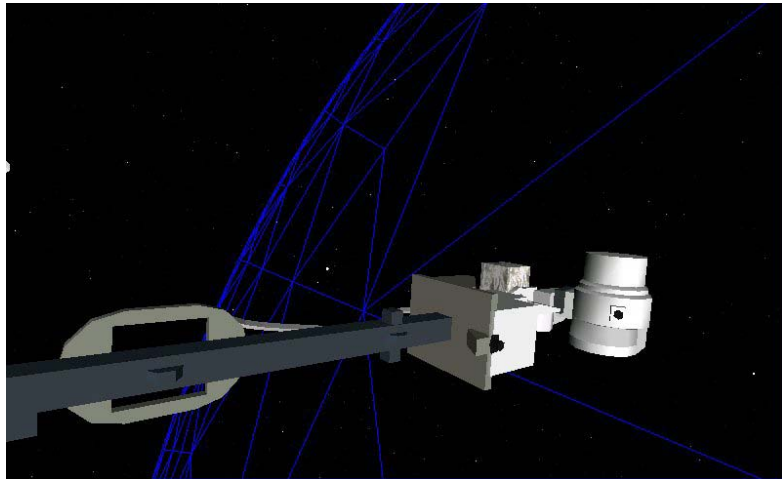
### Foot Restraints:

Task	WIF	APFR Setting
Camera to stanchion install	ESP-2 WIF 5	12, QQ, F, 12



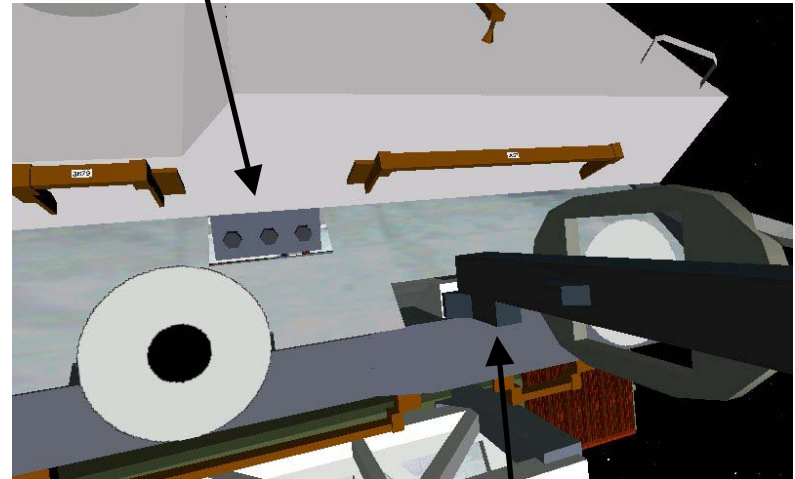


# CP9 ETVCG INSTALLATION - TASK DATA SHEET (cont.)



CP9 ETVCG Photo Closeout

P1 to VSSA Connections  
(connectors not shown mated)

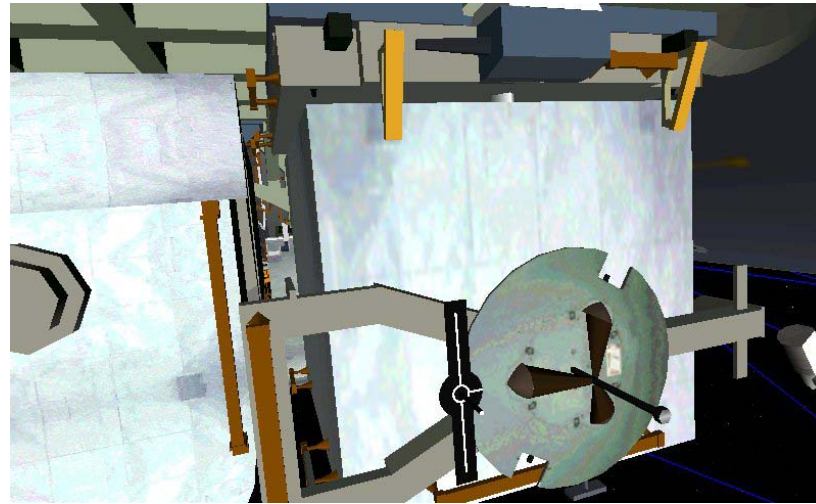


P1 to stanchion structural interface

## SHOSS-ED INSTALLATION (00:35)

TASK TIME (PET TIME) HR : MIN	IV/SSRMS	EV1	EV2
00:00 (03:45)	<ol style="list-style-type: none"> <li>1. SSMRS: SHOSS-ED Hand Off posn</li> <li>2. IV: Verify w/ MCC inhibits in place for PM install                             <ul style="list-style-type: none"> <li>- RPCM P11A A RPC 1 and 15</li> <li>- RPCM P12B A RPC 2 and 16</li> </ul> </li> <li>3. SSRMS: On EV2 Go - release</li> <li>4. SSRMS: On EV2 Go - mnvr away from SHOSS-ED</li> <li>5. IV: Photo close-out; WVS- EV2, center cam (SHOSS-ED overview)</li> </ol>	<p><u>SHOSS-ED INSTALLATION</u> (00:35)</p> <ol style="list-style-type: none"> <li>1. Translate to ESP2 port</li> <li>2. Position self on port face of ESP2; BRT to middle port HR on PM FSE adapter plate</li> <li>3. Assist EV2 as directed</li> <li>4. Hold SHOSS-ED while EV2 drives primary FRAM bolt</li> <li>5. Retrieve med ORU bag</li> </ol>	<p><u>SHOSS-ED INSTALLATION</u> (00:35)</p> <ol style="list-style-type: none"> <li>1. Translate to ESP2 forward face</li> <li>2. Poorman fairlead to ESP2 HR 8012</li> <li>3. Ingress APFR</li> <li>4. Pre-configure PFT [A7, CW2, 30.5]</li> <li>5. GCA SSRMS</li> <li>6. Tether to SHOSS-ED with RET</li> <li>7. Notify SSRMS operator Go to prep for ungrapple</li> <li>8. When prompted by SSRMS operator: Hold SHOSS-ED for release</li> <li>9. Notify SSRMS operator Go for release</li> <li>10. Notify SSRMS operator when SSRMS EE clear of grapple pin</li> <li>11. Guide SHOSS-ED into FRAM</li> <li>12. <b>PGT [A7 (10 approved), CW2 , 30.5], 6-Ext 7/16</b></li> <li>13. Engage primary FRAM bolt to hard stop, 11 turns</li> <li>14. Egress APFR</li> <li>15. Provide WVS survey of SHOSS-ED</li> </ol> <p>As time allows:</p> <ol style="list-style-type: none"> <li>16. Retrieve APFR</li> <li>17. Stow APFR onto airlock stbd toolbox WIF                             <ul style="list-style-type: none"> <li>- Verify locking collar black-on-black</li> <li>- Perform pull test</li> </ul> </li> </ol>
00:35 (04:20)			

**SHOSS-ED INSTALLATION (00:35)**



**SHOSS-ED Photo Closeout**

**EVA 2 INGRESS (00:15)**

TASK TIME (PET TIME) HR : MIN	IV/SSRMS	EV1	EV2
00:00 (06:25)		<p><u>INGRESS (00:10)</u></p> <ol style="list-style-type: none"> <li>1. Translate to airlock</li> <li>2. Perform tool inventory</li>   <li>3. Receive safety tether from EV2</li> <li>4. Stow EV2 safety tether on airlock handrail (fwd pos'n), verify tether reel is in "UNLOCK"</li> <li>5. Transfer med ORU bag to EV2</li>   <li>6. Attach left waist tether to EVA hatch D-ring</li> <li>7. Detach safety tether from right D-ring extender</li> <li>8. Stow safety tether on airlock handrail (aft pos'n), verify tether reel is in "UNLOCK"</li> <li>9. Ingress airlock</li> <li>10. Remove SCU from stowage pouch</li> <li>11. Remove DCM cover; Velcro to DCM</li> <li>12. Connect SCU to DCM; ✓ locked</li> <li>13. WATER - OFF (fwd)</li> <li>14. Close hatch thermal cover; attach Velcro strap</li> </ol> <div data-bbox="802 1135 1341 1258" style="border: 1px solid black; padding: 5px; text-align: center;"> <p><b>CAUTION</b> Do not close hatch until EMU water - OFF for 2 min</p> </div>	<p><u>INGRESS (00:10)</u></p> <ol style="list-style-type: none"> <li>1. Translate to airlock</li> <li>2. Perform tool inventory</li> <li>3. Open thermal cover</li> <li>4. Ingress airlock</li> <li>5. Attach right waist tether to fwd UIA tether point</li> <li>6. Detach safety tether from right D-ring extender and transfer to EV1</li>   <li>7. Receive med ORU bag from EV1</li> <li>8. Stow med ORU bag in airlock</li>   <li>9. Remove SCU from stowage pouch</li> <li>10. Remove DCM cover; Velcro to DCM</li> <li>11. Connect SCU to DCM; ✓ locked</li> <li>12. WATER - OFF (fwd)</li> </ol> <div data-bbox="1434 1135 1974 1258" style="border: 1px solid black; padding: 5px; text-align: center;"> <p><b>CAUTION</b> Do not close hatch until EMU water - OFF for 2 min</p> </div>
00:10 (06:35)		<ol style="list-style-type: none"> <li>15. Verify outer hatch clear of hardware; hatch - close and lock</li> <li>16. Go to PRE-REPRESS (DEPRESS/REPRESS Cue Card) - Steps 5-7 not required</li> </ol>	<ol style="list-style-type: none"> <li>13. Go to PRE-REPRESS (DEPRESS/REPRESS Cue Card) - Steps 5-7 not required</li> </ol>

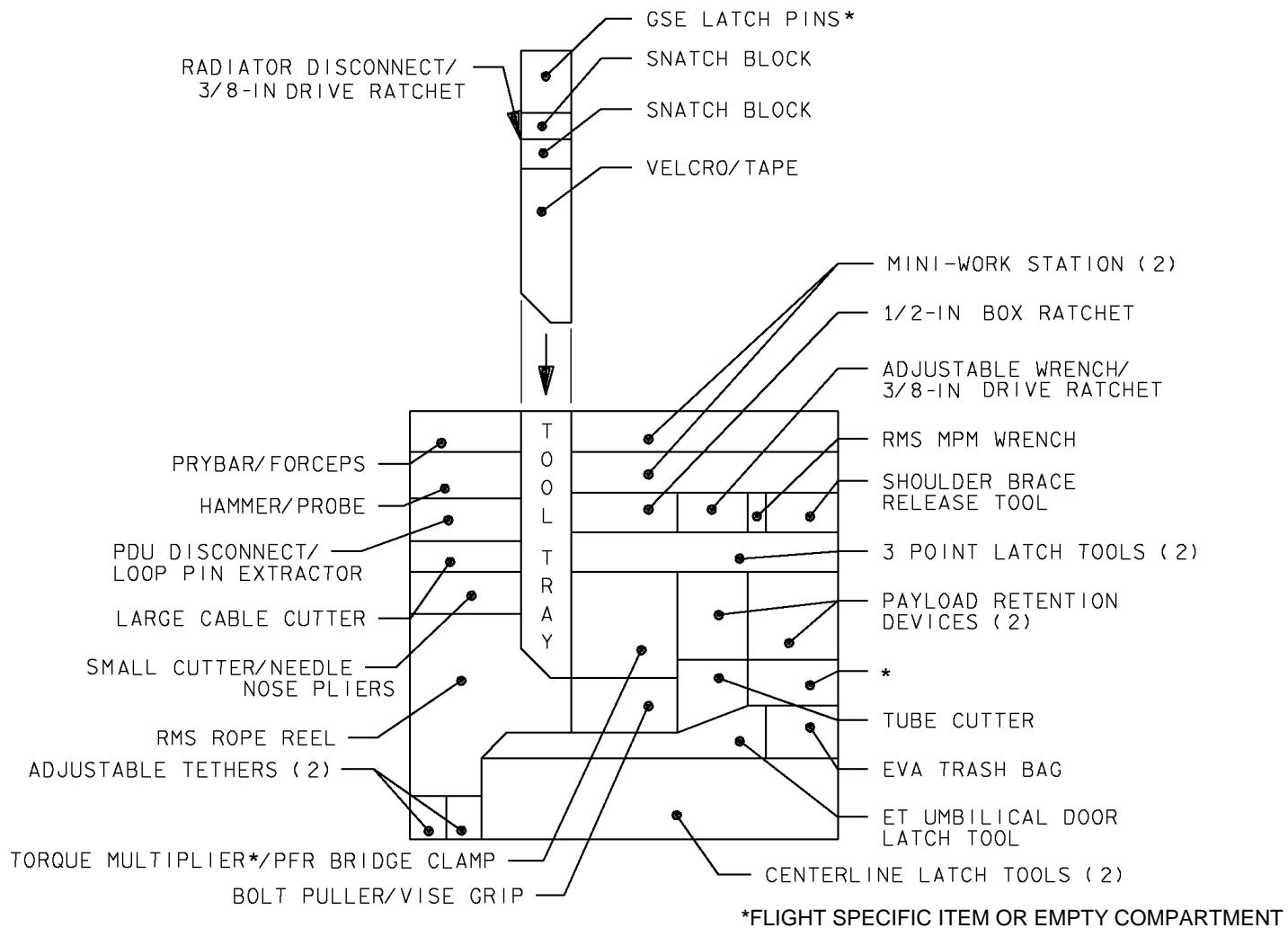
TOOLS AND STOWAGE

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TOOLS AND  
STOWAGE

# TOOLS AND STOWAGE

## - INBOARD - PSA STOWAGE



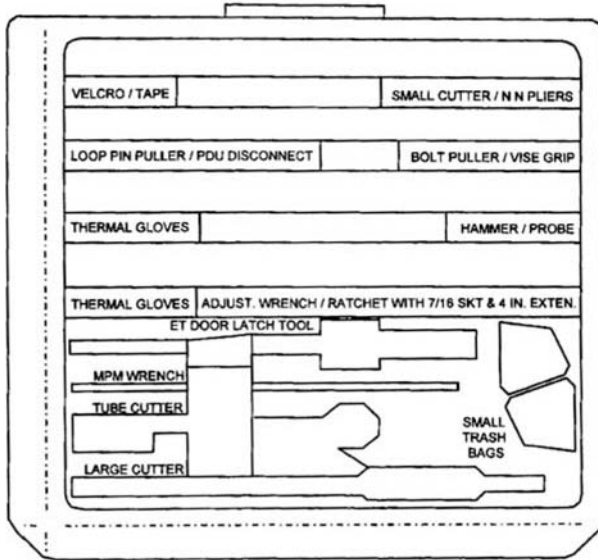
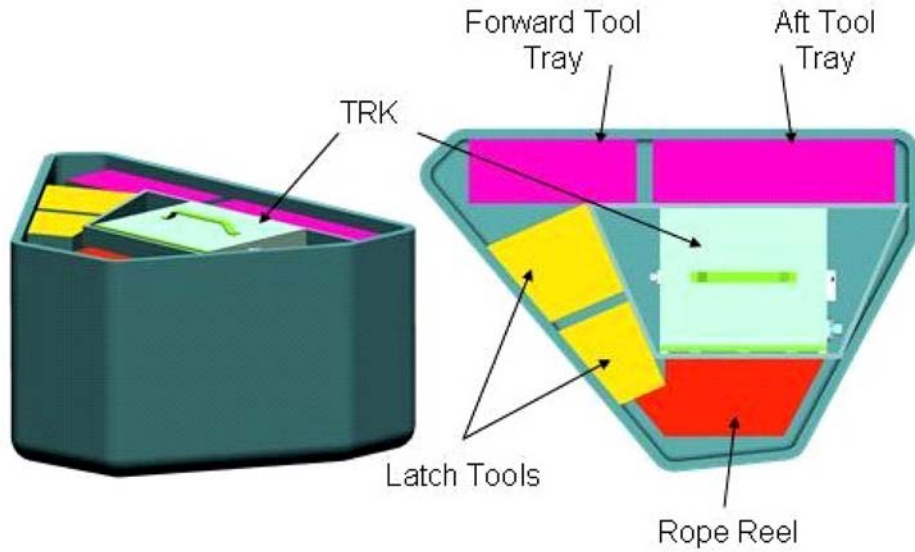
SMALL

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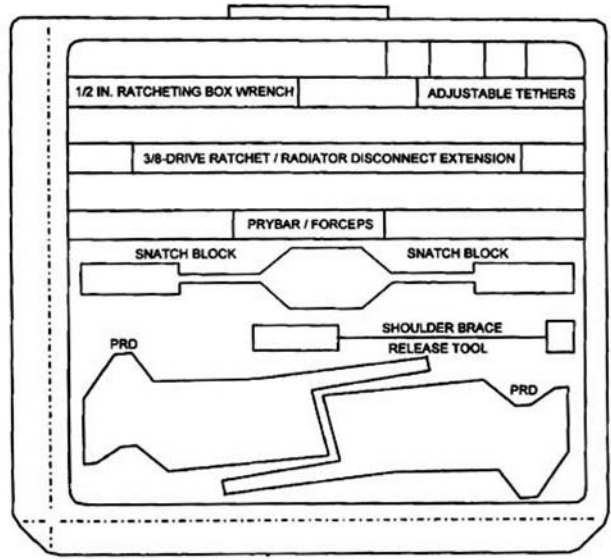
TEMP FS 8-2

**121**  
EVA/ALL/BAS

# PORT LIGHTWEIGHT TOOL STORAGE ASSEMBLY

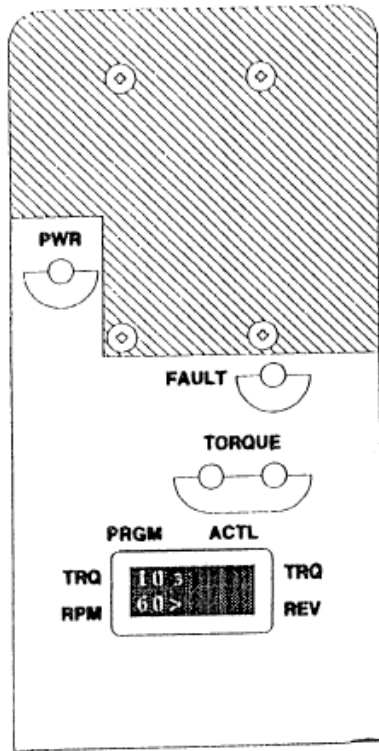
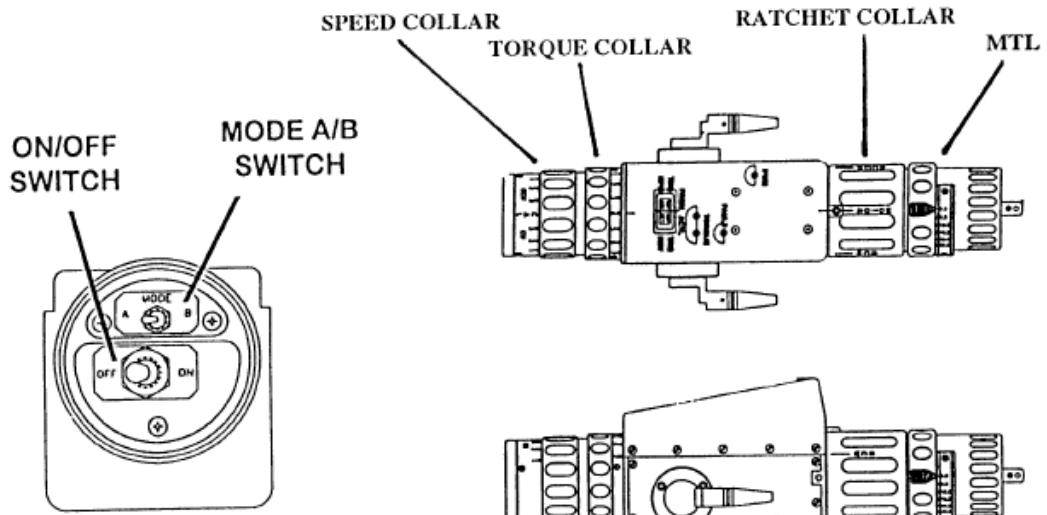


Forward Tray Layout and Labels



Aft Tray Layout and Labels

# PISTOL GRIP TOOL





## PGT SETTINGS TABLE

### TORQUE SETTINGS:

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

### SPEED SETTINGS:

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

### POWER MANAGEMENT:

FUNCTION	MIN
Auto Sleep	15
Auto Off	30

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

(ft-lb)
2.5
5.5
10.5
15.5
23.5
30.5

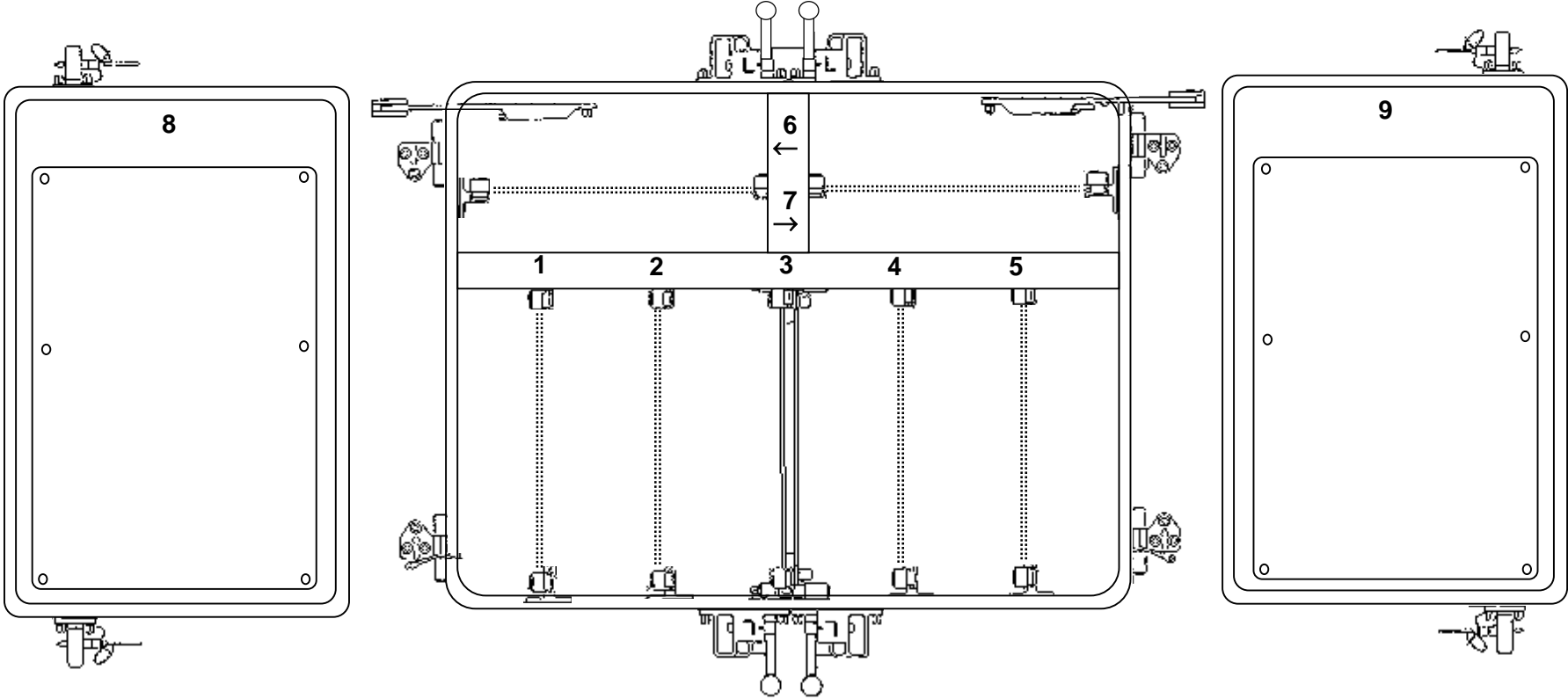
**PGT/FASTENER REF DATA**

<b>FASTENER/APPLICATION</b>	<b>TORQUES (ft-lb)</b>	<b>SOCKET</b>	<b>TORQUE SETTING</b>	<b>SPD/DIR</b>	<b>RATCHET</b>	<b>MTL</b>	<b># BOLTS, TURNS/LIMIT</b>
ESP2 FRGF Removal	22.0	EVA Ratchet w/2-in ext	N/A	N/A	N/A	N/A	4 Bolts, 12 turns
FGB launch mount bolt release	10.0	6-in ext	B1	ccw2	MTR	30.5	4 Bolts, 20 turns
PM FGB GP bolt release	10.0	6-in ext	B1	ccw2	MTR	30.5	4 Bolts, 20 turns
PM FGB GP bolt install	15.4	6-in ext	B2	cw2	MTR	30.5	4 Bolts, 10-11 turns/torque
PM Primary FRAM bolt release	10.0	6-in ext	A7	ccw2	MTR	30.5	1 Bolt, 11 turns/torque
PM Primary FRAM bolt engage	10.0	6-in ext	A7	cw2	MTR	30.5	1 Bolt, 11 turns/torque
ATA FGB GP bolt release	10.0	6-in ext	B1	ccw2	MTR	30.5	4 Bolts, 20 turns
ATA FGB GP bolt install	15.4	6-in ext	B2	cw2	MTR	30.5	4 Bolts, 10-11 turns/torque
SHOSS-ED Primary FRAM bolt release	10.0	6-in ext	A7	ccw2	MTR	30.5	1 Bolt, 11 turns/torque
SHOSS-ED Primary FRAM bolt engage	10.0	6-in ext	A7	cw2	MTR	30.5	1 Bolt, 11 turns/torque
VSSA FSE launch bolt release	16.7	6-in ext	B7	ccw2	MTR	30.5	2 Bolts, 8.5 turns
Stanchion dummy box outer bolt release	6.2	6-in ext	A4	ccw2	MTR	10.5	2 Bolts, 10 turns/torque
Stanchion dummy box center jacking bolt release	6.2	6-in ext	A4	ccw2	MTR	10.5	1 Bolt, 28 turns/torque
Camera center jacking bolt engage	6.9	6-in ext	A5	cw2	MTR	10.5	1 Bolt, 28 turns/torque
Camera outer bolts engage	5.0	6-in ext	A4	cw2	MTR	10.5	2 Bolts, 10 turns/torque
Stanchion primary installation bolt	23.0	6-in ext	B6	cw2	MTR	30.5	1 Bolt, 9 turns then 21/torque

## TOOLBOX STOWAGE

	Z1 PORT TOOLBOX	Z1 STBD TOOLBOX	A/L TOOLBOX 1	A/L TOOLBOX 2
SLOT # 1	SQUARE TM BOARD SQ TORQUE MULTIPLIER 7/16" FLUSH SQ SOCKET 7/16" PROUD SQ SOCKET 7/16" RECESSED SQ SOCKET	SQUARE TM BOARD SQ TORQUE MULTIPLIER 7/16" FLUSH SQ SOCKET 7/16" PROUD SQ SOCKET 7/16" RECESSED SQ SOCKET	HAMMER BOARD HAMMER	CABLE CUTTER BOARD COMPOUND CUTTERS (SM) SCISSORS
SLOT # 2		QD BAIL TOOL BOARD BMRRM LATCH TOOL QD BAIL DRIVE TOOL (1")	PLIERS BOARD NEEDLE NOSE PLIERS	
SLOT # 3	RATCHET BOARD 3/8" DRIVE RATCHET 7/16" X 12" WOBBLE SOCKET 7/16" X 2" RIGID SOCKET 7/16" X 6" WOBBLE SOCKET	RATCHET BOARD 3/8" DRIVE RATCHET 7/16" X 6" WOBBLE SOCKET		
SLOT # 4				
SLOT # 5	ROUND TM BOARD RND TORQUE MULTIPLIER 5/8" PROUD RND SOCKET 7/16" FLUSH RND SOCKET 7/16" PROUD RND SOCKET	ROUND TM BOARD 7/16" FLUSH RND SOCKET 7/16" PROUD RND SOCKET	ADJ WRENCH BOARD FORCEPS VISE GRIPS WRENCH, ADJ	T-HANDLE TOOL BOARD 3-3" T-TOOLS 2-8" T-TOOLS
SLOT # 6	TRASH BAG BOARD LARGE TRASH BAG SMALL TRASH BAG	TRASH BAG BOARD LARGE TRASH BAG	HYDRAZINE BRUSH BOARD HYDRAZINE BRUSH	
SLOT # 7	SOCKET BOARD 5/32" BALL END ALLEN DR 1/2" X 8" WOBBLE SOCKET 5/16" X 7" RIGID SOCKET	SOCKET BOARD 5/32" BALL END ALLEN DR 1/2" X 8" WOBBLE SOCKET 5/16" X 7" RIGID SOCKET	PRD CARRIER PRD	PRD CARRIER PRD
PANEL # 8	CHEATER BAR PANEL CHEATER BAR ADJ EQUIP TETHER	CHEATER BAR PANEL CHEATER BAR ADJ EQUIP TETHER CADDY, ISS GEN PURPOSE 2 CANNON CONN TOOLS	TOOL CADDY PANEL CADDY, ISS (BUNGEE)	
PANEL # 9	18" SOCKET PANEL 7/16" X 18" WOBBLE SOCKET 7/16" X 9" RIGID SOCKET	18" SOCKET PANEL	BOLT PULLER PANEL BOLT PULLER MECHANICAL FINGER	LARGE CUTTER PANEL GP CUTTER (LARGE)
EXTERNAL	2 SQUARE SCOOPS 2 ROUND SCOOPS D-HANDLE	1 SQUARE SCOOP 1 ROUND SCOOP D-HANDLE		

**TOOLBOX PANEL AND SLOT LABELS**



## SHUTTLE EMU EQUIPMENT BY ITEM

ITEM	S/N or ID	UP	DN	LOCATION
Adjustable Thermal Mittens		2 pr	2 pr	Port TSA
Battery, EMU		1	0	EMU 3015 (SI)
Battery, EMU		1	0	EMU 3003 (Fs)
Battery, EMU		1	1	Locker -TBD
Battery, EMU Helmet Light (EHIP)	1031, 1038	2	2	Vol H (Inbd)
Battery, EMU Helmet Light (EHIP)	1025, 1026	2	2	Vol H (Obd)
Battery Charger, EMU Middeck		1	0	Vol D - TBD
Battery Charger, EMU Middeck		0	1	Vol D
Bends Treatment Adapter (BTA)		1	1	Vol 3B - TBD
BSC Contingency Tool		1	1	EMU Equipment Bag
CCA (Comm Cap) (LEMO)	SI	2	2	EMU 3015 LTA Bag
CCA (Comm Cap) (LEMO)	Fs	2	2	EMU 3003 LTA Bag
Comfort Gloves	Fs	3 pr	3 pr	Mesh Bag (Fs)
Comfort Gloves, Spectra	SI	3 pr	3 pr	Mesh Bag (SI)
Contaminant Control Cartridge (LiOH)		1	1	EMU 3015 (SI)
Contaminant Control Cartridge (LiOH)		1	1	EMU 3003 (Fs)
Contaminant Control Cartridge (LiOH)		4	4	A/L Floor Bag -TBD
Cooling Loop (Multiple Water Connector) Jumper		1	1	EMU Equipment Bag
Cue Card, Crewlock Depress/Repress (ISS)		1	0	ODF Locker
Cue Card, Depress/Repress (Shuttle)		1	1	FDF Locker
Cue Card, EMU Consumables		1	1	FDF Locker
Cue Card, EVA Prebreathe		2	1	ODF (1)/FDF(1) Lockers
Cuff Checklist - ISS		2	0	ODF Locker
Cuff Checklist - ISS - eCWS		1	0	ODF Locker
Cuff Checklist - Shuttle		2	2	FDF Locker
DCM Plug (ESCU Connector)		1	1	EVA Bag
DIDB	SI, Fs	20	12	Vol H (TBD)
DIDB Restraint Bag		1	1	EMU 3015 (SI)
DIDB Restraint Bag		1	1	EMU 3003 (Fs)
Empty Mesh Bag (EVA Sys Xfer)		1	1	Mesh Bag (SI)
Empty Mesh Bag (EVA Tool Xfer)		1	1	Mesh Bag (Fs)
EMU - Large (SI)	3015	1	1	Ext A/L Stbd
EMU - Large (Fs)	3003	1	1	Ext A/L Port
EMU - Large	3017	1	0	Middeck Ceiling
EMU - Large	3011	0	1	Middeck Ceiling
EMU Equipment Bag	1011	1	1	Vol H (Inbd)
EMU Servicing Kit		0	1	Vol H (Inbd)
EMU Servicing Kit		1	0	Vol H (Inbd)
Ergometer Shoes (CEVIS use)	SI, Fs	1 pr	1 pr	Shoe Bag on Ergometer
EV Crew Options Kit (ECOK) (SI)	Mesh Bag (SI)	1	1	EMU 3015 (SI)
EV Crew Options Kit (ECOK) (Fs)	Mesh Bag (Fs)	1	1	EMU 3003 (Fs)
EVA Bag	1013	1	1	Vol H (Obd)
EVA Checklist (Shuttle)		2	2	FDF Locker
EVA Scissor/Tether Assembly		1	1	EMU 3015 (SI)
EVA Scissor/Tether Assembly		1	1	EMU 3003 (Fs)
Feedwater Switch Guard		1	1	EMU 3015 (SI)
Feedwater Switch Guard		1	1	EMU 3003 (Fs)
Glove, EMU	SI	1 pr	1 pr	EMU 3015 (SI)
Glove, EMU	Fs	1 pr	1 pr	EMU 3003 (Fs)
Glove, EMU (backup)	SI2, Fs2	2 pr	2 pr	Vol D - TBD
Helmet Light, EMU (EHIP)	1004	1	1	Vol H (Inbd)
Helmet Light, EMU (EHIP)	1006	1	1	Vol H (Obd)
Helmet, EMU (with Cover)		1	0	EMU 3015 (SI)
Helmet, EMU (with Cover)		1	0	EMU 3003 (Fs)
Helmet, EMU (with Cover)		1	0	EMU 3017

## SHUTTLE EMU EQUIPMENT BY ITEM (Cont)

ITEM	S/N or ID	UP	DN	LOCATION
Helmet, EMU (with Cover)		0	1	EMU 3011
ISS EVA Systems Checklist		3	1	ODF Locker
LCVG (backup without Biomed)	SI, Fs	2	2	Vol D - TBD
LCVG (with Biomed)	SI	1	1	EMU 3015 (SI)
LCVG (with Biomed)	Fs	1	1	EMU 3003 (Fs)
LTA Donning Handle		2	2	EMU Equipment Bag
Maximum Absorption Garment (MAG)	M	6	6	Mesh Bag (SI)
Maximum Absorption Garment (MAG)	M	6	6	Mesh Bag (Fs)
Mesh Bag (SI) (EV Crew Options Kit)	SI	1	1	EMU 3015 (SI)
Mesh Bag (Fs) (EV Crew Options Kit)	Fs	1	1	EMU 3003 (Fs)
Multiple Water Connector Cover (HUT line)		1	1	EMU 3015 (SI)
Multiple Water Connector Cover (HUT line)		1	1	EMU 3003 (Fs)
SAFER	1003	1	0	A/L Floor Bag
SAFER	1006	0	1	A/L Floor Bag
SAFER Inhibit Plug	1003	1	0	SAFER 1003
SAFER Inhibit Plug	1006	0	1	SAFER 1006
SAFER IVA Battery Assy	1028	1	0	SAFER 1003
SAFER IVA Battery Assy	1026	0	1	SAFER 1006
SAFER Switch Guard	1003	1	1	SAFER
SOP Checkout Fixture (SCOF)		2	2	EMU Equipment Bag
Thermal Comfort Undergarment (TCU), bottom	M	3	3	Mesh Bag (SI)
Thermal Comfort Undergarment (TCU), bottom	M	3	3	Mesh Bag (Fs)
Thermal Comfort Undergarment (TCU), top	M	3	3	Mesh Bag (SI)
Thermal Comfort Undergarment (TCU), top	M	3	3	Mesh Bag (Fs)
Thermax Sock Liners	SI	3 pr	3 pr	Mesh Bag (SI)
Tube Socks	Fs	3 pr	3 pr	Mesh Bag (Fs)
Wrist Mirror, EMU		2	2	EMU 3015 (SI)
Wrist Mirror, EMU		2	2	EMU 3003 (Fs)
Wristlets	SI	3 pr	3 pr	Mesh Bag (SI)
Wristlets	Fs	3 pr	3 pr	Mesh Bag (Fs)

## SHUTTLE EMU EQUIPMENT BY LOCATION

LOCATION	ITEM	S/N or ID	UP	DN
Locker	Battery, EMU		1	1
A/L Floor Bag - TBD	Contaminant Control Cartridge (LiOH)		4	4
A/L Floor Bag	SAFER	1003	1	0
A/L Floor Bag	SAFER	1006	0	1
EMU 3003 (Fs)	Battery, EMU	2035	1	0
EMU 3003 (Fs)	Contaminant Control Cartridge (LiOH)		1	1
EMU 3003 (Fs)	DIDB Restraint Bag		1	1
EMU 3003 (Fs)	EV Crew Options Kit (ECOK) (Fs)	Mesh Bag (Fs)	1	1
EMU 3003 (Fs)	EVA Scissor/Tether Assembly		1	1
EMU 3003 (Fs)	Feedwater Switch Guard		1	1
EMU 3003 (Fs)	Glove, EMU	Fs	1 pr	1 pr
EMU 3003 (Fs)	Helmet, EMU (with Cover)		1	0
EMU 3003 (Fs)	LCVG (with Biomed)	Fs	1	1
EMU 3003 (Fs)	Mesh Bag (Fs) (EV Crew Options Kit)	Fs	1	1
EMU 3003 (Fs)	Multiple Water Connector Cover (HUT line)		1	1
EMU 3003 (Fs)	Wrist Mirror, EMU		2	2
EMU 3003 LTA Bag	CCA (Comm Cap) (LEMO)	Fs	1	1
EMU 3017	Helmet, EMU (with Cover)		1	0
EMU 3011	Helmet, EMU (with Cover)		0	1
EMU 3015 (SI)	Battery, EMU	2034	1	0
EMU 3015 (SI)	Contaminant Control Cartridge (LiOH)		1	1
EMU 3015 (SI)	DIDB Restraint Bag		1	1
EMU 3015 (SI)	EV Crew Options Kit (ECOK) (SI)	Mesh Bag (SI)	1	1
EMU 3015 (SI)	EVA Scissor/Tether Assembly		1	1
EMU 3015 (SI)	Feedwater Switch Guard		1	1
EMU 3015 (SI)	Glove, EMU	SI	1 pr	1 pr
EMU 3015 (SI)	Helmet, EMU (with Cover)		1	0
EMU 3015 (SI)	LCVG (with Biomed)	SI	1	1
EMU 3015 (SI)	Mesh Bag (SI) (EV Crew Options Kit)	SI	1	1
EMU 3015 (SI)	Multiple Water Connector Cover (HUT line)		1	1
EMU 3015 (SI)	Wrist Mirror, EMU		2	2
EMU 3015 LTA Bag	CCA (Comm Cap) (LEMO)	SI	1	1
EMU Equipment Bag	BSC Contingency Tool		1	1
EMU Equipment Bag	Cooling Loop (Multiple Water Connector) Jumper		1	1
EMU Equipment Bag	LTA Donning Handle		2	2
EMU Equipment Bag	SOP Checkout Fixture (SCOF)		2	2
EVA Bag	DCM Plug (ESCU Connector)		1	1
Ext A/L Port	EMU - Large (Fs)	3003	1	1
Ext A/L Stbd	EMU - Large (SI)	3015	1	1
FDL Locker	Cue Card, Depress/Repress (Shuttle)		1	1
FDL Locker	Cue Card, EMU Consumables		1	1
FDL Locker	Cuff Checklist - Shuttle		2	2
FDL Locker	EVA Checklist (Shuttle)		2	2
Mesh Bag (SI)	Comfort Gloves, Spectra	SI	3 pr	3 pr
Mesh Bag (SI)	Empty Mesh Bag (EVA Sys Xfer)		1	1
Mesh Bag (SI)	Maximum Absorption Garment (MAG)	M	6	6
Mesh Bag (SI)	Thermal Comfort Undergarment (TCU), bottom	M	3	3
Mesh Bag (SI)	Thermal Comfort Undergarment (TCU), top	M	3	3
Mesh Bag (SI)	Thermax Sock Liners	SI	3 pr	3 pr
Mesh Bag (SI)	Wristlets	SI	3 pr	3 pr
Mesh Bag (Fs)	Comfort Gloves	Fs	3 pr	3 pr
Mesh Bag (Fs)	Empty Mesh Bag (EVA Tool Xfer)		1	1
Mesh Bag (Fs)	Maximum Absorption Garment (MAG)	M	6	6
Mesh Bag (Fs)	Thermal Comfort Undergarment (TCU), bottom	M	3	3
Mesh Bag (Fs)	Thermal Comfort Undergarment (TCU), top	M	3	3

## SHUTTLE EMU EQUIPMENT BY LOCATION (Cont)

LOCATION	ITEM	S/N or ID	UP	DN
Mesh Bag (Fs)	Tube Socks	Fs	3 pr	3 pr
Mesh Bag (Fs)	Wristlets	Fs	3 pr	3 pr
Middeck Ceiling	EMU - Large	3011	0	1
Middeck Ceiling	EMU - Large	3017	1	0
ODF (1)/FDF(1) Lockers	Cue Card, EVA Prebreathe		2	1
ODF Locker	Cue Card, Crewlock Depress/Repress (ISS)		1	0
ODF Locker	Cuff Checklist - ISS		2	0
ODF Locker	Cuff Checklist - ISS - eCWS		1	0
ODF Locker	ISS EVA Systems Checklist		3	1
Port TSA	Adjustable Thermal Mittens		2 pr	2 pr
SAFER	SAFER Switch Guard	1003	1	1
SAFER 1006	SAFER Inhibit Plug	1006	0	1
SAFER 1006	SAFER IVA Battery Assy	1026	0	1
SAFER 1003	SAFER Inhibit Plug	1003	1	0
SAFER 1003	SAFER IVA Battery Assy	1028	1	0
Shoe Bag on Ergometer	Ergometer Shoes (CEVIS use)	SI, Fs	1 pr	1 pr
Vol 3B - TBD	Bends Treatment Adapter (BTA)		1	1
Vol D -TBD	Battery Charger, EMU Middeck	1005	1	0
Vol D -TBD	Battery Charger, EMU Middeck	1002	0	1
Vol D -TBD	Glove, EMU (backup)	SI2, Fs2	2 pr	2 pr
Vol D -TBD	LCVG (backup without Biomed)	SI, Fs	2	2
Vol H (Inbd)	Battery, EMU Helmet Light (EHIP)	1031, 1038	2	2
Vol H (Inbd)	EMU Equipment Bag	1011	1	1
Vol H (Inbd)	EMU Servicing Kit		0	1
Vol H (Inbd)	EMU Servicing Kit		1	0
Vol H (Inbd)	Helmet Light, EMU (EHIP)	1004	1	1
Vol H (Obd)	Battery, EMU Helmet Light (EHIP)	1025, 1026	2	2
Vol H (Obd)	DIDB	SI, Fs	20	12
Vol H (Obd)	EVA Bag	1013	1	1
Vol H (Obd)	Helmet Light, EMU (EHIP)	1006	1	1



## SHUTTLE EVA TOOLS BY ITEM

ITEM	COMMENT	UP	DN	LOCATION
1" Foam Brush Assy	pre-posn 115	1	0	MPLM
1" Foam Brush Assy	TPS	1	1	PLB TSA port
1" Silicone Gel Brush	TPS	9	9	Middeck
1" Silicone Gel Brush	TPS	9	9	Middeck
1/2" Nozzle x 5"	TPS	1	1	Middeck
1/2" Nozzle x 5"	TPS	1	1	Middeck
1/2" Nozzle x 5"	TPS	1	1	Middeck
1/2" Box Ratchet Tool Caddy		1	1	PLB TSA port
1/2" Box Socket Wrench		1	1	PLB TSA port
1/2" Nozzle x 7"	TPS	3	3	Middeck
1/4" Hex, Radiator Extension		1	1	PLB TSA port
3" Silicone Gel Brush	TPS	9	9	Middeck
3" Silicone Gel Brush	TPS	9	9	Middeck
3" Foam Brush Assy	pre-posn 115	1	0	MPLM
3" Foam Brush Assy	pre-posn 115	1	0	MPLM
3" Foam Brush Assy	TPS	1	1	PLB TSA port
3" Foam Brush Assy	TPS	1	1	PLB TSA port
3 Point Latch Tool		2	2	PLB TSA port
3 Point Latch Tool Stowage Bag		1	1	PLB TSA port
3/8" Ratchet, 4" Extension, 7/16" Socket		1	1	PLB TSA port
3/8" Socket w/universal	pre-posn 12A, 13A	1	0	MPLM
3/8" Drive Ratchet		1	1	PLB TSA port
3/8" Ratchet w/7/16" Socket		1	1	Middeck
6" x 6" Chemstat (ESD Protection Patch)		1	1	PLB TSA Stbd
Adjustable Equipment Tether (Eq-Eq w/slide lock)		2	2	EMU
Adjustable Equipment Tether (Sm-Sm)		2	2	PLB TSA port
Adjustable Fuse Tether (Eq hooks w/slide lock)	pre-posn f/12A, 13A	1	0	Middeck
Adjustable Fuse Tether (Eq hooks w/slide lock)	pre-posn 12A, 13A	1	0	MPLM
Adjustable Thermal Mitten		1	1	PLB TSA port
Adjustable Thermal Mitten		1	1	PLB TSA port
Adjustable Thermal Mitten		1	1	PLB TSA port
Adjustable Thermal Mitten		1	1	PLB TSA port
Angle Stamp	pre-posn 115	1	0	MPLM
Angle Stamp	pre-posn 115	1	0	MPLM
Angle Stamp	pre-posn 115	1	0	MPLM
Angle Stamp	TPS	1	1	PLB TSA port
Angle Stamp	TPS	1	1	PLB TSA port
Angle Stamp	TPS	1	1	PLB TSA port
Body Restraint Tether (BRT)		2	2	Middeck
Bolt Puller		1	1	PLB TSA port
Bolt Puller/Vise Grip Pliers Tool Caddy		1	1	PLB TSA port
BRS Pin Contingency Tool	pre-posn 12A-15A	1	0	MPLM
Centerline Latch Tool		2	2	PLB TSA port
Centerline Latch Tool Bag		1	1	PLB TSA port
Chisel-Long Probe		1	1	PLB TSA port
CIPA Applicator (CIPAA)	TPS	1	1	Middeck
CIPA Applicator (CIPAA)	TPS	1	1	Middeck
CIPA Discard Container Assy	pre-posn 115	1	0	MPLM
CIPA Discard Container Assy	TPS	1	1	PLB TSA port
CIPAA Spare Hose assembly	TPS	1	1	Middeck
CIPAA Spare Hose assembly	TPS	1	1	Middeck

## SHUTTLE EVA TOOLS BY ITEM (Cont)

ITEM	COMMENT	UP	DN	LOCATION
CIPAA Spare Hose assembly	TPS	1	1	Middeck
Clamp, High Strength Bridge		1	1	PLB sill bay 12 port
Compound Cutter (Small Cutter)		1	1	PLB TSA port
Compound Cutter/Needle Nose Pliers Tool Caddy		1	1	PLB TSA port
Contour Gauge, Mechanical	pre-posn 115	2	0	MPLM
Contour Gauge, Mechanical	TPS	2	2	PLB TSA port
EMU Cuff Checklist Band		3	3	Middeck
ERCM Tether	w/locking hook	2	2	PLB
ERCM Tether Reel Box		1	1	PLB
ESP2 Grapple Fixture		0	1	PLB TSA Stbd
ET Umbilical Door Tool		1	1	PLB TSA port
EVA Adjustable Wrench		1	1	Middeck
EVA Adjustable Wrench		1	1	PLB TSA port
EVA Adjustable Wrench/4" Ratchet Ext Tool Caddy		1	1	PLB TSA port
EVA Forceps		1	1	PLB TSA port
EVA Temporary Rail Stop (ETRS)	pre-posn 12A, 13A	2	0	MPLM
EVA Trash Bag	pre-posn 12A-13A	2	0	MPLM
EVA Trash Bag		2	2	PLB TSA port
EVA Wipe	pre-posn 115	1	0	MPLM
EVA Wipe	pre-posn 115	1	0	MPLM
EVA Wipe	pre-posn 115	1	0	MPLM
EVA Wipe	TPS	3	3	PLB TSA port
EVA Wipe	TPS	1	1	PLB TSA port
EVA Wipe	TPS	1	1	PLB TSA port
Flat Stamp	pre-posn 115	1	0	MPLM
Flat Stamp	TPS	1	1	PLB TSA port
Gel Brush Kit	TPS	1	1	Middeck
Gel Brush Kit	TPS	1	1	Middeck
General Purpose Cutter		1	1	PLB TSA port
General Purpose Tool Caddy (GP tool caddy)		1	1	Middeck
General Purpose Tool Caddy (GP tool caddy)		1	1	PLB TSA port
General Purpose Tool Caddy (GP tool caddy)		1	1	PLB TSA port
Hammer		1	1	PLB TSA port
Hammer/Chisel Long Probe Tool Caddy		1	1	PLB TSA port
Holster	TPS	1	1	Middeck
Holster	TPS	1	1	Middeck
Holster	TPS	1	1	Middeck
Locking Strut Aid	pre-posn f/12A-15A	4	0	MPLM
Loop Pin Extractor Puller		1	1	PLB TSA port
Modular Mini-Workstation Key Strap Assembly		1	1	Middeck
Modular MWS Baseplate Assy	sn 1029 swap 1005	2	1	Middeck
Modular MWS Baseplate Assy	sn 1009 return	0	1	Middeck
Modular MWS Gimbal Assy	sn 1005 return	0	1	Middeck
Modular MWS RH Swingarm Assy	pre-posn for 12A	2	0	MPLM
Modular MWS RH Swingarm Assy	1005,1006 return	0	2	MPLM
MPM Ratchet Wrench		1	1	PLB TSA port
MWS Tool Stowage Caddy	pre-posn 115	1	0	MPLM
MWS Tool Stowage Caddy	pre-posn 115	1	0	MPLM
MWS Tool Stowage Caddy	TPS	1	1	PLB TSA port
MWS Tool Stowage Caddy	TPS	1	1	PLB TSA port
Needle Nose Pliers		1	1	PLB TSA port

## SHUTTLE EVA TOOLS BY ITEM (Cont)

ITEM	COMMENT	UP	DN	LOCATION
Orbiter Slidewire (short)		1	1	PLB sill
ORU Transfer Bag (Med w/internal tether loops)	pre-posn 12A, 13A	1	0	MPLM
Payload Retention Device (PRD)		2	2	PLB TSA port
PB Articulating Socket		1	1	PLB TSA port
PDU Disc/Loop Pin Puller Tool Caddy		1	1	PLB TSA port
PDU Disconnect Tool		1	1	PLB TSA port
Pencil Tip Gel Brush	TPS	3	3	Middeck
Pencil Tip Gel Brush	TPS	3	3	Middeck
PFR		1	1	PLB Bkhd Fwd
PFR Attachment Device (PAD)		1	1	PLB TSA port
Pry Bar		1	1	PLB TSA port
Prybar/EVA Forceps Tool Caddy		1	1	PLB TSA port
Radiator Extension/Drive Ratchet Tool Caddy		1	1	PLB TSA port
Removable Brush Handle Assembly	TPS	1	1	Middeck
Removable Brush Handle Assembly	TPS	1	1	Middeck
Removable Brush Handle Assembly	pre-posn 115	1	0	MPLM
Removable Brush Handle Assembly	pre-posn 115	1	0	MPLM
Removable Brush Handle Assembly	pre-posn 115	1	0	MPLM
Removable Brush Handle Assembly	TPS	1	1	PLB TSA port
Removable Brush Handle Assembly	TPS	1	1	PLB TSA port
Removable Brush Handle Assembly	TPS	1	1	PLB TSA port
Retractable Equipment Tether (Eq-Eq w/slide lock)		2	2	EMU
RMS Shoulder Brace Release Hand Tool		1	1	PLB TSA port
Silicone Gel Brush Caddy	TPS	1	1	Middeck
Silicone Gel Brush Caddy	TPS	1	1	Middeck
SLRI 10	pre-posn 12A, 13A	1	0	MPLM
SLRI 6	pre-posn 12A, 13A	1	0	MPLM
Snatch Block		2	2	PLB TSA port
Tether, Safety	pre-posn 12A	2	0	MPLM
Tether, Waist (w/slide lock)		4	4	EMU
Tile Repair Kit (TRK)	pre-posn 115	1	0	MPLM
Tile Repair Kit (TRK)	TPS	1	1	PLB TSA port
Tool Caddy		1	1	PLB TSA port
Tool Caddy		1	1	PLB TSA port
Tool Caddy		1	1	PLB TSA port
Tool Caddy		1	1	PLB TSA port
Tool Caddy		1	1	PLB TSA port
Tool Caddy		1	1	PLB TSA port
Tool Caddy		1	1	PLB TSA port
Tool Caddy		1	1	PLB TSA port
Tool Caddy – standard		1	1	PLB TSA port
Trash Bag	pre-posn 115	2	0	MPLM
Trash Bag	TPS	2	2	PLB TSA port
TRK Stowage Bag	pre-posn 115	1	0	MPLM
TRK Stowage Bag	TPS	1	1	PLB TSA port
Tube Cutter		1	1	PLB TSA port
Velcro/Tape Caddy		1	1	PLB TSA port
Vise Grip Pliers		1	1	PLB TSA port
Winch and Mount Assy, Aft (w/4 ball pip pin)		1	1	PLB Bkhd Aft
Winch and Mount Assy, Fwd (w/4 ball pip pin)		1	1	PLB Bkhd Fwd
Winch Hook Adapter (RMS Rope Reel)		1	1	PLB TSA port

## SHUTTLE EVA TOOLS BY LOCATION

ITEM	COMMENT	UP	DN	LOCATION
Adjustable Equipment Tether (Eq-Eq w/slide lock)		2	2	EMU
Retractable Equipment Tether (Eq-Eq w/slide lock)		2	2	EMU
Tether, Waist (w/slide lock)		4	4	EMU
1" Silicone Gel Brush	TPS	9	9	Middeck
1" Silicone Gel Brush	TPS	9	9	Middeck
1/2" Nozzle x 5"	TPS	1	1	Middeck
1/2" Nozzle x 5"	TPS	1	1	Middeck
1/2" Nozzle x 5"	TPS	1	1	Middeck
1/2" Nozzle x 7"	TPS	3	3	Middeck
3" Silicone Gel Brush	TPS	9	9	Middeck
3" Silicone Gel Brush	TPS	9	9	Middeck
3/8" Ratchet w/7/16" socket		1	1	Middeck
Adjustable Fuse Tether (Eq hooks w/slide lock)	pre-posn f/12A, 13A	1	0	Middeck
Body Restraint Tether (BRT)		2	2	Middeck
CIPA Applicator (CIPAA)	TPS	1	1	Middeck
CIPA Applicator (CIPAA)	TPS	1	1	Middeck
CIPAA Spare Hose Assembly	TPS	1	1	Middeck
CIPAA Spare Hose Assembly	TPS	1	1	Middeck
CIPAA Spare Hose Assembly	TPS	1	1	Middeck
EMU Cuff Checklist Band		3	3	Middeck
EVA Adjustable Wrench		1	1	Middeck
Gel Brush Kit	TPS	1	1	Middeck
Gel Brush Kit	TPS	1	1	Middeck
General Purpose Tool Caddy (GP tool caddy)		1	1	Middeck
Holster	TPS	1	1	Middeck
Holster	TPS	1	1	Middeck
Holster	TPS	1	1	Middeck
Modular Mini-Workstation Key Strap Assembly		1	1	Middeck
Modular MWS Baseplate Assy	sn 1029 swap 1005	2	1	Middeck
Modular MWS Baseplate Assy	sn 1009 return	0	1	Middeck
Modular MWS Gimbal Assy	sn 1005 return	0	1	Middeck
Pencil Tip Gel Brush	TPS	3	3	Middeck
Pencil Tip Gel Brush	TPS	3	3	Middeck
Removable Brush Handle Assembly	TPS	1	1	Middeck
Removable Brush Handle Assembly	TPS	1	1	Middeck
Silicone Gel Brush Caddy	TPS	1	1	Middeck
Silicone Gel Brush Caddy	TPS	1	1	Middeck
1" Foam Brush Assy	pre-posn 115	1	0	MPLM
3" Foam Brush Assy	pre-posn 115	1	0	MPLM
3" Foam Brush Assy	pre-posn 115	1	0	MPLM
3/8" Socket w/universal	pre-posn 12A, 13A	1	0	MPLM
Adjustable Fuse Tether (Eq hooks w/slide lock)	pre-posn 12A, 13A	1	0	MPLM
Angle Stamp	pre-posn 115	1	0	MPLM
Angle Stamp	pre-posn 115	1	0	MPLM
Angle Stamp	pre-posn 115	1	0	MPLM
BRS Pin Contingency Tool	pre-posn 12A-15A	1	0	MPLM
CIPA Discard Container Assy	pre-posn 115	1	0	MPLM
Contour Gauge, Mechanical	pre-posn 115	2	0	MPLM
EVA Temporary Rail Stop (ETRS)	pre-posn 12A, 13A	2	0	MPLM
EVA Trash Bag	pre-posn 12A-13A	2	0	MPLM
EVA Wipe	pre-posn 115	1	0	MPLM

## SHUTTLE EVA TOOLS BY LOCATION (Cont)

ITEM	COMMENT	UP	DN	LOCATION
EVA Wipe	pre-posn 115	1	0	MPLM
EVA Wipe	pre-posn 115	1	0	MPLM
Flat Stamp	pre-posn 115	1	0	MPLM
Locking Strut Aid	pre-posn f/12A-15A	4	0	MPLM
Modular MWS RH Swingarm Assy	pre-posn for 12A	2	0	MPLM
Modular MWS RH Swingarm Assy	1005,1006 return	0	2	MPLM
MWS Tool Stowage Caddy	pre-posn 115	1	0	MPLM
MWS Tool Stowage Caddy	pre-posn 115	1	0	MPLM
ORU Transfer Bag (Med w/internal tether loops)	pre-posn 12A, 13A	1	0	MPLM
Removable Brush Handle Assembly	pre-posn 115	1	0	MPLM
Removable Brush Handle Assembly	pre-posn 115	1	0	MPLM
Removable Brush Handle Assembly	pre-posn 115	1	0	MPLM
SLRI 10	pre-posn 12A, 13A	1	0	MPLM
SLRI 6	pre-posn 12A, 13A	1	0	MPLM
Tether, Safety	pre-posn 12A	2	0	MPLM
Tile Repair Kit (TRK)	pre-posn 115	1	0	MPLM
Trash Bag	pre-posn 115	2	0	MPLM
TRK Stowage Bag	pre-posn 115	1	0	MPLM
ERCM Tether	w/locking hook	2	2	PLB
ERCM Tether Reel Box		1	1	PLB
Winch and Mount Assy, Aft (w/4 ball pip pin)		1	1	PLB Bkhd Aft
PFR		1	1	PLB Bkhd Fwd
Winch and Mount Assy, Fwd (w/4 ball pip pin)		1	1	PLB Bkhd Fwd
Orbiter Slidewire (short)		1	1	PLB sill
Clamp, High Strength Bridge		1	1	PLB sill bay 12 port
1" Foam Brush Assy	TPS	1	1	PLB TSA port
1/2" Box Ratchet Tool Caddy		1	1	PLB TSA port
1/2" Box Socket Wrench		1	1	PLB TSA port
1/4" Hex, Radiator Extension		1	1	PLB TSA port
3" Foam Brush Assy	TPS	1	1	PLB TSA port
3" Foam Brush Assy	TPS	1	1	PLB TSA port
3 Point Latch Tool		2	2	PLB TSA port
3 Point Latch Tool Stowage Bag		1	1	PLB TSA port
3/8" Ratchet, 4" Extension, 7/16" Socket		1	1	PLB TSA port
3/8" Drive Ratchet		1	1	PLB TSA port
Adjustable Equipment Tether (Sm-Sm)		2	2	PLB TSA port
Adjustable Thermal Mitten		1	1	PLB TSA port
Adjustable Thermal Mitten		1	1	PLB TSA port
Adjustable Thermal Mitten		1	1	PLB TSA port
Adjustable Thermal Mitten		1	1	PLB TSA port
Angle Stamp	TPS	1	1	PLB TSA port
Angle Stamp	TPS	1	1	PLB TSA port
Angle Stamp	TPS	1	1	PLB TSA port
Bolt Puller		1	1	PLB TSA port
Bolt Puller/Vise Grip Pliers Tool Caddy		1	1	PLB TSA port
Centerline Latch Tool		2	2	PLB TSA port
Centerline Latch Tool Bag		1	1	PLB TSA port
Chisel-Long Probe		1	1	PLB TSA port
CIPA Discard Container Assy	TPS	1	1	PLB TSA port
Compound Cutter (Small Cutter)		1	1	PLB TSA port
Compound Cutter/Needle Nose Pliers Tool Caddy		1	1	PLB TSA port

## SHUTTLE EVA TOOLS BY LOCATION (Cont)

ITEM	COMMENT	UP	DN	LOCATION
Contour Gauge, Mechanical	TPS	2	2	PLB TSA port
ET Umbilical Door Tool		1	1	PLB TSA port
EVA Adjustable Wrench		1	1	PLB TSA port
EVA Adjustable Wrench/4" Ratchet Ext Tool Caddy		1	1	PLB TSA port
EVA Forceps		1	1	PLB TSA port
EVA Trash Bag		2	2	PLB TSA port
EVA Wipe	TPS	3	3	PLB TSA port
EVA Wipe	TPS	1	1	PLB TSA port
EVA Wipe	TPS	1	1	PLB TSA port
Flat Stamp	TPS	1	1	PLB TSA port
General Purpose Cutter		1	1	PLB TSA port
General Purpose Tool Caddy (GP tool caddy)		1	1	PLB TSA port
General Purpose Tool Caddy (GP tool caddy)		1	1	PLB TSA port
Hammer		1	1	PLB TSA port
Hammer/Chisel Long Probe Tool Caddy		1	1	PLB TSA port
Loop Pin Extractor Puller		1	1	PLB TSA port
MPM Ratchet Wrench		1	1	PLB TSA port
MWS Tool Stowage Caddy	TPS	1	1	PLB TSA port
MWS Tool Stowage Caddy	TPS	1	1	PLB TSA port
Needle Nose Pliers		1	1	PLB TSA port
Payload Retention Device (PRD)		2	2	PLB TSA port
PB Articulating Socket		1	1	PLB TSA port
PDU Disc/Loop Pin Puller Tool Caddy		1	1	PLB TSA port
PDU Disconnect Tool		1	1	PLB TSA port
PFR Attachment Device (PAD)		1	1	PLB TSA port
Pry Bar		1	1	PLB TSA port
Prybar/EVA Forceps Tool Caddy		1	1	PLB TSA port
Radiator Extension/Drive Ratchet Tool Caddy		1	1	PLB TSA port
Removable Brush Handle Assembly	TPS	1	1	PLB TSA port
Removable Brush Handle Assembly	TPS	1	1	PLB TSA port
Removable Brush Handle Assembly	TPS	1	1	PLB TSA port
RMS Shoulder Brace Release Hand Tool		1	1	PLB TSA port
Snatch Block		2	2	PLB TSA port
Tile Repair Kit (TRK)	TPS	1	1	PLB TSA port
Tool Caddy		1	1	PLB TSA port
Tool Caddy		1	1	PLB TSA port
Tool Caddy		1	1	PLB TSA port
Tool Caddy		1	1	PLB TSA port
Tool Caddy		1	1	PLB TSA port
Tool Caddy		1	1	PLB TSA port
Tool Caddy		1	1	PLB TSA port
Tool Caddy – standard		1	1	PLB TSA port
Trash Bag	TPS	2	2	PLB TSA port
TRK Stowage Bag	TPS	1	1	PLB TSA port
Tube Cutter		1	1	PLB TSA port
Velcro/Tape Caddy		1	1	PLB TSA port
Vise Grip Pliers		1	1	PLB TSA port
Winch Hook Adapter (RMS Rope Reel)		1	1	PLB TSA port
6" x 6" Chemstat (ESD Protection Patch)		1	1	PLB TSA Stbd
ESP2 Grapple Fixture		0	1	PLB TSA Stbd

## APFR MANAGEMENT

		APFR 1	APFR 2	APFR 3 (Ingress Aid)	APFR 4 (TS)	APFR 5 (TS)	APFR 6	APFR 7	IAPFR 1	IAPFR 2
		8A pitch knob problem, 9A no problem		8A pitch knob problem, 9A no problem,	Has heat shield, Tool Stanchion w/ old ORU tether, Safety tether	Has heat shield, Tool Stanchion w/ old ORU tether, ballstack	Has heat shield			
<b>PRE-EVA APFR Locations/Settings</b>		CETA1 WIF 4 (3,GG) (12,PP,F,12)	S0 WIF 42 (10,PP,F,12)	Lab WIF 9 (TBD)	NODE1 WIF 5 (6,PP,B,12)	PMA1 WIF 2 (12,KK,F,6)	PMA1 WIF 4 (4,PP,A,6)	A/L (stbd) toolbox 1 (12,MM) (--,QQ,G,12)	Z1 WIF 1 (12,PP,F,12)	Z1 WIF 3 (6,PP,F,12)
<b>EVA 1</b>	OBSS DTO			Load Cell WIF (11,FF,A,6)						
	Cleanup			Lab WIF 9 (--,FF,A,6)						
<b>EVA 2</b>	PM Retrieval			ICC WIF 1 (9,QQ,G,2)						
	PM Install						ESP2 WIF 5 (3,PP,F,11)			
	SHOSS-ED Retrieval			ICC WIF 2 (3,LL,E,12)						
	Cleanup			Lab WIF 9 (--,LL,E,12)						
	Camera to Stanchion Install						ESP2 WIF 5 (12,QQ,F,12)			
	SHOSS-ED Install						ESP2 WIF 5 (4,OO,H,12)			
	Cleanup						A/L (stbd) toolbox 1 (12,MM) (--,OO,H,12)			

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## 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 (√MCC for config, if reqd)

- MO13Q
8. √ARLK H2O S/O VLV – OP (tb-OP)
- R11L
- If SPLY H2O XOVR VLV closed (tb-CL or bp) (water transfer config):

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
- R11L
- If SPLY H2O XOVR VLV open (tb-OP) (nominal config):

- L1
11. √RAD CNTLR OUT TEMP – NORM
  12. √FLASH EVAP CNTLR PRI A,B (two) – OFF
- ML31C
13. SPLY H2O TKD OUTLET – CL (tb-CL)
- R11L
14. √SPLY H2O TKA OUTLET – CL (tb-CL)  
TKB OUTLET – CL (tb-CL)  
TKC OUTLET – OP (tb-OP)  
√INLET – CL (tb-CL)

#### SM 60 TABLE MAINT

- CRT
15. Use TKC quantity:  
PARAM ID – ITEM 1 +0 6 2 0 5 4 8 EXEC

16. Log value before recharge

Recharge #	H2O TKB(C) %
1	
2	
3	
4	
5	

- AW82D
17. √EMU 1,2 H2O WASTE tb (two) – CL  
SPLY (two) – OP (tb-OP)
  18. √H2O TKB(C) quantity decreasing

#### NOTE

Full charge requires ~15 min

EMU MAINT/RECHARGE

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## 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 (√MCC for config, if reqd)

- MO13Q
8. √ARLK H2O S/O VLV – OP (tb-OP)
- R11L
- If SPLY H2O XOVR VLV closed (tb-CL or bp) (water transfer config):

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
- R11L
- If SPLY H2O XOVR VLV open (tb-OP) (nominal config):

- L1
11. √RAD CNTLR OUT TEMP – NORM
  12. √FLASH EVAP CNTLR PRI A,B (two) – OFF
- ML31C
13. SPLY H2O TKD OUTLET – CL (tb-CL)
- R11L
14. √SPLY H2O TKA OUTLET – CL (tb-CL)  
TKB OUTLET – CL (tb-CL)  
TKC OUTLET – OP (tb-OP)  
√INLET – CL (tb-CL)

#### SM 60 TABLE MAINT

- CRT
15. Use TKC quantity:  
PARAM ID – ITEM 1 +0 6 2 0 5 4 8 EXEC

16. Log value before recharge

Recharge #	H2O TKB(C) %
1	
2	
3	
4	
5	


- AW82D
17. √EMU 1,2 H2O WASTE tb (two) – CL  
SPLY (two) – OP (tb-OP)
  18. √H2O TKB(C) quantity decreasing


#### NOTE

Full charge requires ~15 min

EMU/AIRLOCK CONSUMABLES TRACKING CUE CARD

AIRLOCK Operations	EVA	METOX For 10.2 Ops (S/N or bar code)	PWR (EMU Water Bag) (S/N)	IRU EMU Fill Quantity Post EVA (lbs)	PWR (dump / fill)
	1				
	2				
	3				

<b>EV1 - SI EMU 3015</b> 	EVA	LiOH (S/N)	METOX (S/N or bar code)	EMU BATTERY	REBA (S/N)	Helmet Light Batt (S/N)
	1	N/A	(regenerate)		(recharge)	(recharge)
	2		N/A		(recharge)	(recharge)
	3	N/A	(regenerate)		(recharge)	(recharge)

<b>EV2 - Fs EMU 3003</b> 	EVA	LiOH (S/N)	METOX (S/N or bar code)	EMU BATTERY	REBA (S/N)	Helmet Light Batt (S/N)
	1	N/A	(regenerate)		(recharge)	(recharge)
	2		N/A		(recharge)	(recharge)
	3	N/A	(regenerate)		(recharge)	(recharge)



TOP  
BACK OF 'EMU/AIRLOCK CONSUMABLES TRACKING CUE CARD'

HOOK  
VELCRO



HOOK  
VELCRO

(reduced copy)  
FS CC 10-12

EVA-6b/121/O/A



EVA/121/BAS

EMU CONTINGENCY PROCS

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## DISPLAY LOSS DURING POWER TRANSFER (WARM RESTART)

EMU CONT  
PROCS

**WARNING**  
CO2 buildup may occur while fan is off

### NOTE

EMU will be w/o comm following step 2  
or step 10. Step 3 or step 11 should be  
pre-coordinated

- |       |  |
|-------|--|
| DCM   | 1. FAN – OFF   |
|       | If PWR – SCU:  |
| AW18H | 2. PWR/BATT CHGR EMU 1(2) BUS SEL – OFF (7 sec)            |
| DCM   | 3. PWR – BATT  |
|       | 4. √DISPLAY – ‘O2 POS – XX’                                |
| AW18H | 5. PWR/BATT CHGR EMU 1(2) MODE – PWR<br>BUS SEL – MNA(MNB) |
|       | 6. √EMU INPUT 1(2) volts = 18.0-20.0                       |
| DCM   | 7. PWR – SCU   |
|       | 8. √DISPLAY – ‘O2 POS – XX’                                |
|       | If PWR – BATT:   |
|       | 9. PWR – SCU   |
| AW18H | 10. PWR/BATT CHGR EMU 1(2) BUS SEL – OFF (7 sec)           |
| DCM   | 11. PWR – BATT   |
|       | 12. √DISPLAY – ‘O2 POS – XX’                               |
|       | 13. If reqd, FAN – ON                                      |

## VACUUM H2O RECHARGE (MANNED)

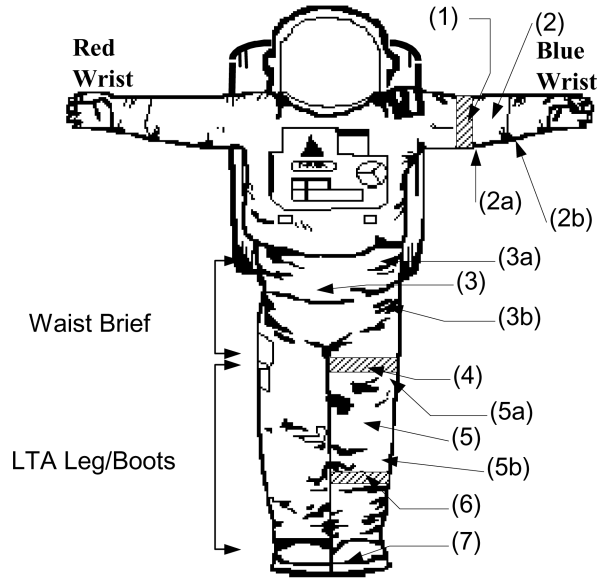
**WARNING**  
Procedure should be used only if performing a contingency EVA

- |         |  |
|---------|--|
| EV      | 1. Perform AIRLOCK INGRESS, Cuff C/L, 43 (Close hatch, partially engage latches) |
|         | 2. √Helmet purge vlv – cl, locked  |
| DCM     | 3. √PURGE vlv – cl (dn)  |
|         | 4. √WATER – OFF  |
| IV      | 5. √ARLK H2O S/O VLV – OP (tb-OP)  |
| MD(flr) | 6. √EMU O2 ISOL VLV – OP   |
| ML86B:C | 7. √cb MNC EXT ARLK HTR LINE ZN 1,2 (two) – op                                   |
| EV      | 8. Remove DCM cover  |
|         | 9. Connect SCU to DCM  |
|         | 10. COMM mode – HL   |
| AW82B   | 11. √EV-1(EV-2) O2 vlv – OP  |
| AW18H   | 12. PWR/BATT CHGR EMU 1(2) BUS SEL – MNA(MNB)                                    |
| DCM     | 13. PWR – SCU (fwd), WARN TONE   |
| R11L    | If SPLY H2O XOVR VLV closed (tb-CL or bp) (water transfer config):               |
|         | 14. SPLY H2O TKA OUTLET – CL (tb-CL)   |
|         | If SPLY H2O XOVR VLV open (tb-OP) (nominal config):                              |
| IV      | 15. √RAD CNTLR OUT TEMP – NORM   |
|         | 16. √FLASH EVAP CNTLR PRI A,B (two) – OFF  |
| ML31C   | 17. SPLY H2O TKD OUTLET – CL (tb-CL)   |
| R11L    | 18. SPLY H2O TKB OUTLET – CL (tb-CL)   |
|         | √TKA OUTLET – CL (tb-CL)   |
|         | TKC OUTLET – OP (tb-OP)  |
| EV      | AW82D 19. √EMU 1(2) H2O WASTE – CL (tb-CL)                                       |
|         | SPLY – OP (tb-OP)  |

**WARNING**  
O2 will be off. IV1 stand by inner hatch  
Equal vlvs for emergency repress



# STS-121 NOMINAL EMU SIZING MATRIX



SEMU	HUT SIZE/ SEMU Number	(1) Arm Sizing Ring	(2a) Arm Cam	(2) Lower Arm	(2b) Wrist Cam	Phase VI Glove
<b>Sellers (SI)</b>	L / 3015	None	Long	04	Long	6BB
<b>Fossum (Fs)</b>	L / 3003	0.5 inch	Short	03	Short	6BB
<b>NOTE</b> Record any changes made in-flight to EMU sizing. Report changes to MCC-H						

LTA	(3a) Brief Upper Cam	(3) Adjust Waist Brief	(3b) Brief Lower Cam	(4) Thigh Sizing Ring	(5a) Leg Upper Cam	(5) Leg Segment	(5b) Leg Lower Cam	(6) Leg Sizing Ring	(7) Boot/ Insert	LCVG/ BLVD	CCA/CEM
<b>Sellers (SI)</b>	Short	02	Long	None	Short	03	Long	1.0 inch	02 / T.S. (Lg)	03 / 05	03 / 317
<b>Fossum (Fs)</b>	Short	01	Short	None	Short	03	Long	1.5 inch	02 / T.S. (Lg)	04 / 05	03 / 311

**NOTE**  
Record any changes made in-flight to EMU sizing. Report changes to MCC-H

## EMU CONTINGENCY RESIZE MATRIX

Perform EMU RESIZE (12-17) per matrix as directed by MCC-H

FOR LOSS OF:	EV1 (Sellers) Prime Identifier – SI 1	EV2 (Fossum) Prime Identifier – Fs 1
HUT/PLSS	(Large ORU SEMU #3015) 1. Use Krikalev SEMU L /???? 2. Install EV1 Arms/rings/gloves 3. Use EV1 CCA 4. Use EV1 LTA	(Large ORU SEMU #3003) 1. Use Krikalev SEMU L /???? 2. Install EV2 Arms/rings/gloves 3. Use EV2 CCA 4. Use EV2 LTA
Waist Brief	(02 Adjustable) 1. Use Phillips '02' Waist Brief 2. Set Cams: 3a-Sht, 3b-Lng 3. Install EV1's Leg/Boot	(01 Adjustable) 1. Use Krikalev '01' Waist Brief 2. Set Cams: 3a-Sht, 3b-Sht 3. Install EV2's Leg/Boot
Gloves	(6BB) 1. Use EV1 '6BB' B/U gloves	(6BB) 1. Use EV2 '6BB' B/U gloves
LCVG	(03) 1. Use EV1 '03' B/U LCVG 2. Transfer biomed, dosimeter	(04) 1. Use EV2 '04' B/U LCVG 2. Transfer biomed, dosimeter
Lower Arm Segment	(04) 1. √Wrist color of Arm Segment 2. Use Krikalev '04' Lower Arms 3. Set Cams 2a-Lng, 2b-Lng	(03) 1. √Wrist color of Arm Segment 2. Use EV2 '03' B/U Lower Arms 3. Set Cams 2a-Sht, 2b-Sht
Leg Segment	(03) 1. Use Krikalev '03' Leg Segment 2. Set Cams 5a-Sht, 5b-Lng	(03) 1. Use Krikalev '03' Leg Segment 2. Set Cams 5a-Sht, 5b-Lng
Sizing Rings	Leg: Use ISS '1.0 in' B/U rings	Arm: Use Krikalev '0.5 in' rings Leg: Use Krikalev '1.5 in' rings
Boot/BSI	(02/Thermal Slipper) 1. Use Phillips 02 Boot 2. Use EV1 Thermal Slipper	(02/Thermal Slipper) 1. Use Phillips 02 Boot 2. Use EV2 Thermal Slipper
CCA	(03/317) 1. Use EV1 back-up CCA	(03/311) 1. Use EV2 back-up CCA

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UNSCH/CONT  
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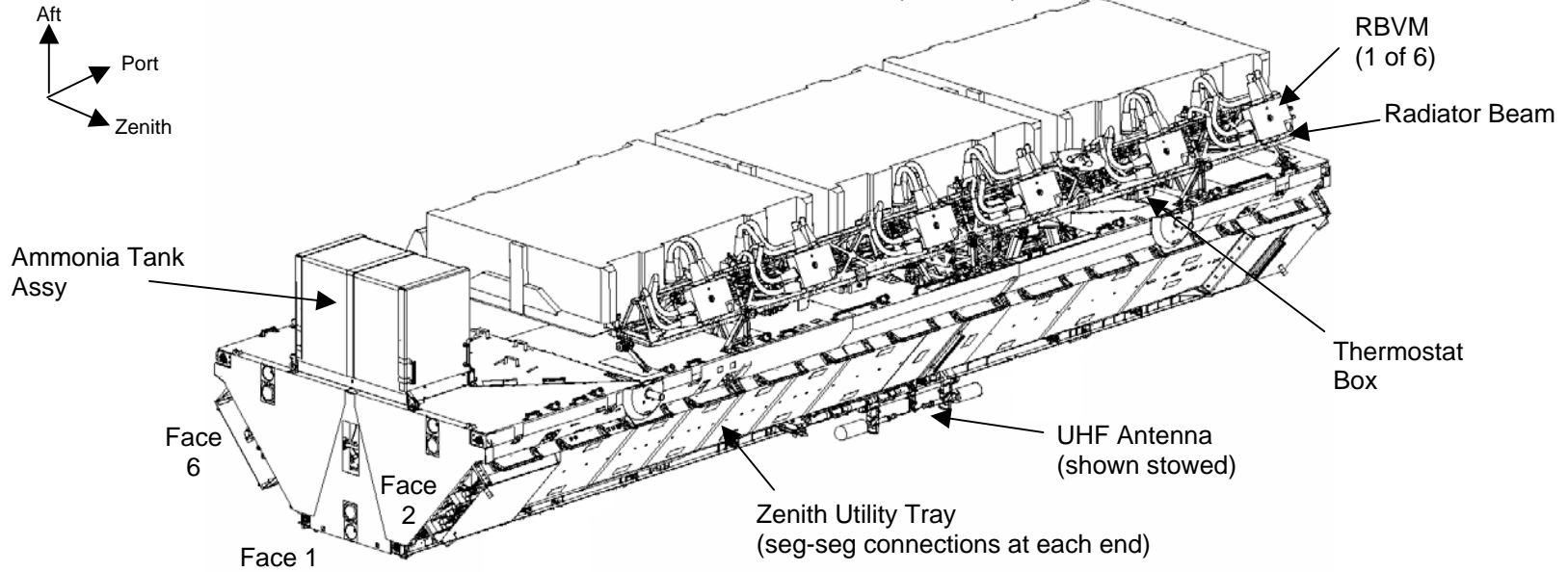
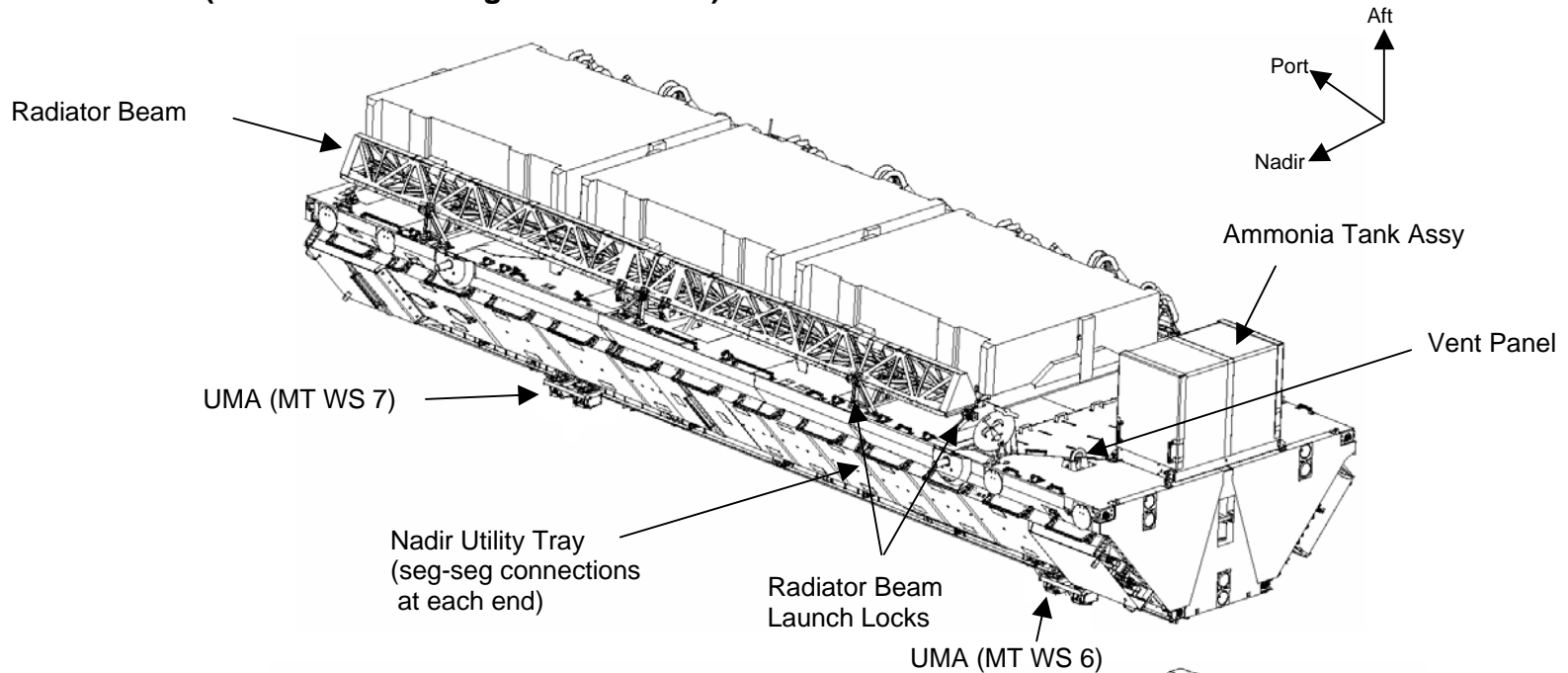
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TRRJ OVERVIEW – P1 PORT/S1 STBD .....	FS 17-30
RADIATOR OVERVIEW .....	FS 17-31
UHF ANTENNA .....	FS 17-32

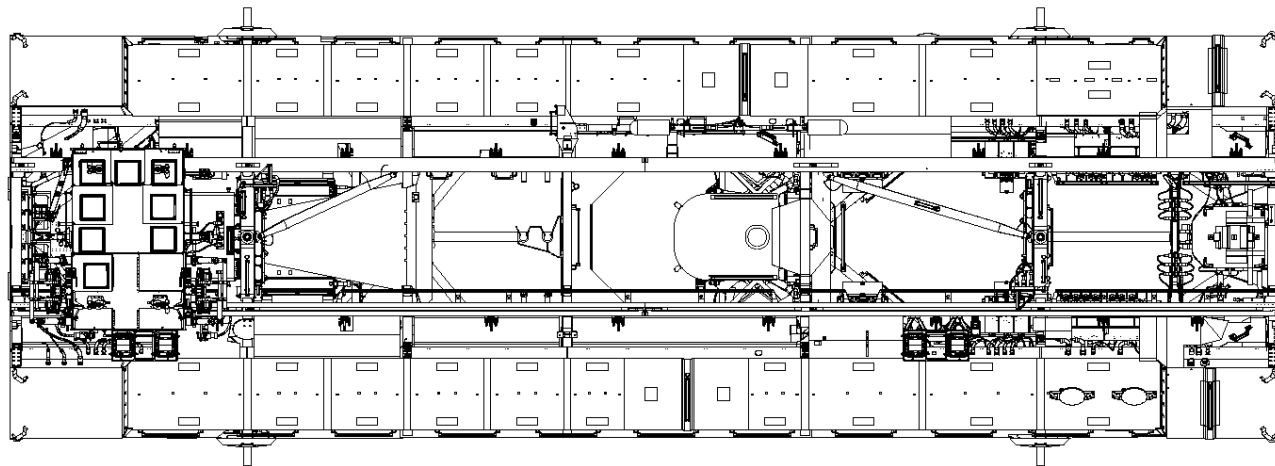
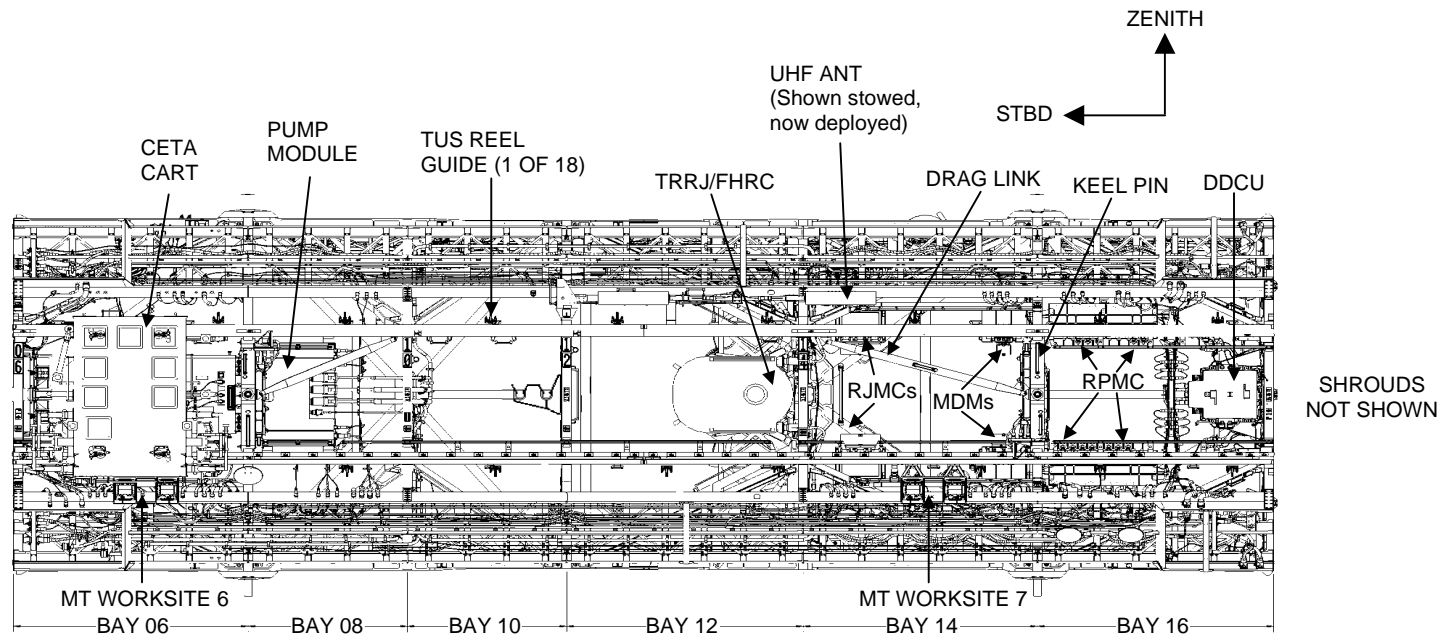
**GENERIC  
EVA REF**

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# P1 OVERVIEW (Keel Pins and Drag Links stowed)

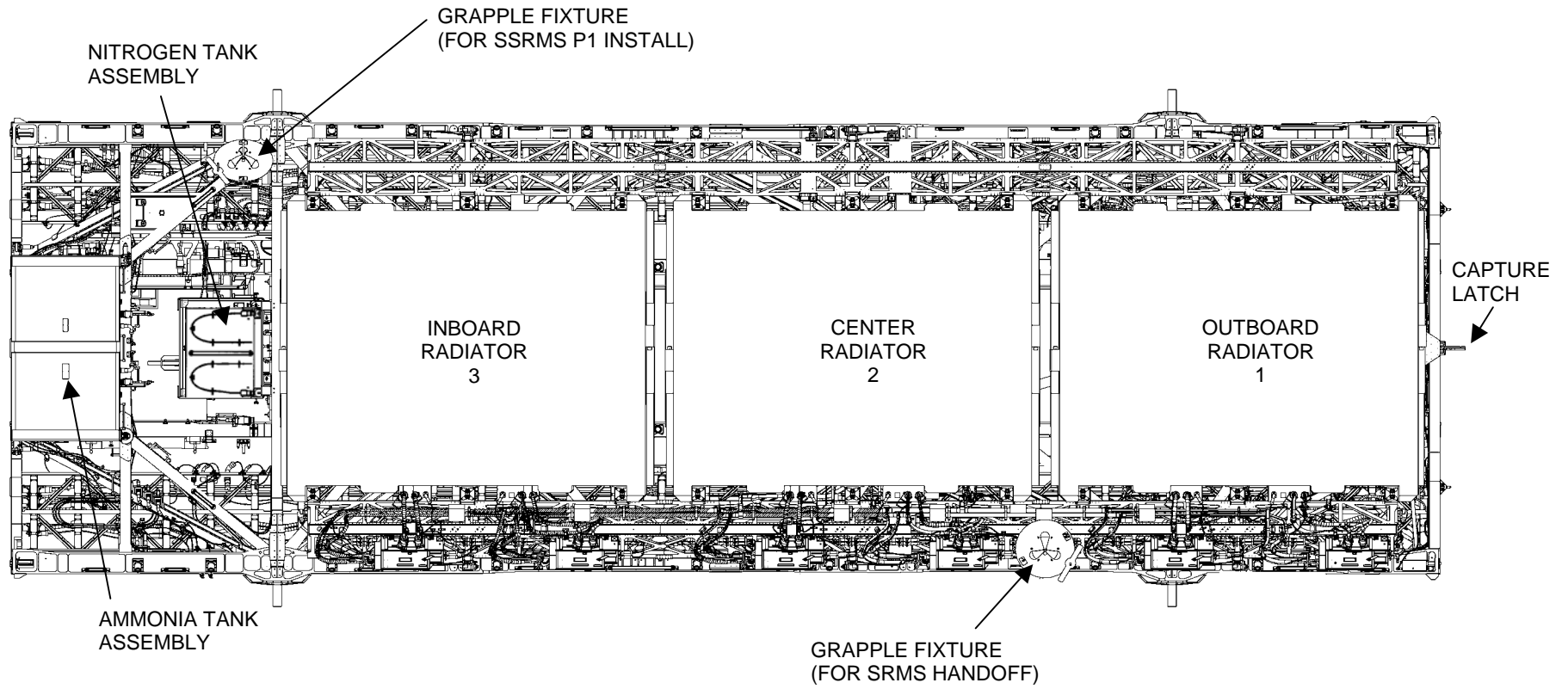


# P1 FORWARD FACE (FACE 1)

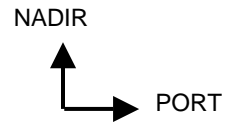


NOTE: Drag links and keel pins stowed

# P1 AFT FACE (FACE 4)

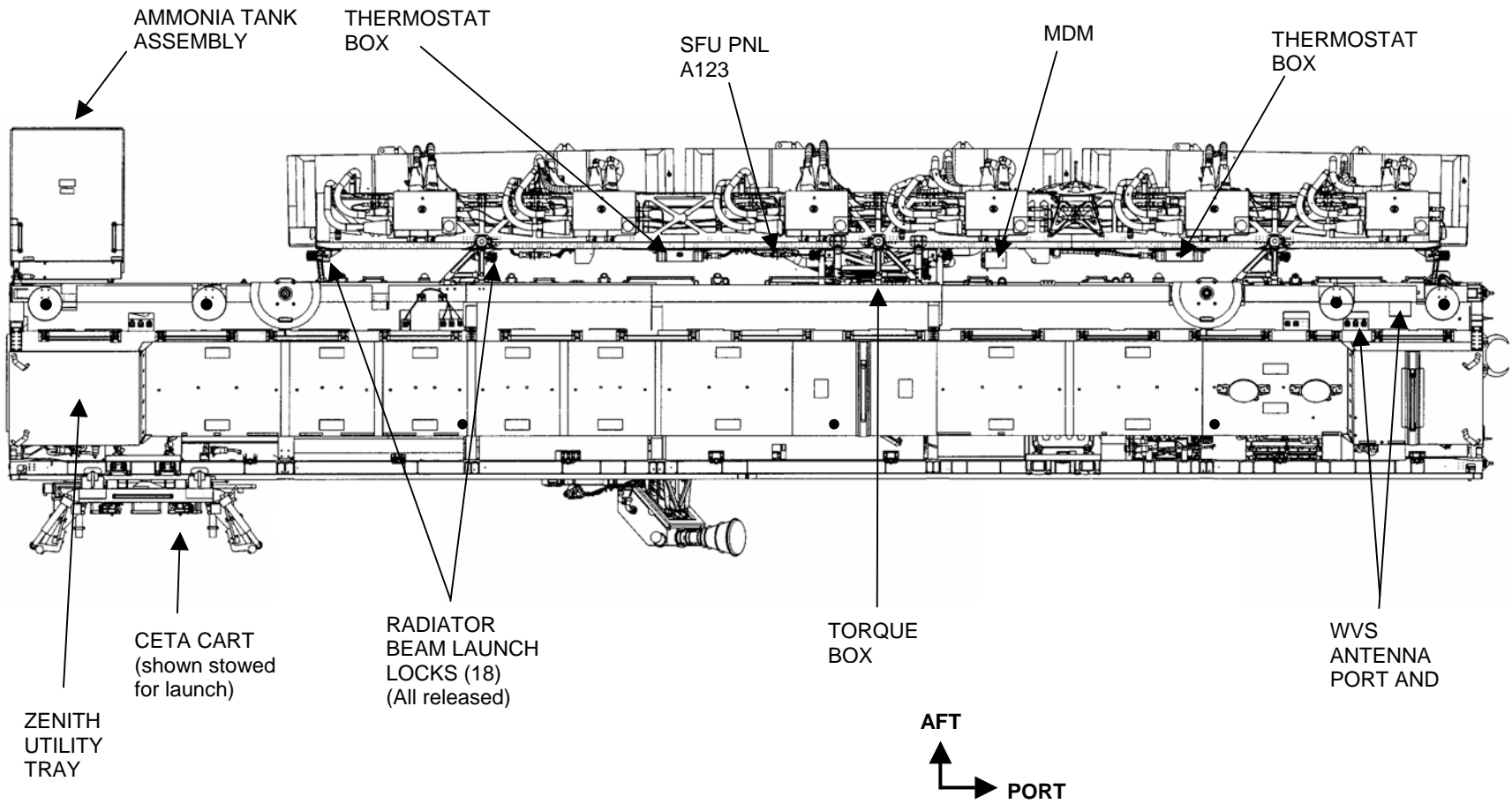


NOTE: Shrouds not shown on radiator beams and aft face



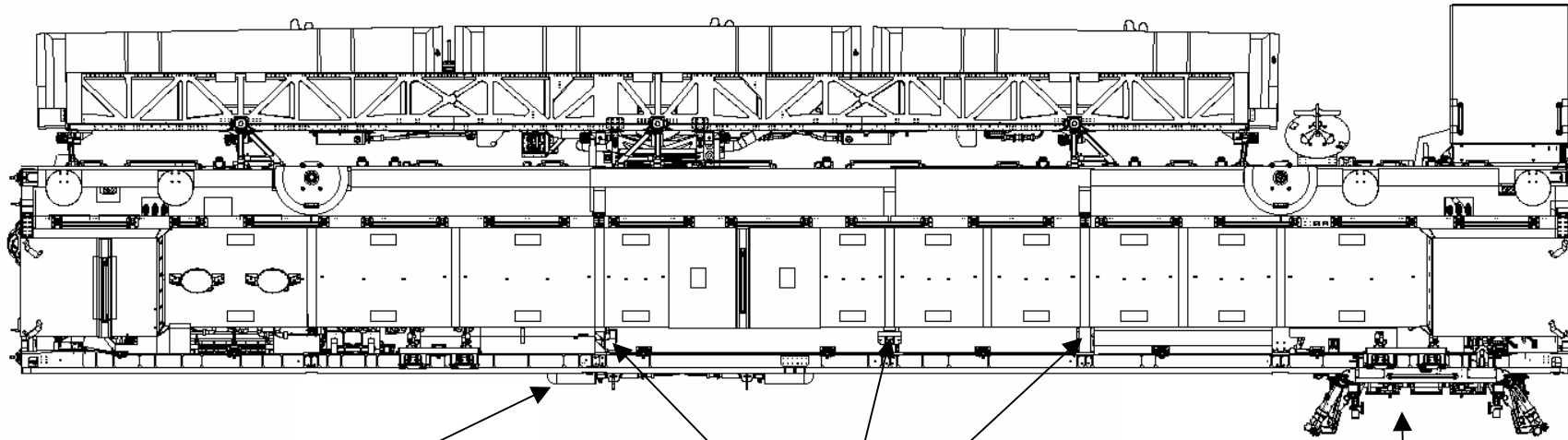


# P1 ZENITH SIDE (FACE 2)



P1 NADIR SIDE (FACE 6)

Aft  
Port



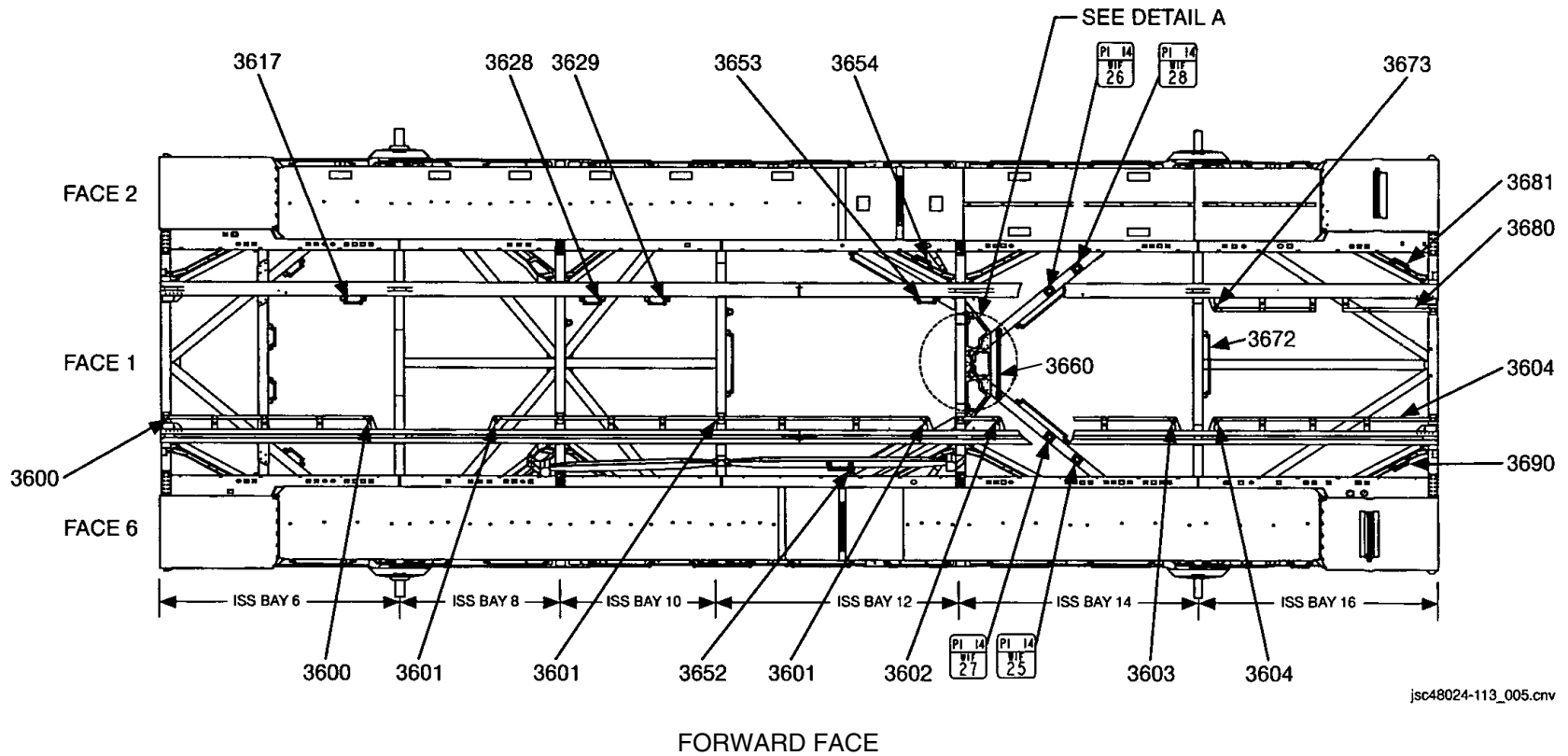
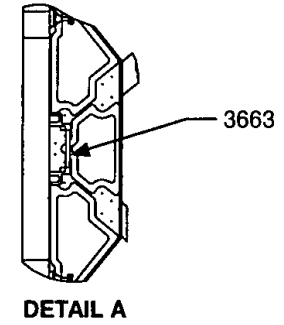
UHF Antenna  
(Shown stowed)

Drag Link Stowage Brackets  
(Drag Links and Keel Pins not shown)

CETA Cart shown in  
the launch  
configuration with  
brake handles  
stowed

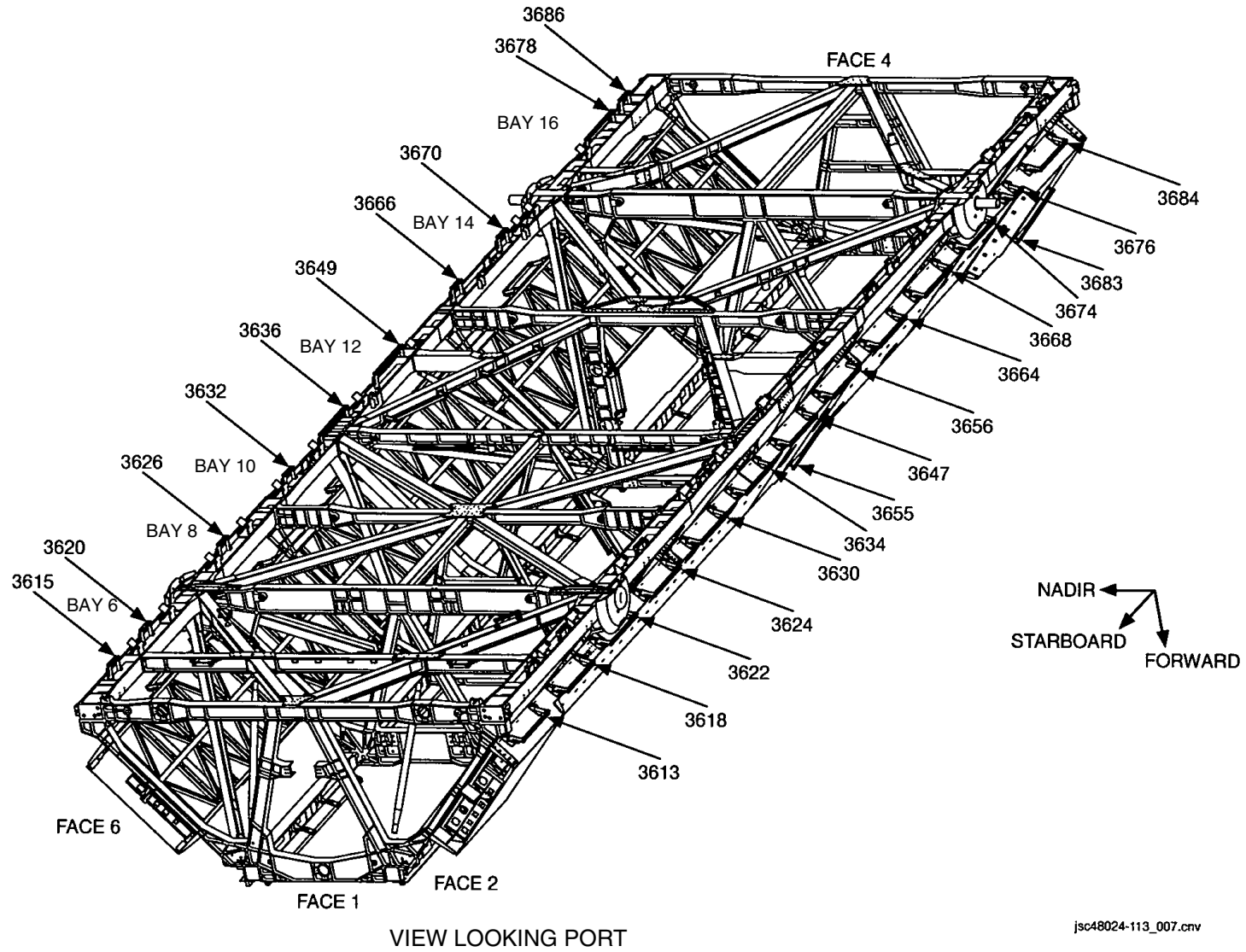
# P1 HANDRAILS AND WIFS, FACES 1, 2, AND 6

STARBOARD ←  
 ↓  
 NADIR

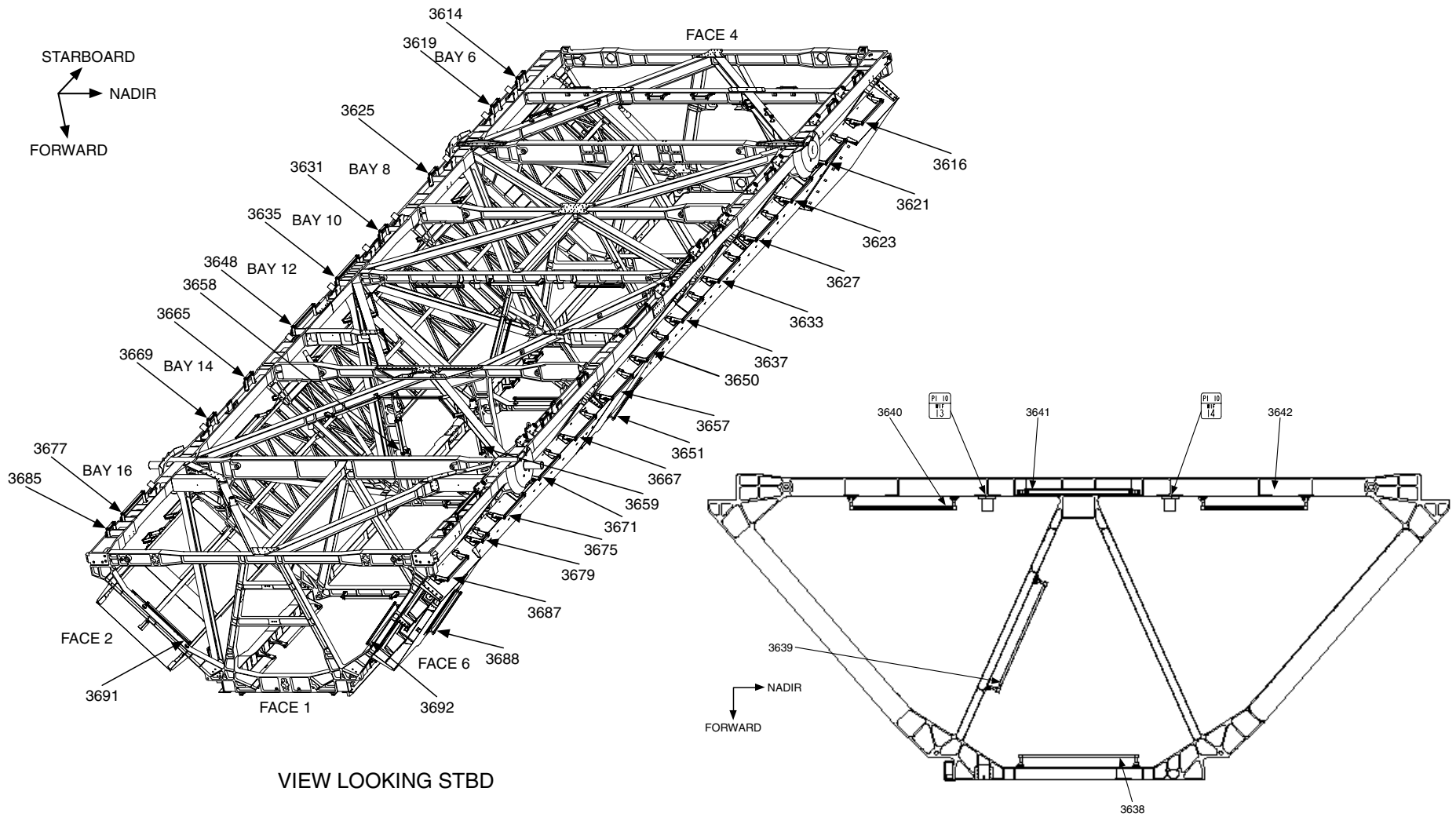


jsc48024-113\_005.cmv

# P1 HANDRAILS AND WIFS, FACE 4



# P1 HANDRAILS AND WIFS, FACE 4 (Cont)



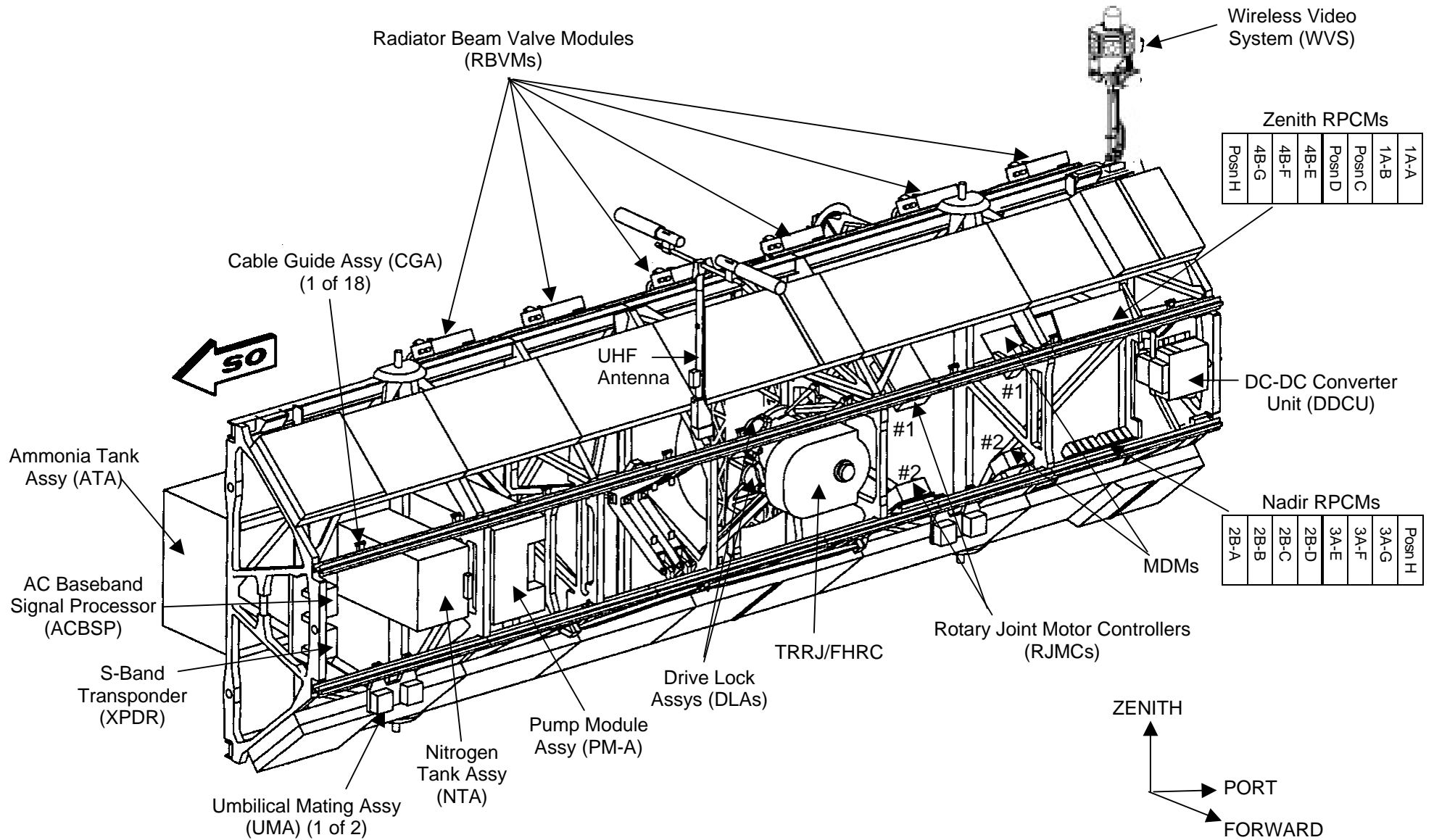
VIEW LOOKING STBD

VIEW OF BULKHEAD BETWEEN ISS BAY 10 AND BAY 12

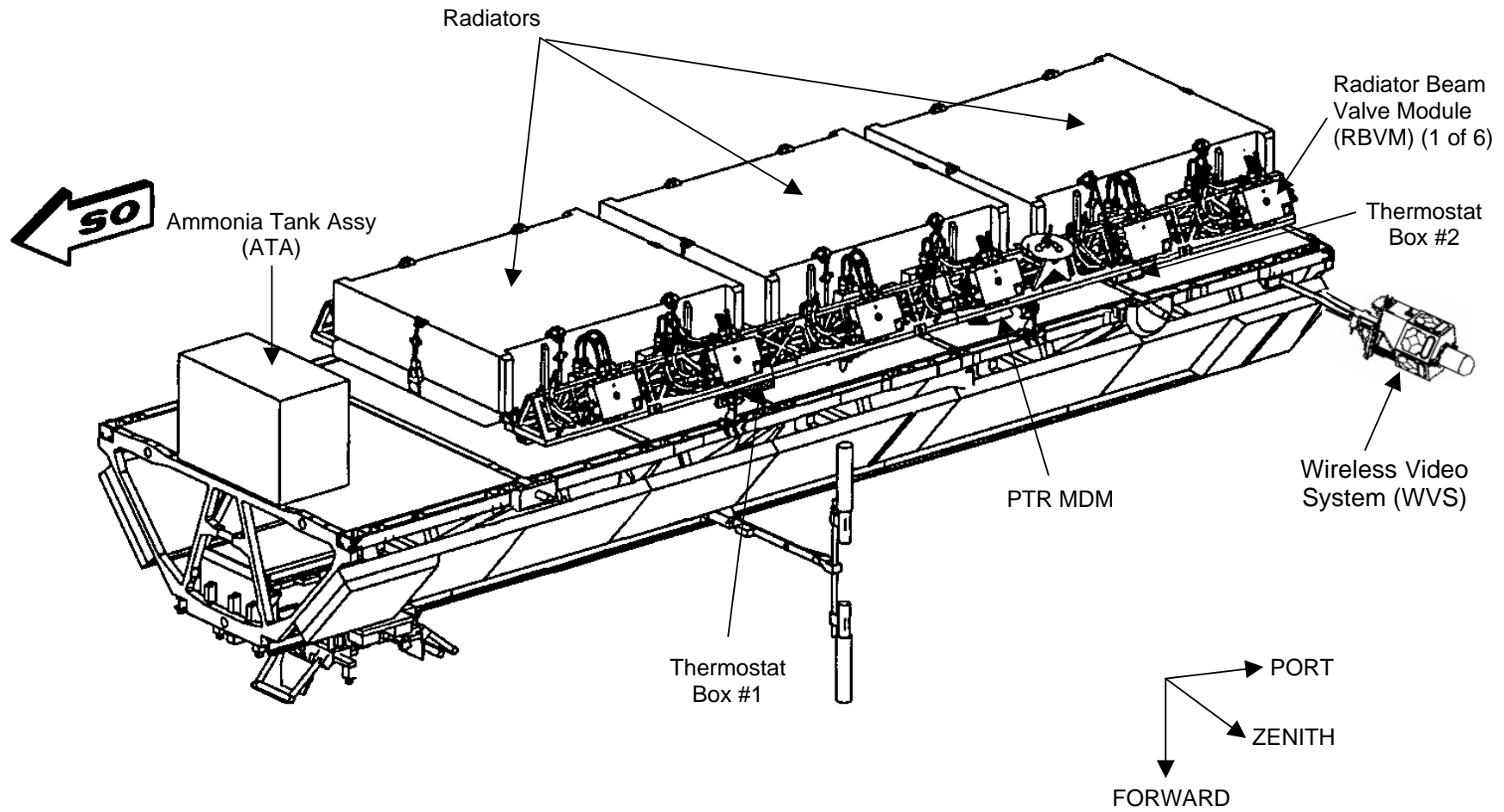
iss48024-113\_009



# P1 ORUs

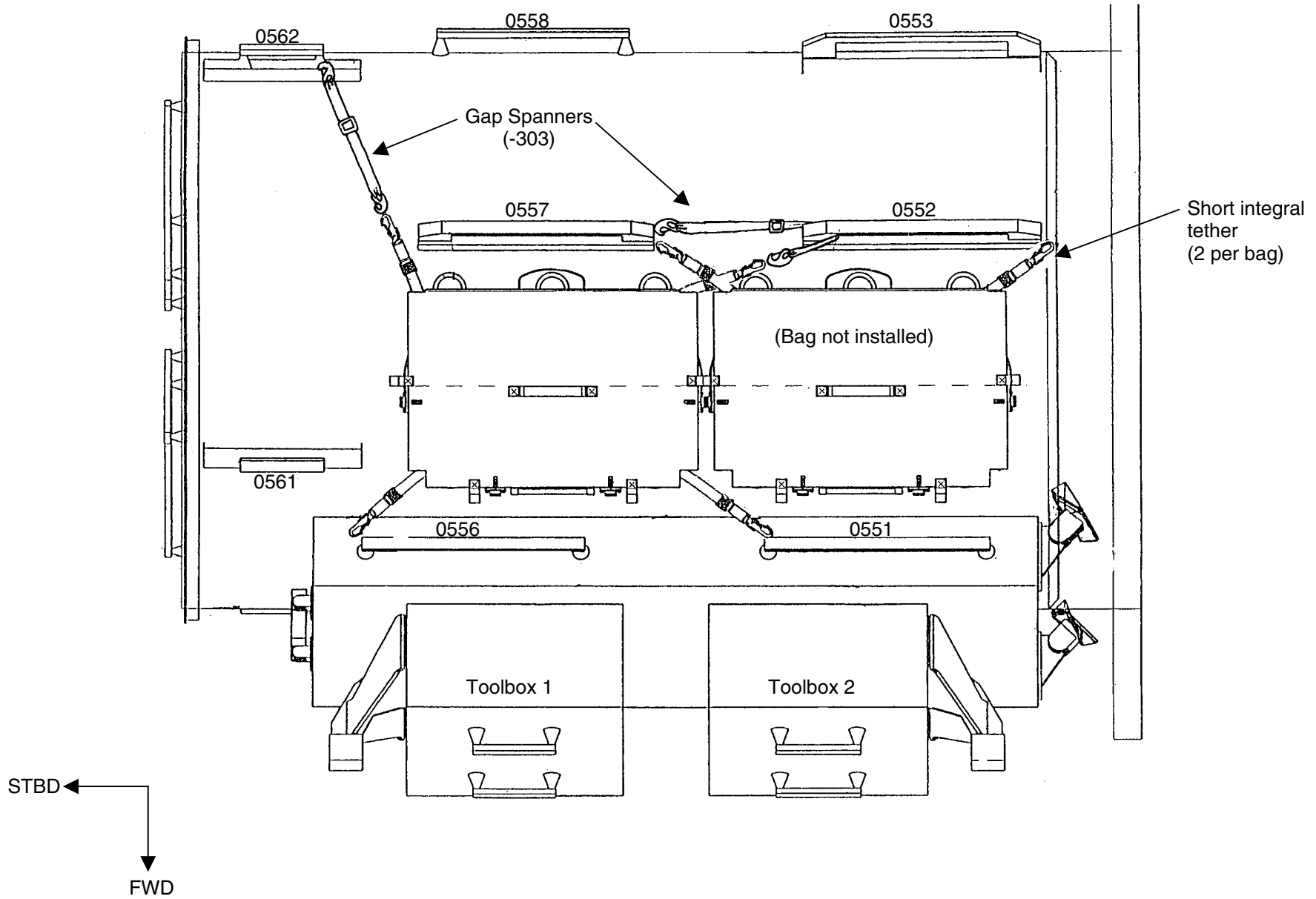


P1 ORUs (Cont)

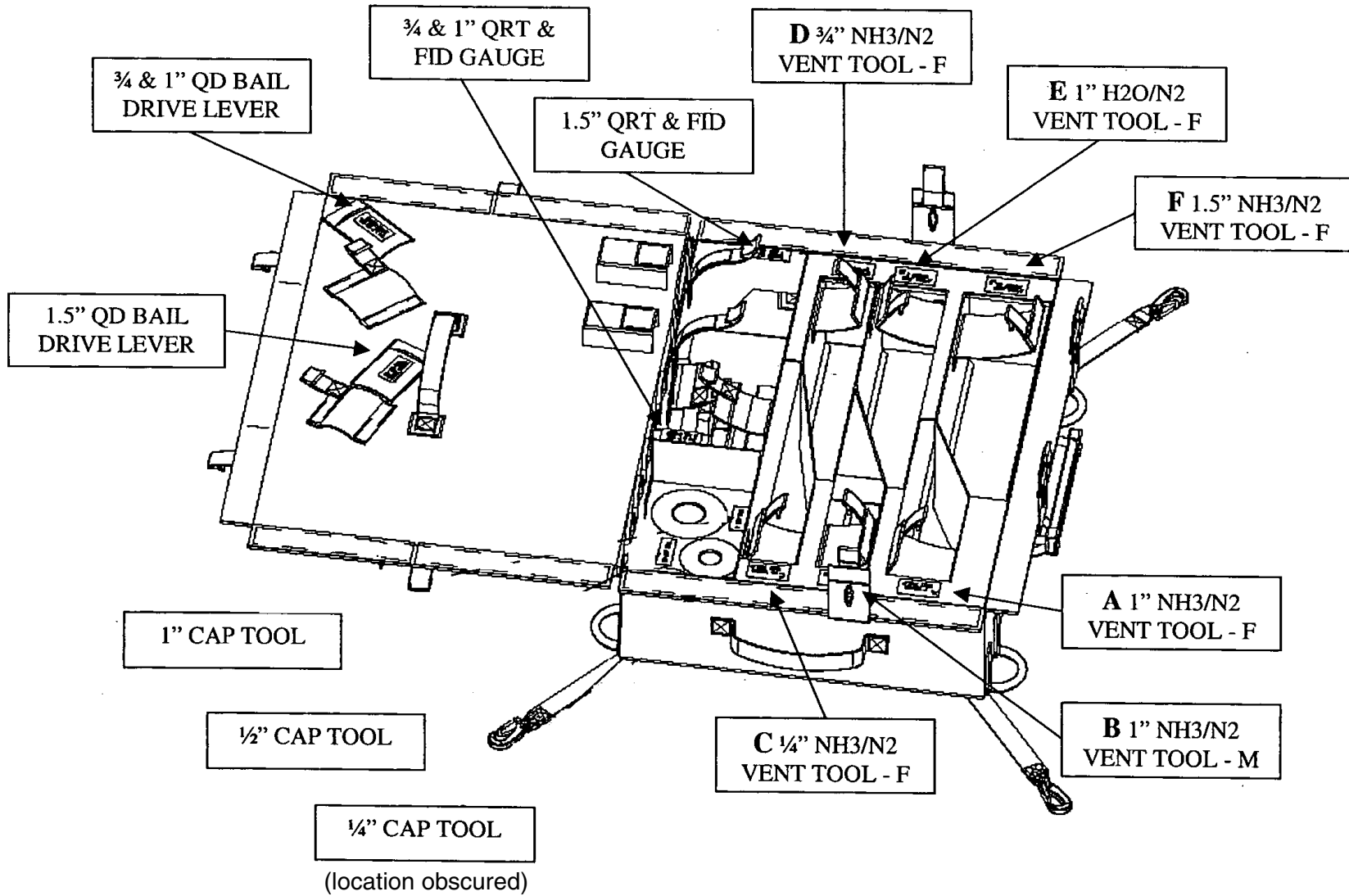




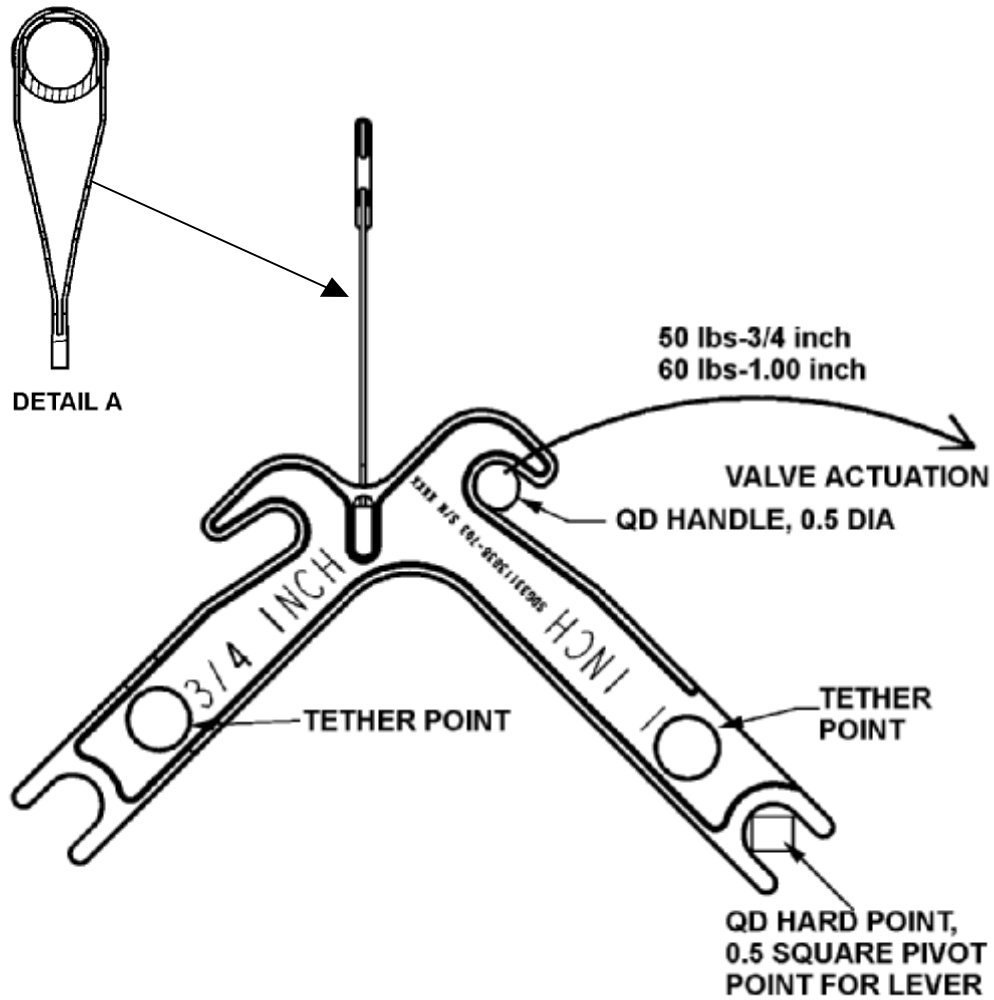
# QD TOOLBAGS INSTALLED ON CREWLOCK ZENITH



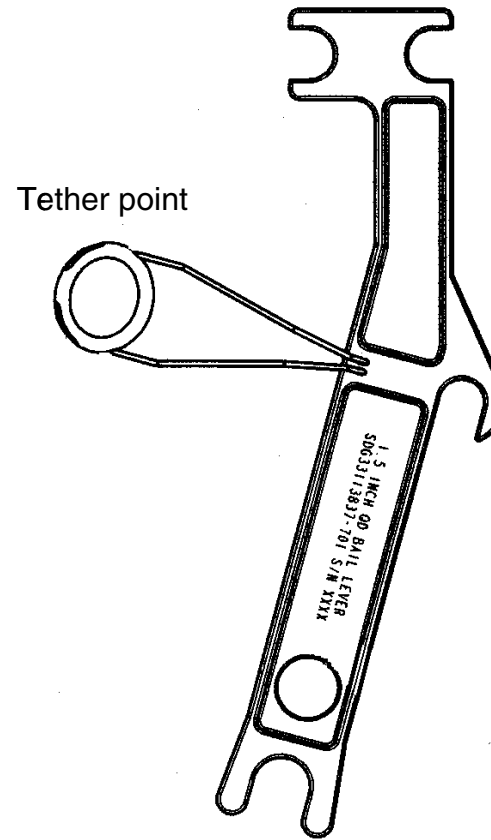
# QD TOOLBAG CONTENTS



# FLUID QD BAIL LEVERS

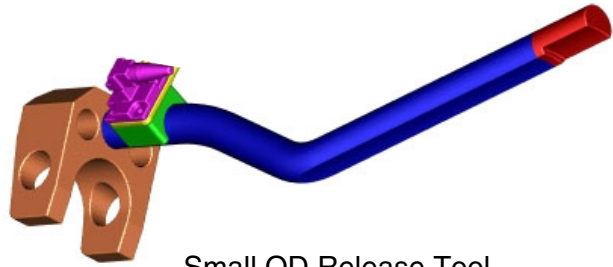


Small QD Bail Lever

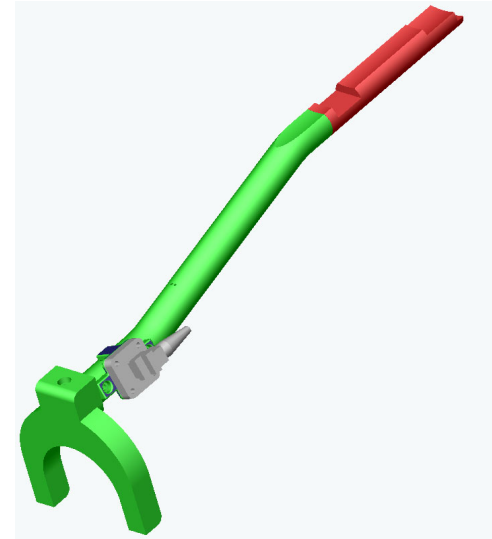


1.5-in QD Bail Lever

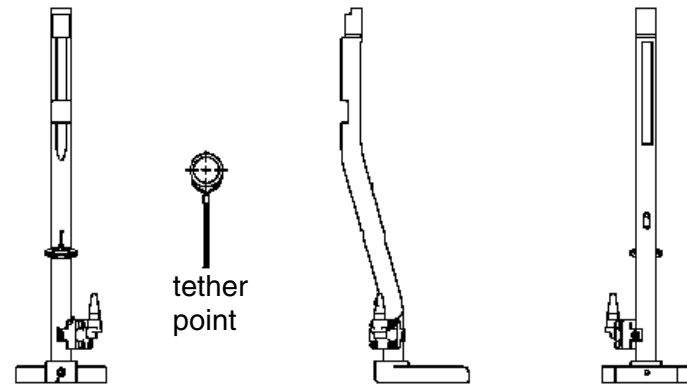
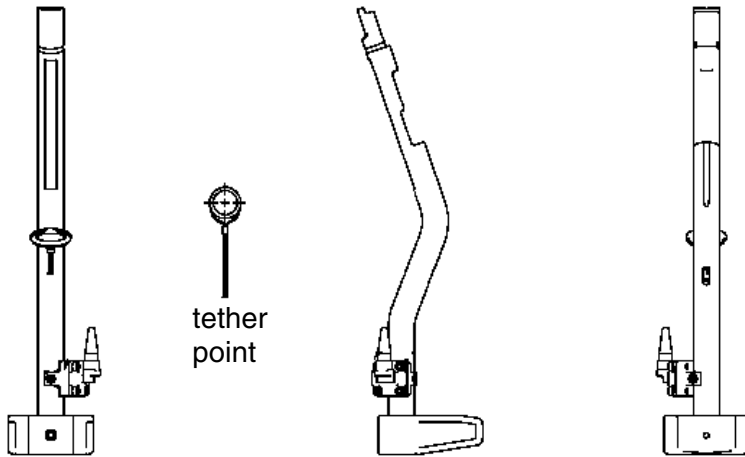
# FLUID QD RELEASE TOOLS



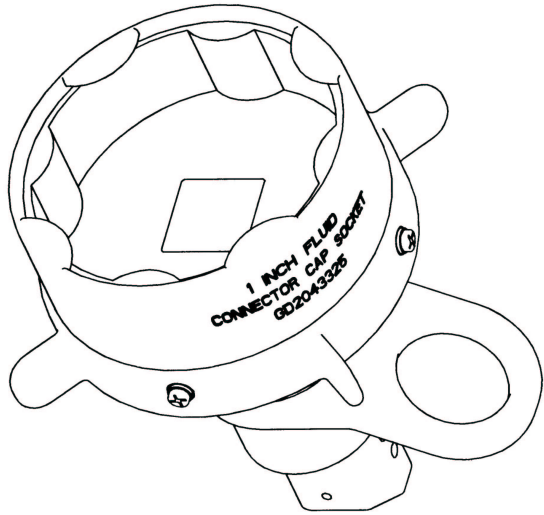
Small QD Release Tool  
w/FID Gauge



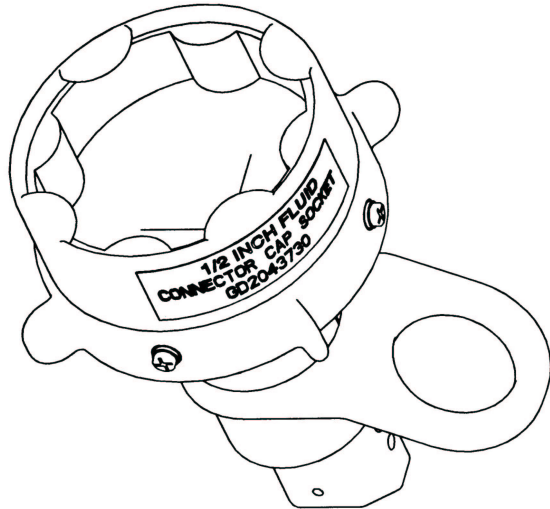
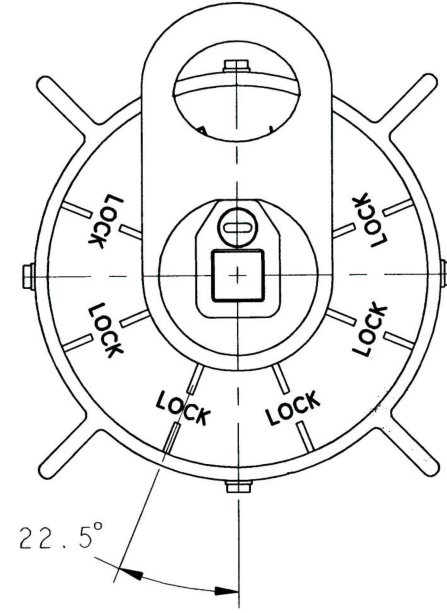
1.5-in QD Release Tool  
w/FID Gauge



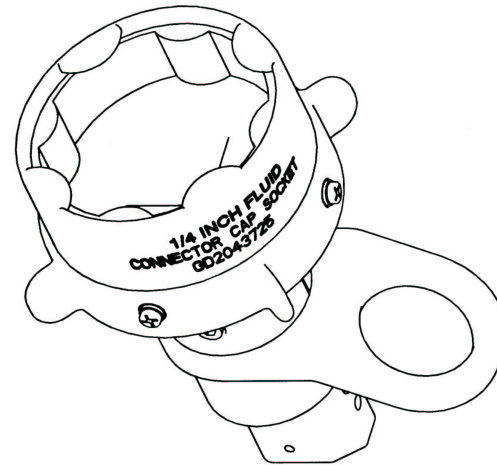
# FLUID QD CAP TOOLS



1-in QD Cap Tool

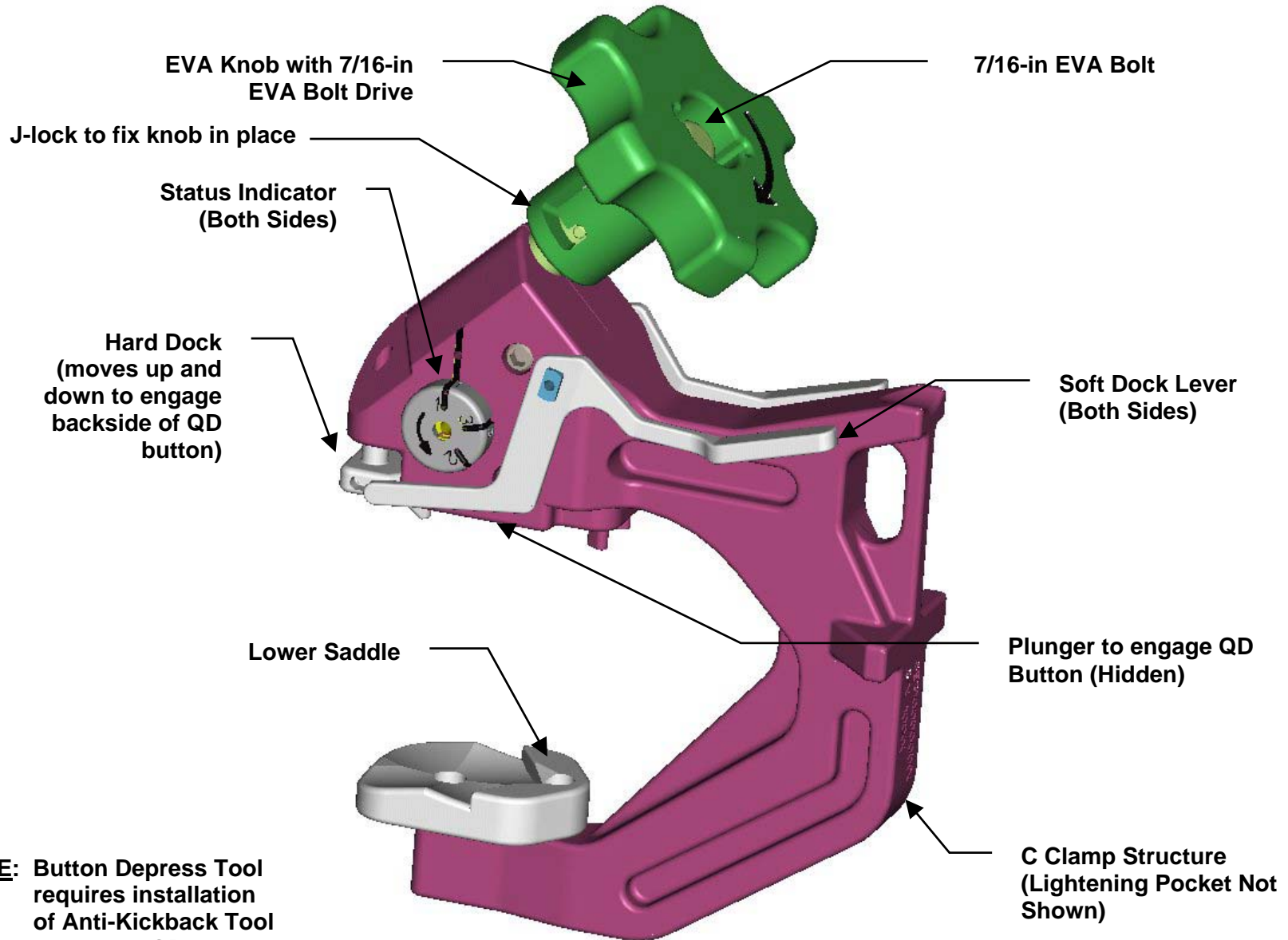


1/2-in QD Cap Tool



1/4-in QD Cap Tool

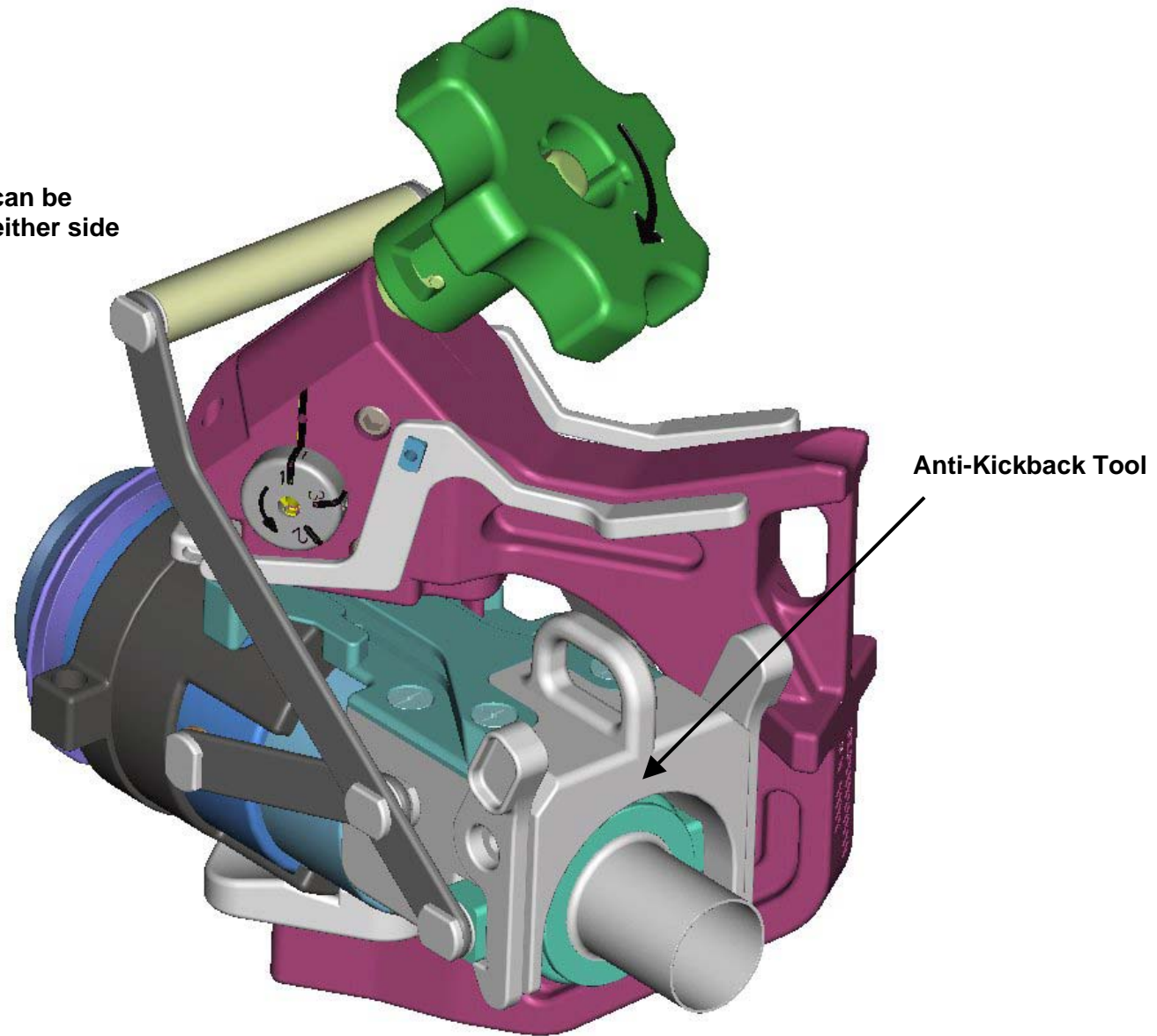
## 1.0-IN BUTTON DEPRESS TOOL



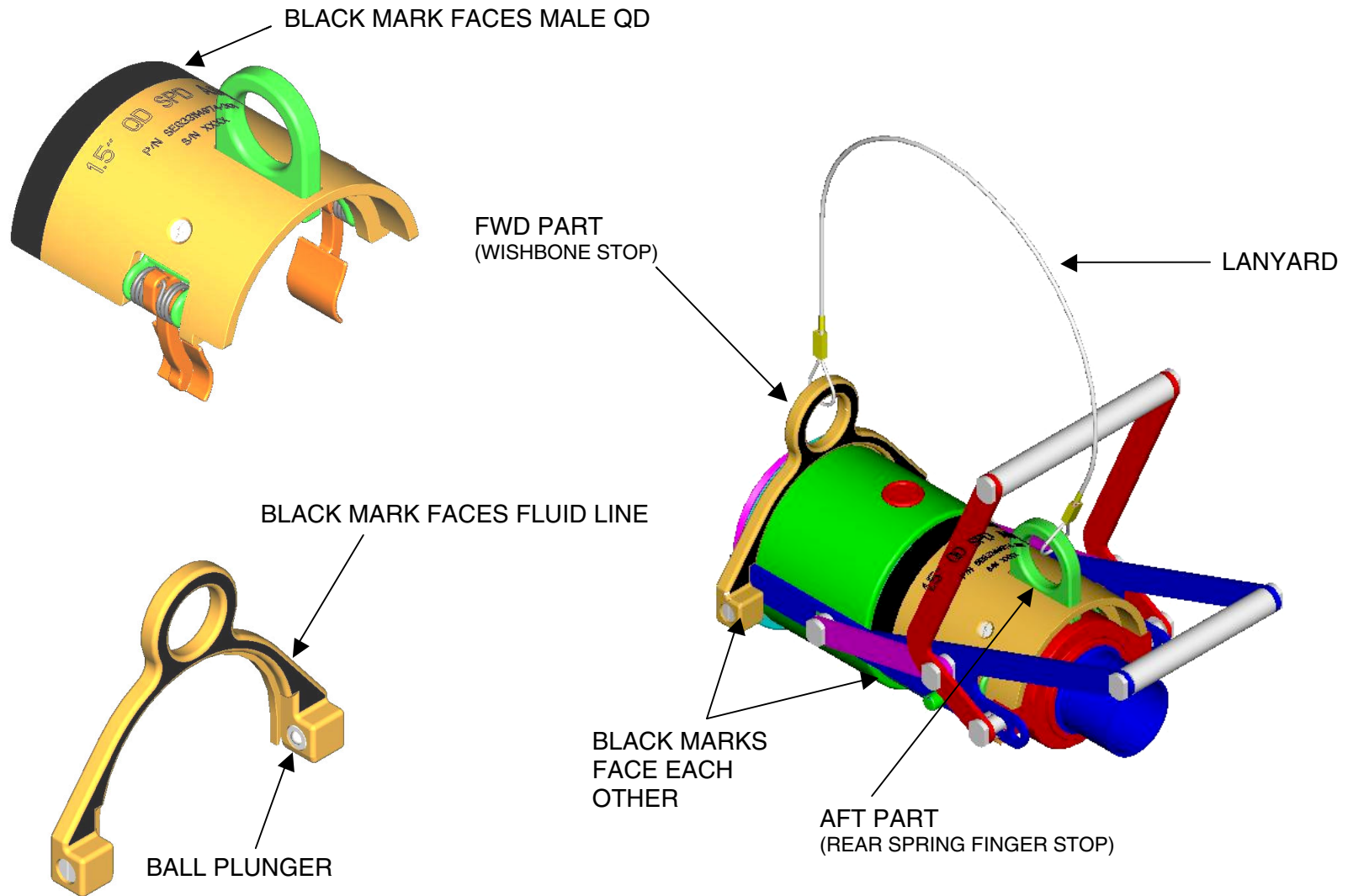
**NOTE:** Button Depress Tool requires installation of Anti-Kickback Tool to engage QD

## 1.0-IN BUTTON DEPRESS TOOL – INSTALLED

Button Depress Tool can be installed on QD from either side

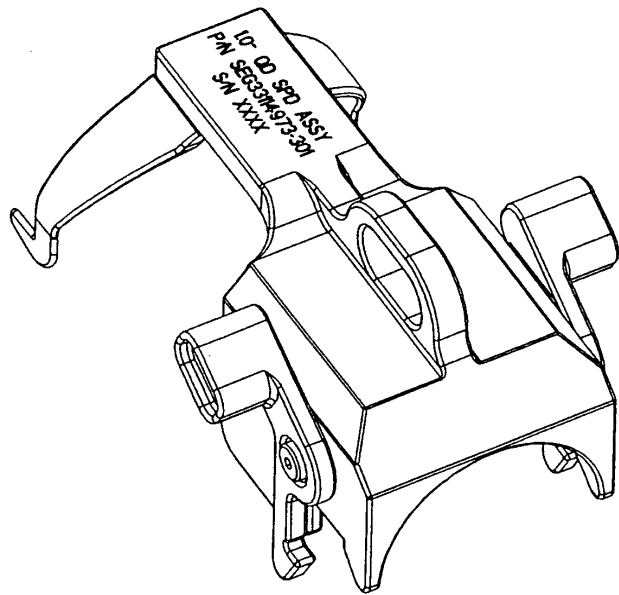


# 1.5-IN FLUID QD SPOOL POSITIONING DEVICE





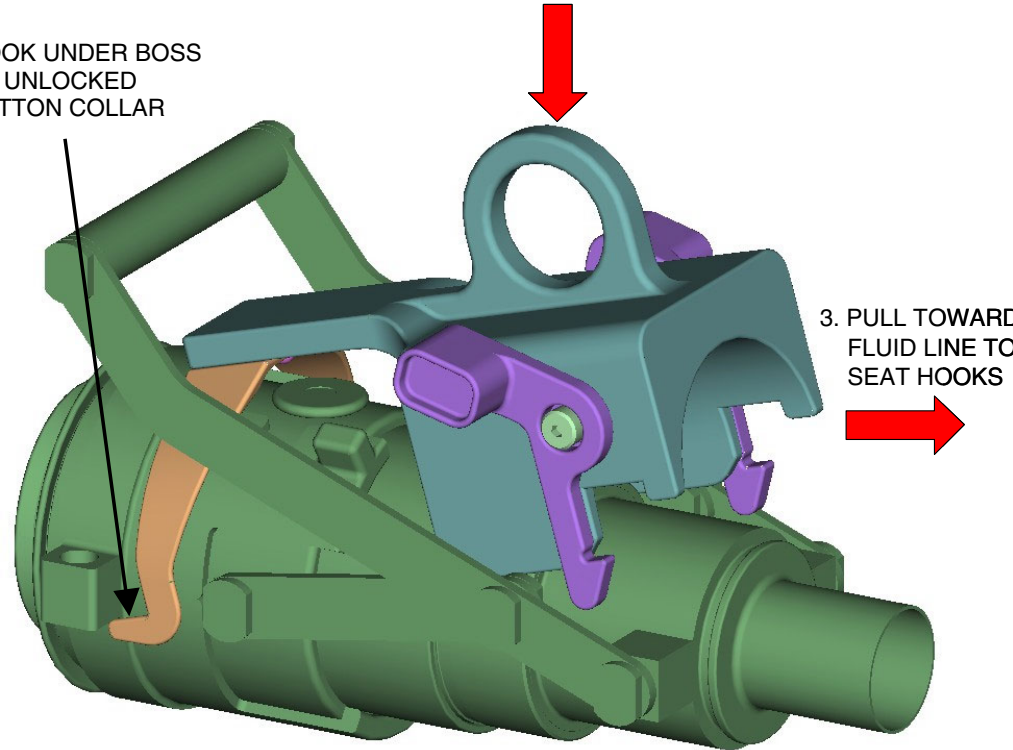
## 1.0-IN FLUID QD SPOOL POSITIONING DEVICE



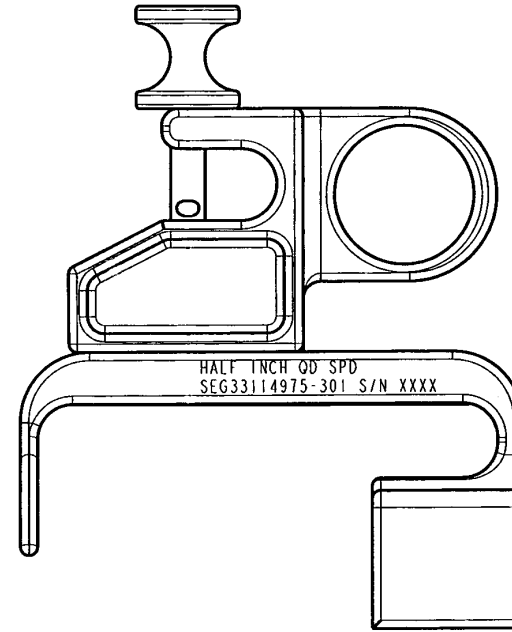
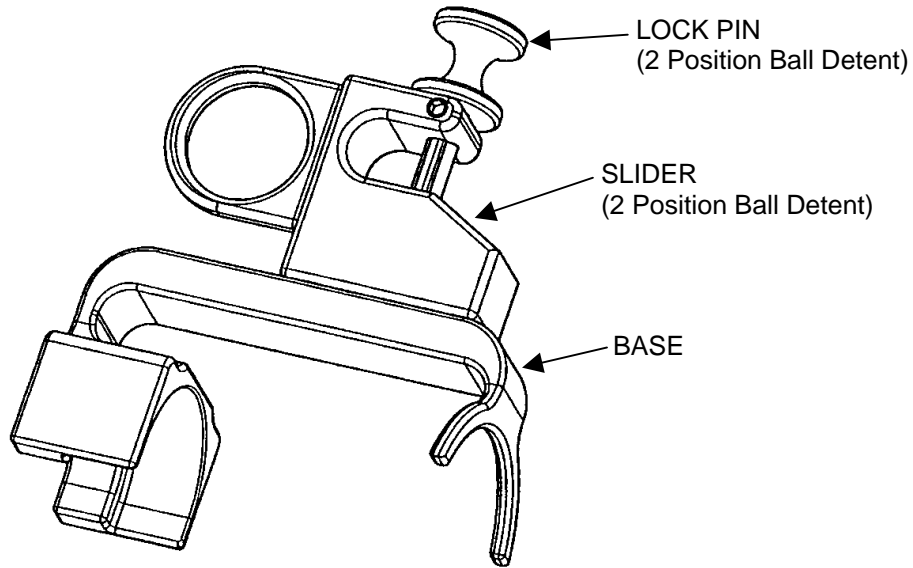
1. HOOK UNDER BOSS  
OF UNLOCKED  
BUTTON COLLAR

2. ROTATE INTO PLACE

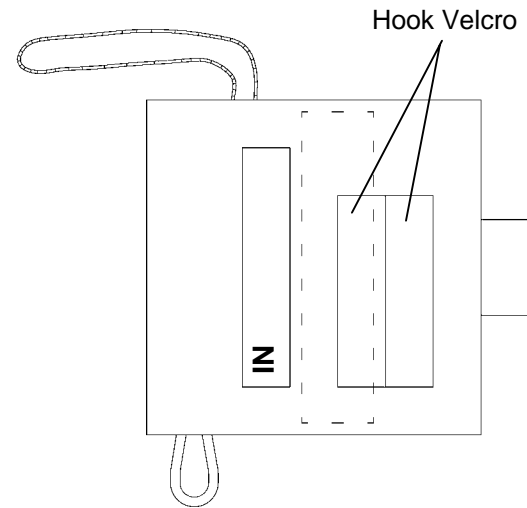
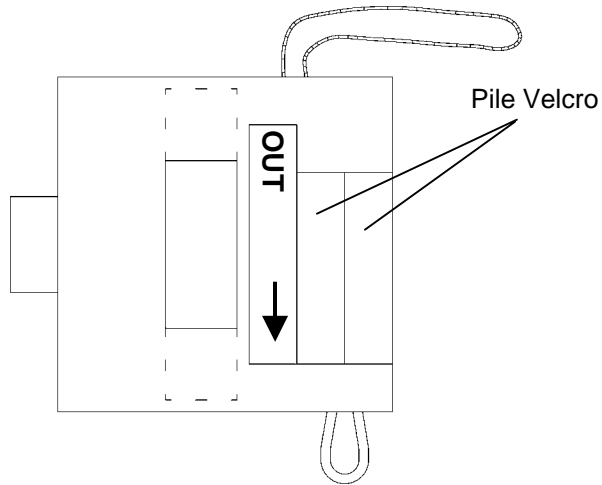
3. PULL TOWARD  
FLUID LINE TO  
SEAT HOOKS



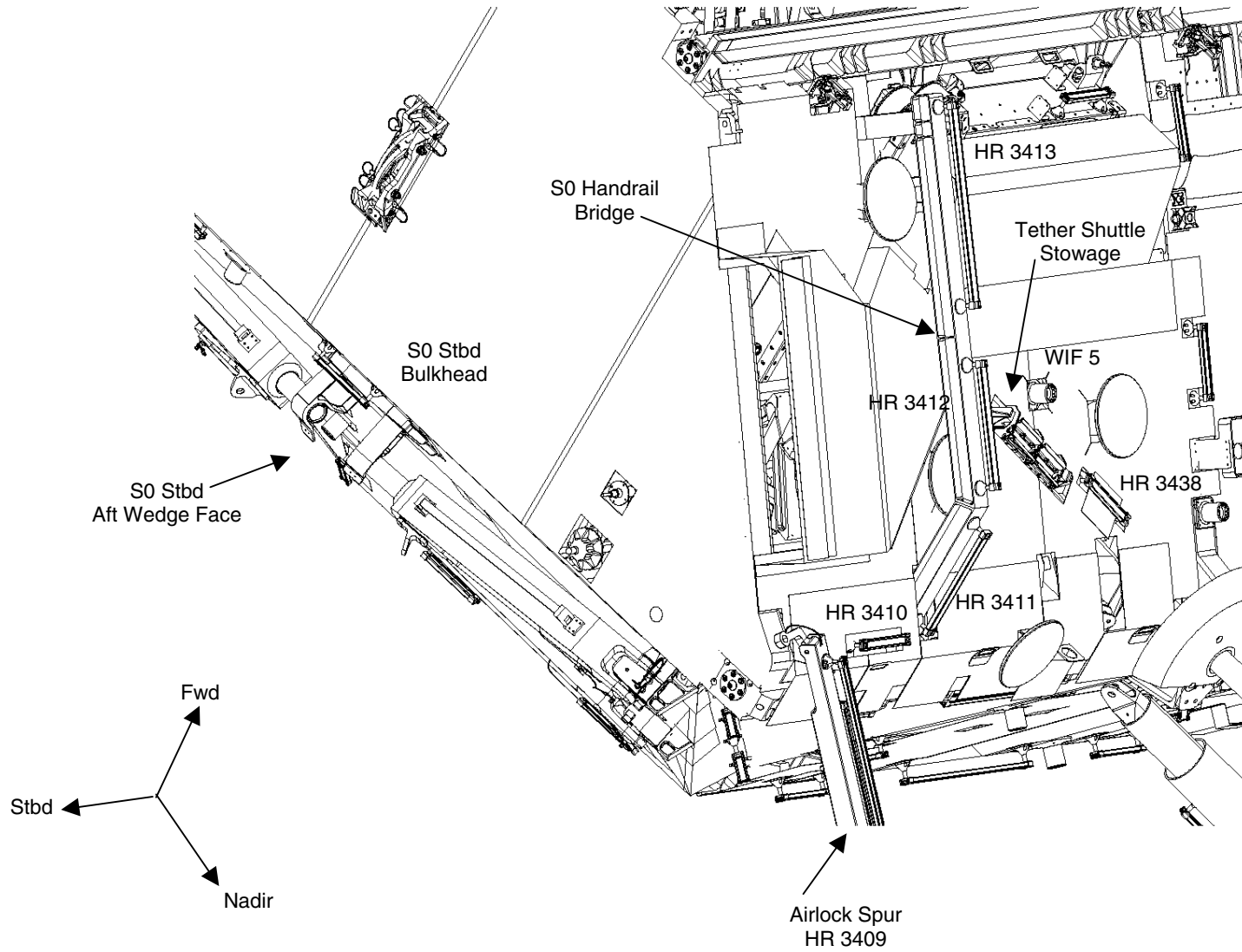
### 0.5-IN FLUID QD SPOOL POSITIONING DEVICE



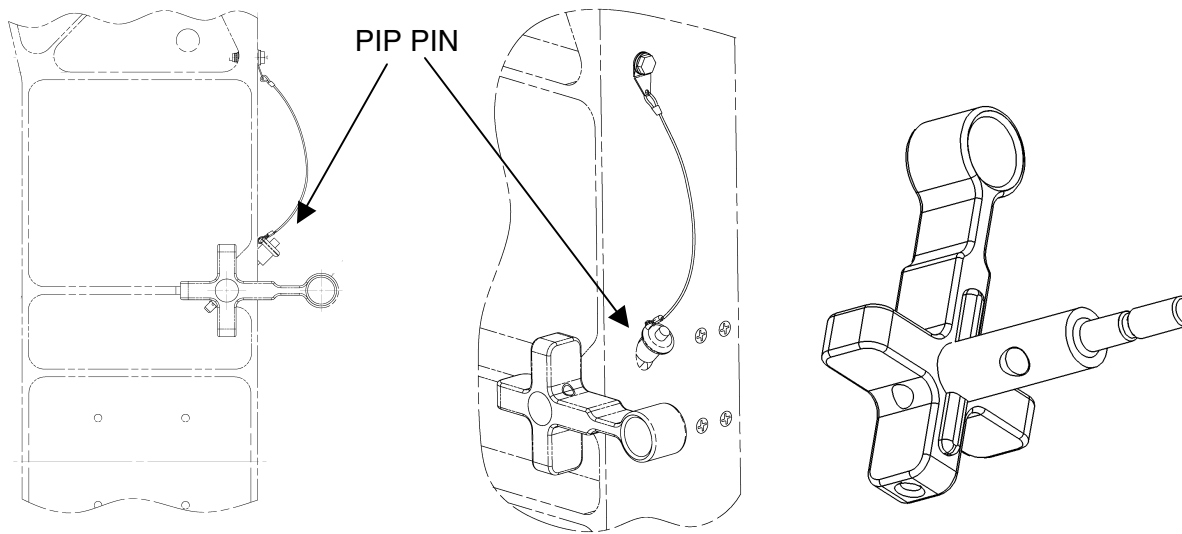
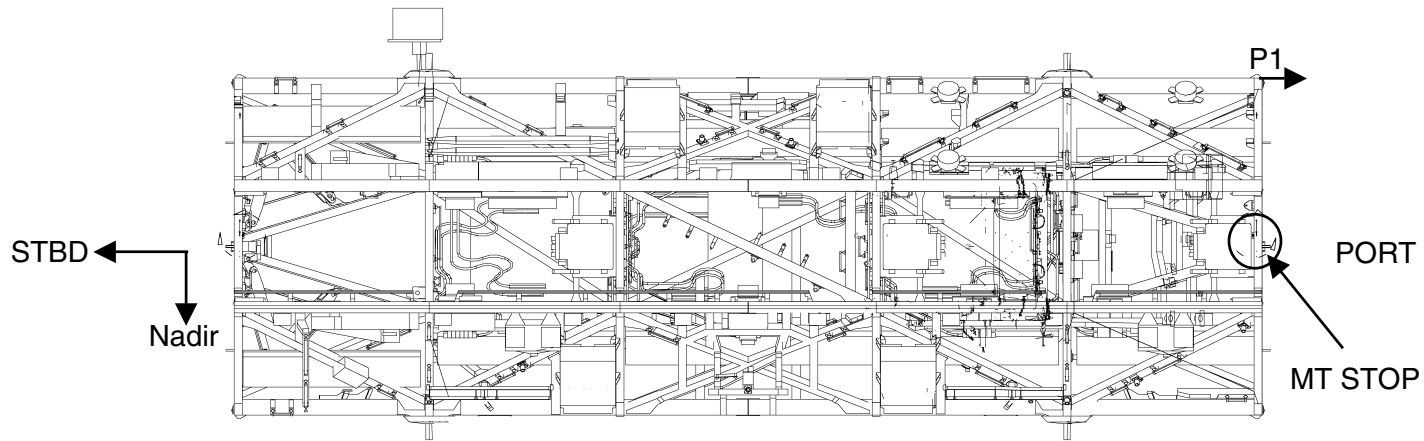
### 0.5-IN SPD BOOTIE EXTENSION



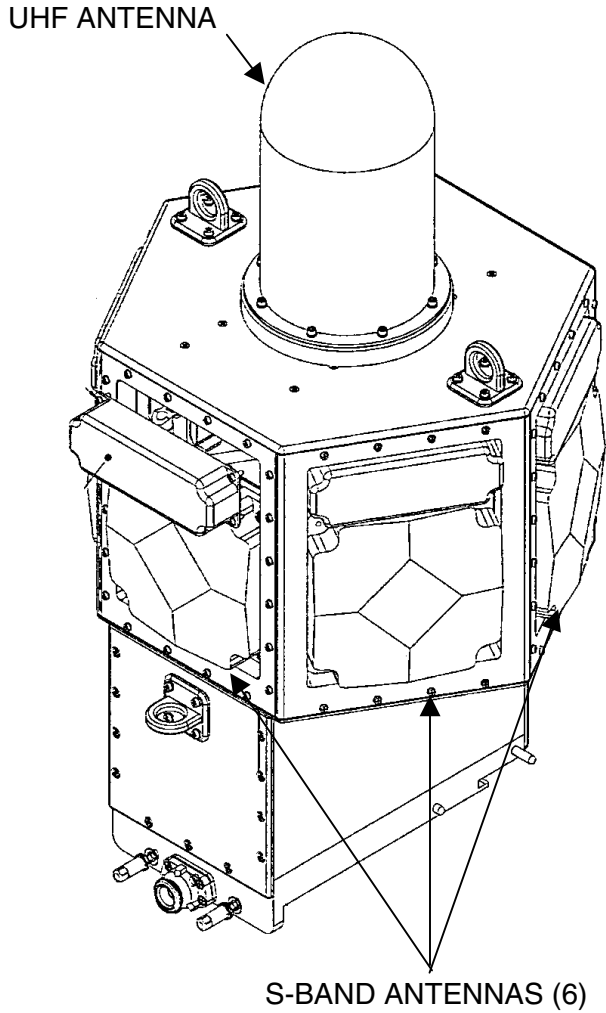
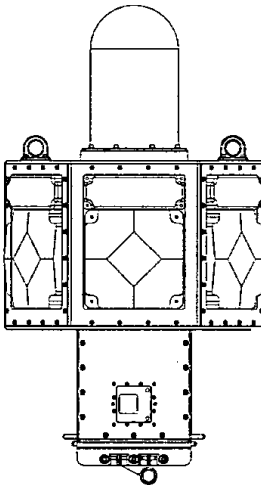
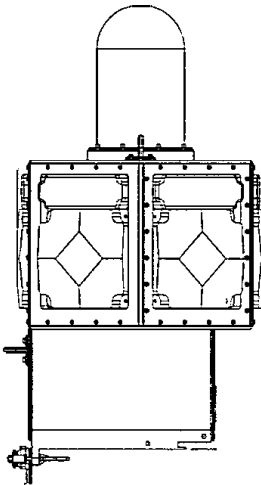
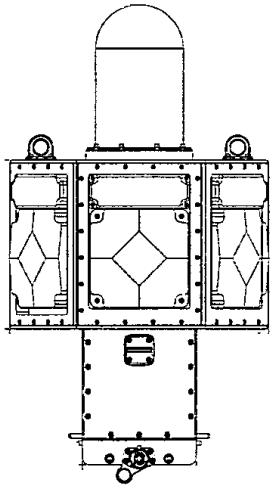
# TETHER SHUTTLE STOWAGE



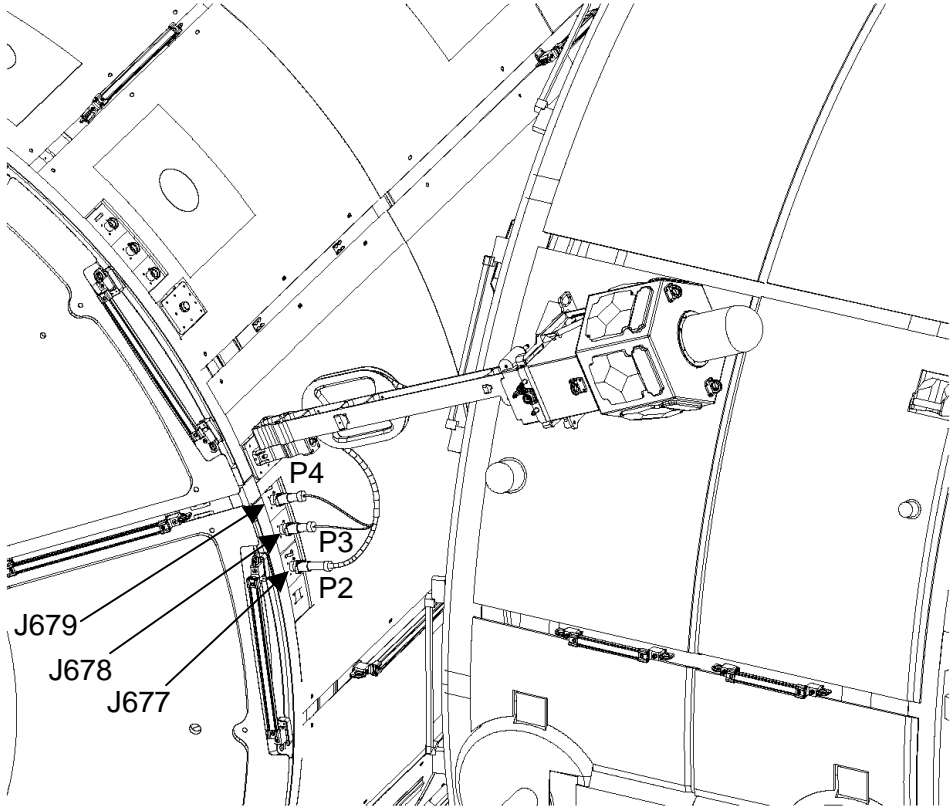
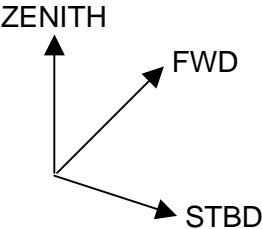
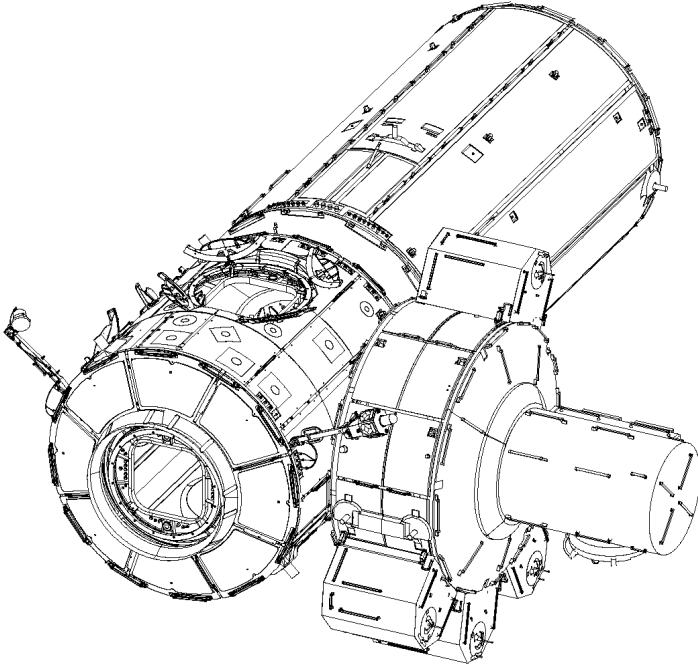
# MT STOP



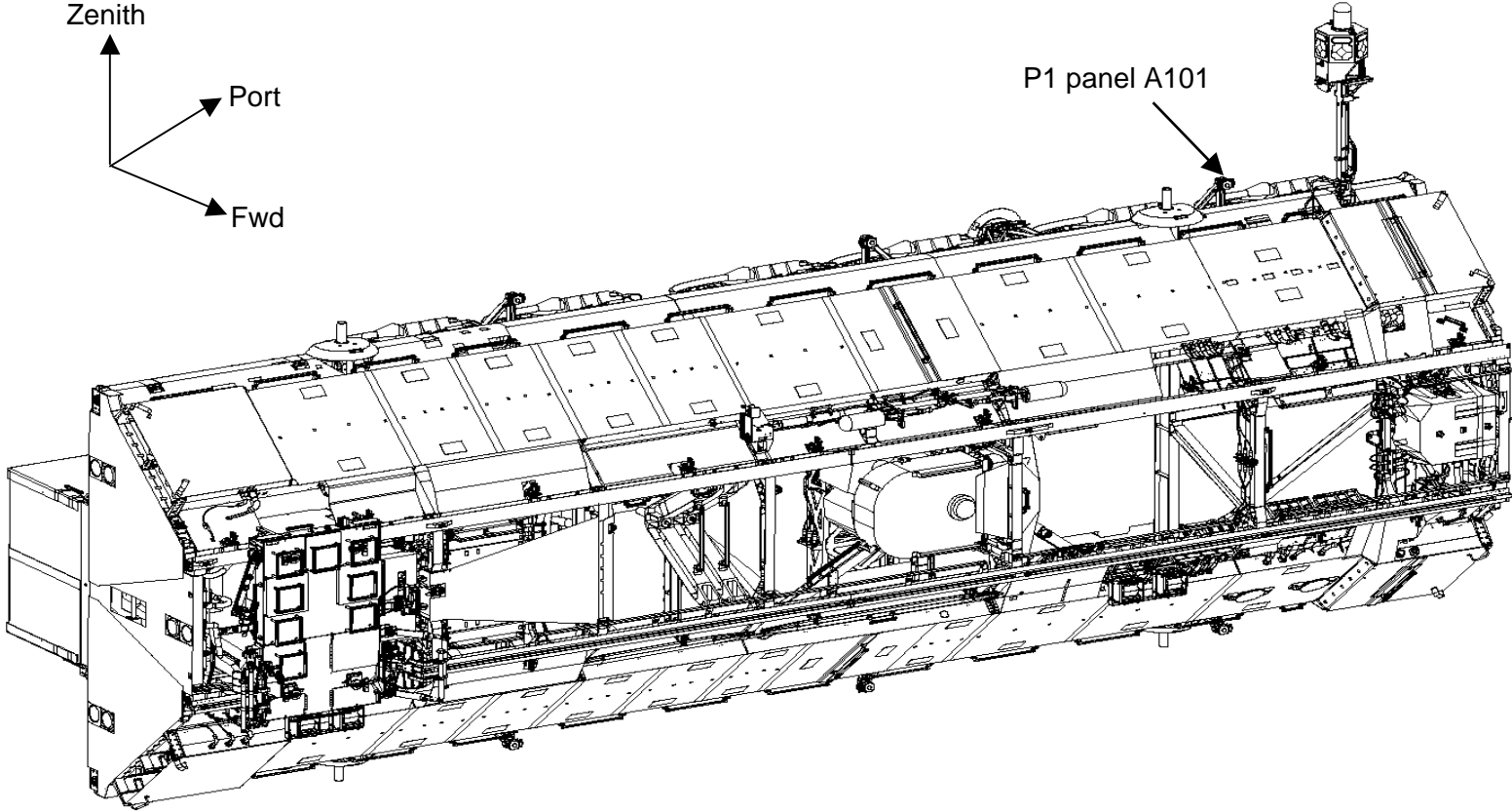
WVS EXTERNAL TRANSCEIVER ASSY (WETA)



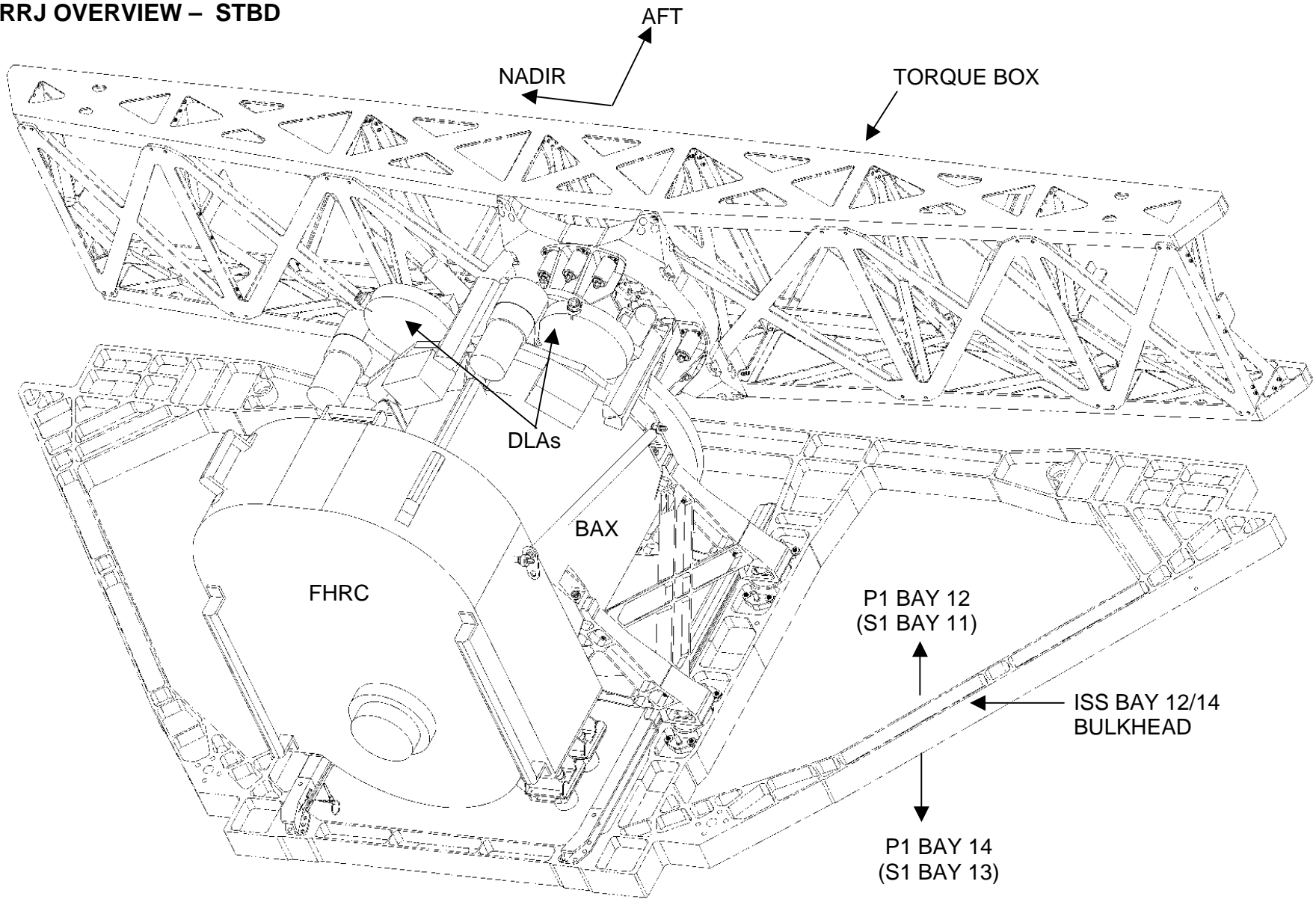
NODE WETA INSTALL – CP12



P1 WETA INSTALL – CP08



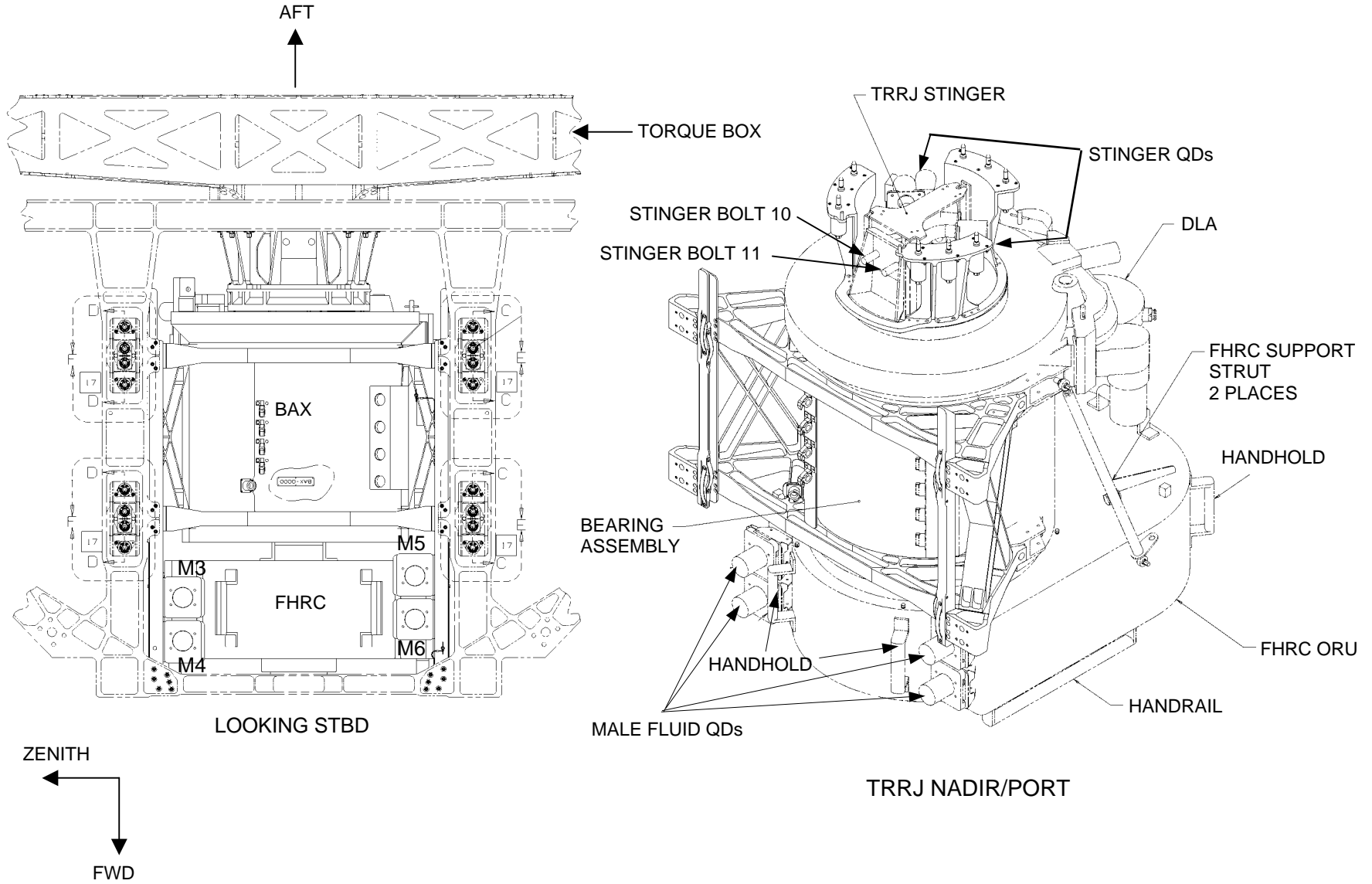
# TRRJ OVERVIEW – STBD



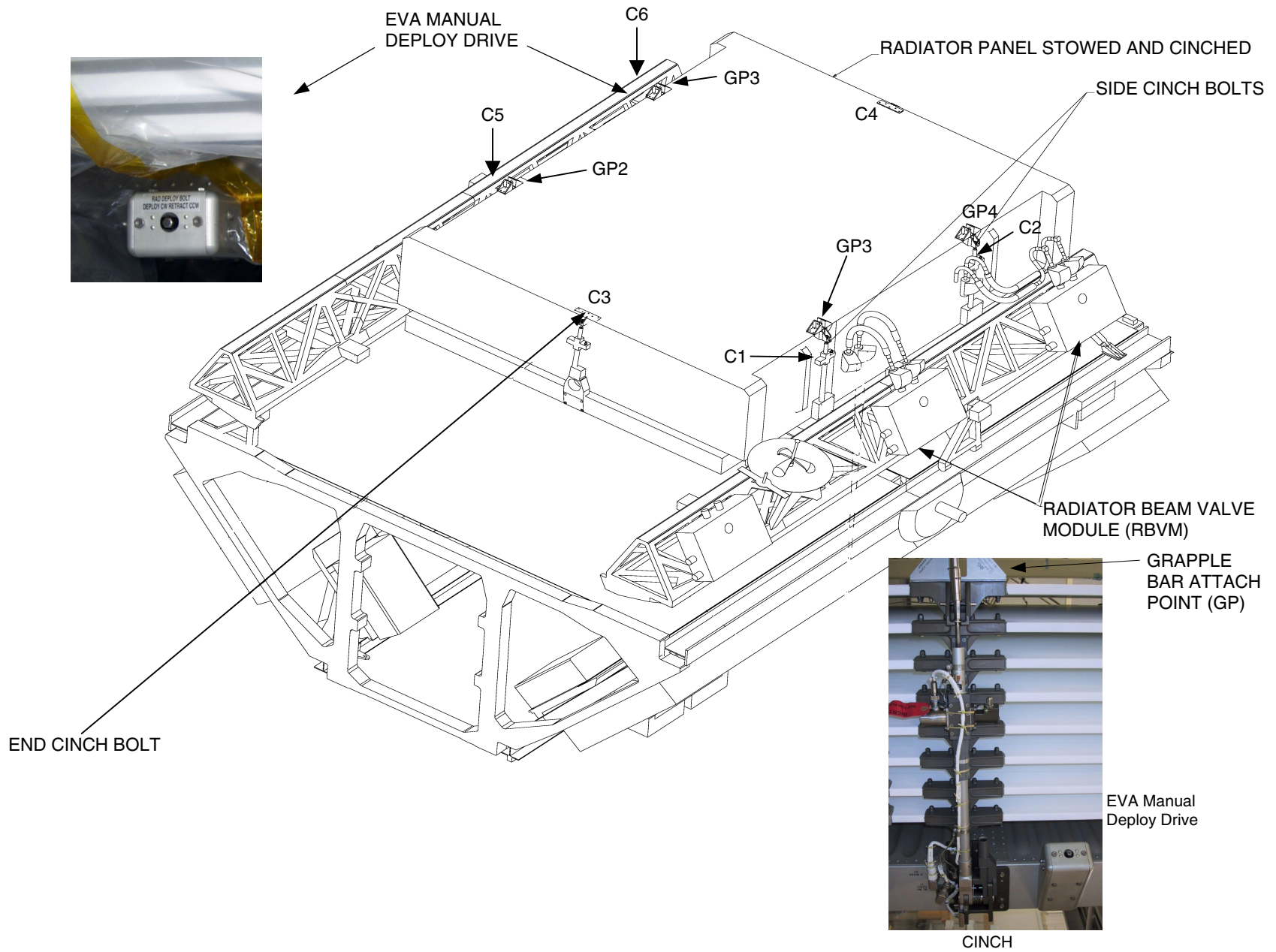
P1: ISS BAY 12, LOOKING PORT/AFT  
S1: ISS BAY 11, LOOKING STBD/AFT



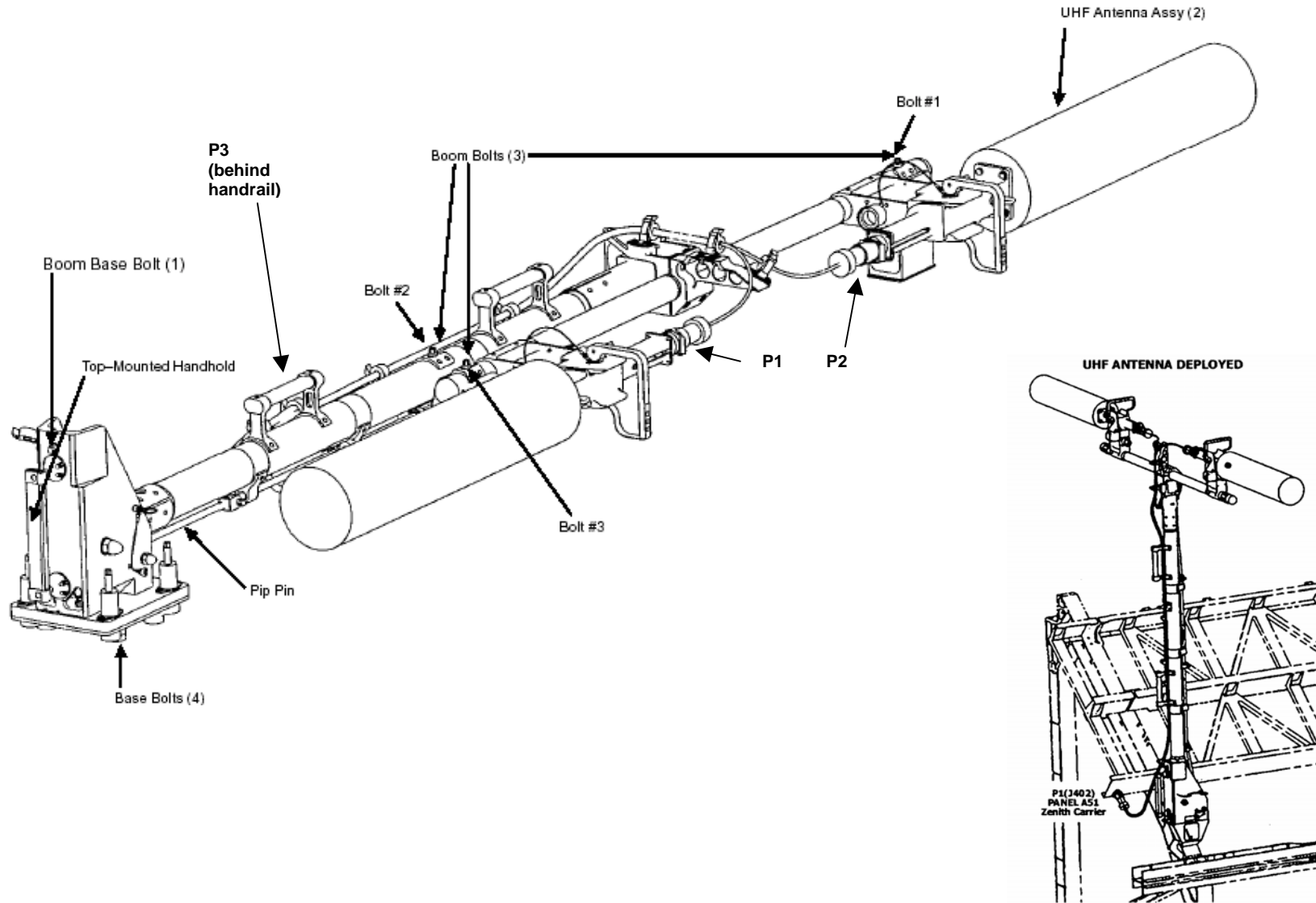
# TRRJ OVERVIEW – P1 PORT/S1 STBD



# RADIATOR OVERVIEW



# UHF ANTENNA



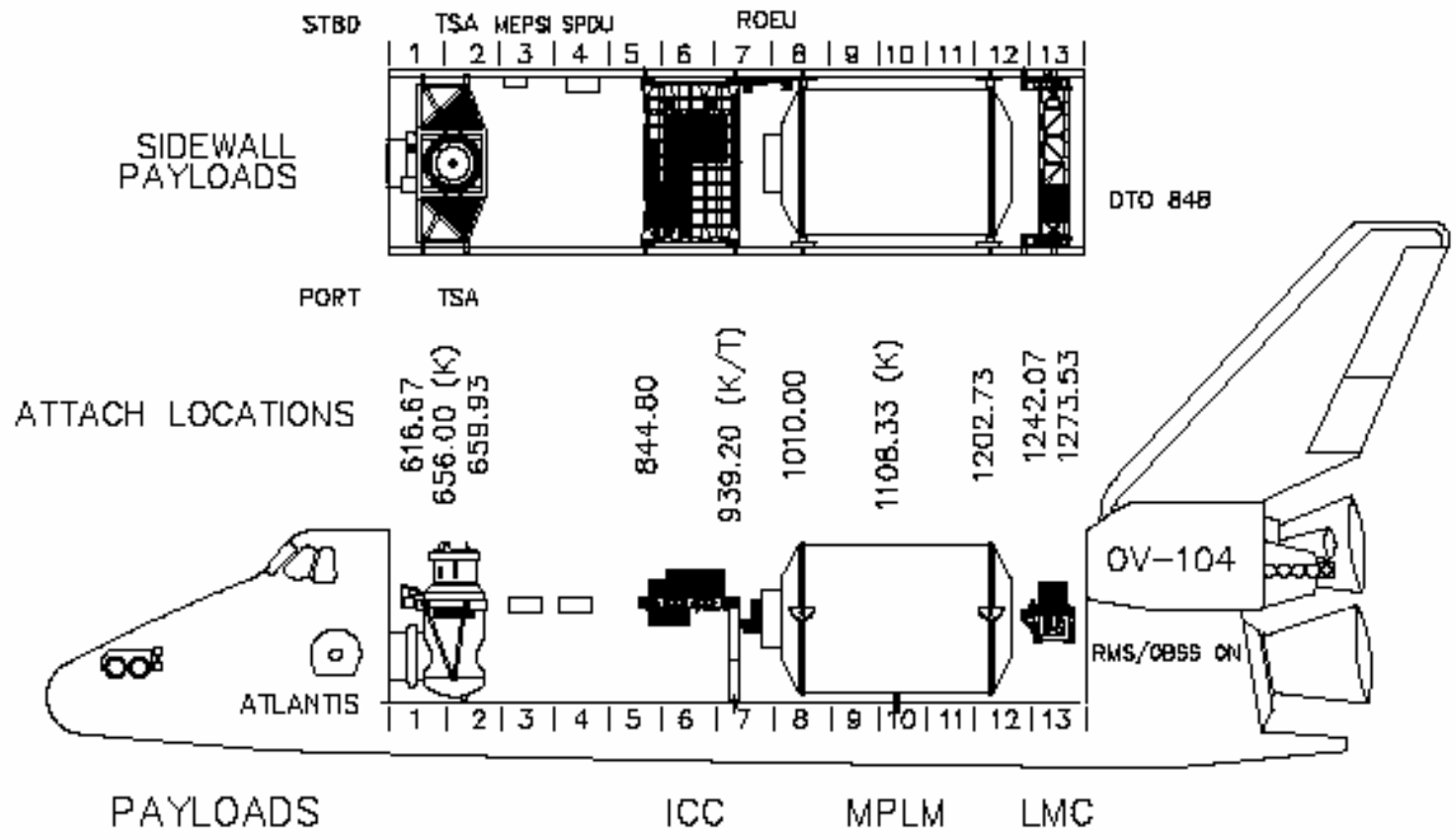
FLIGHT SPECIFIC EVA REFERENCE

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ESP2 HR AND WIF LAYOUT (ZENITH).....	FS 18-4
ESP2 HR AND WIF LAYOUT (NADIR).....	FS 18-5
ESP2 FINAL CONFIG.....	FS 18-6
ICC LAUNCH CONFIG (TOP AND BOTTOM VIEWS).....	FS 18-7
ICC LANDING CONFIG .....	FS 18-8
ICC LAYOUT.....	FS 18-9
SHOSS-ED WITH AGB.....	FS 18-10
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MBSU COLDPLATE (INSIDE SHOSS-ED BOX).....	FS 18-12
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VIDEO STANCHION.....	FS 18-25
VSSA DUMMY BOX .....	FS 18-26
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ETVCG PAN AND TILT RELEASE LEVERS.....	FS 18-28
LMC LAYOUT .....	FS 18-29
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DTO 848 SAMPLE BOX ACCESS HATCH .....	FS 18-31
DTO 848 SAMPLE BOX COMPONENTS.....	FS 18-32
DTO 849 WS STABILIZATION LOAD CELL CONCEPT .....	FS 18-34

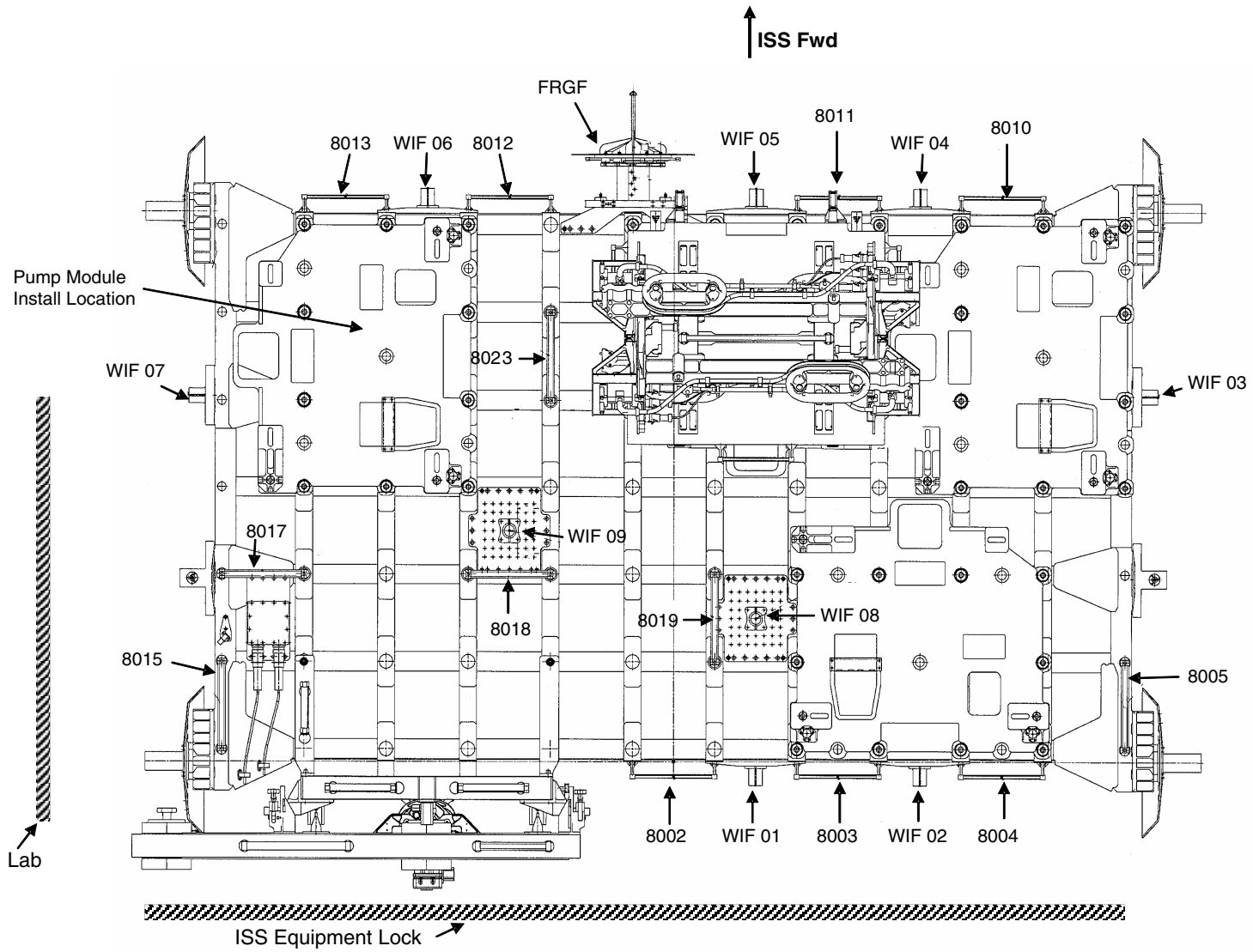
FLIGHT SPECIFIC  
EVA REF

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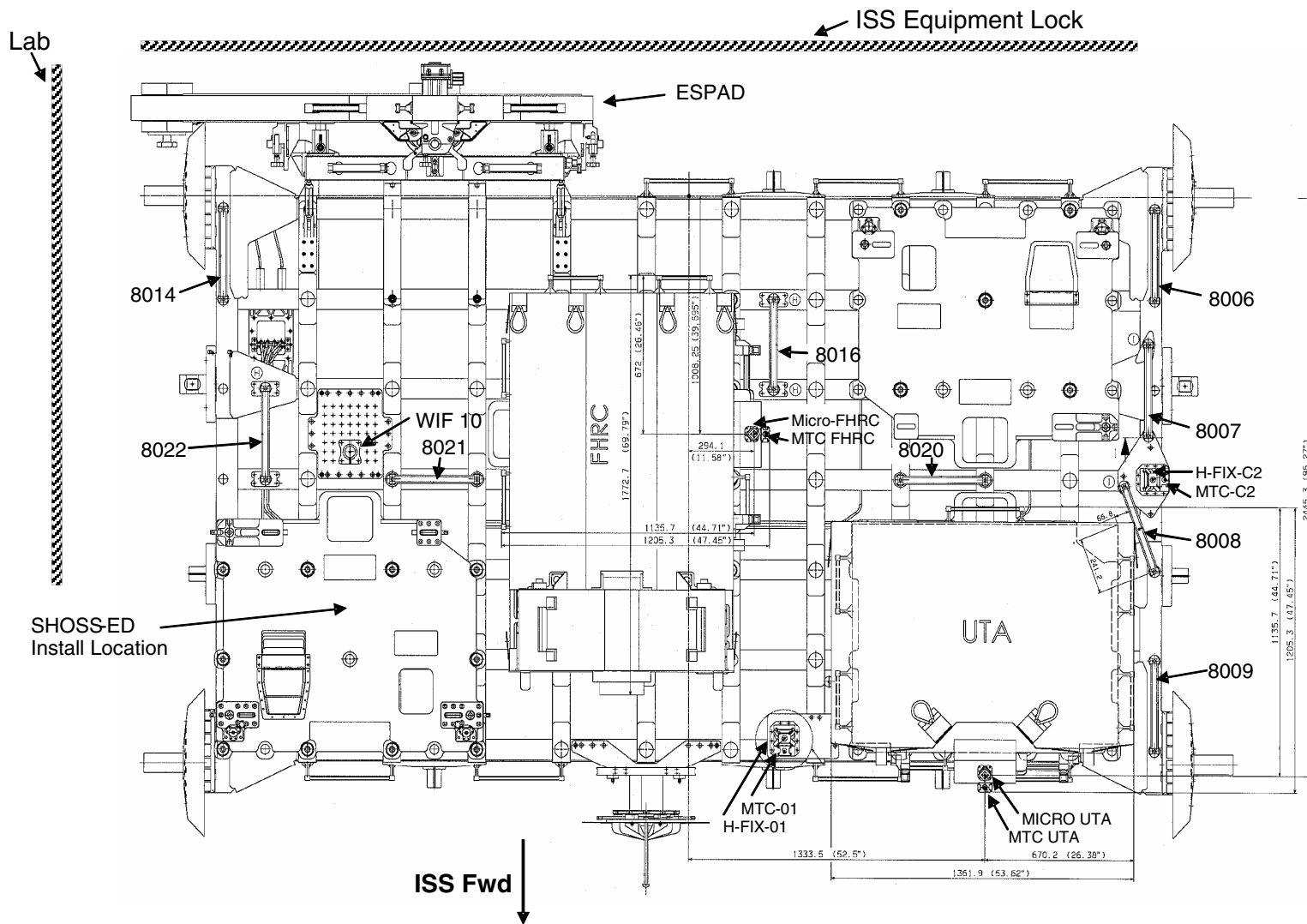
# STS-121 PAYLOAD BAY LAYOUT



# ESP2 HR AND WIF LAYOUT (ZENITH)

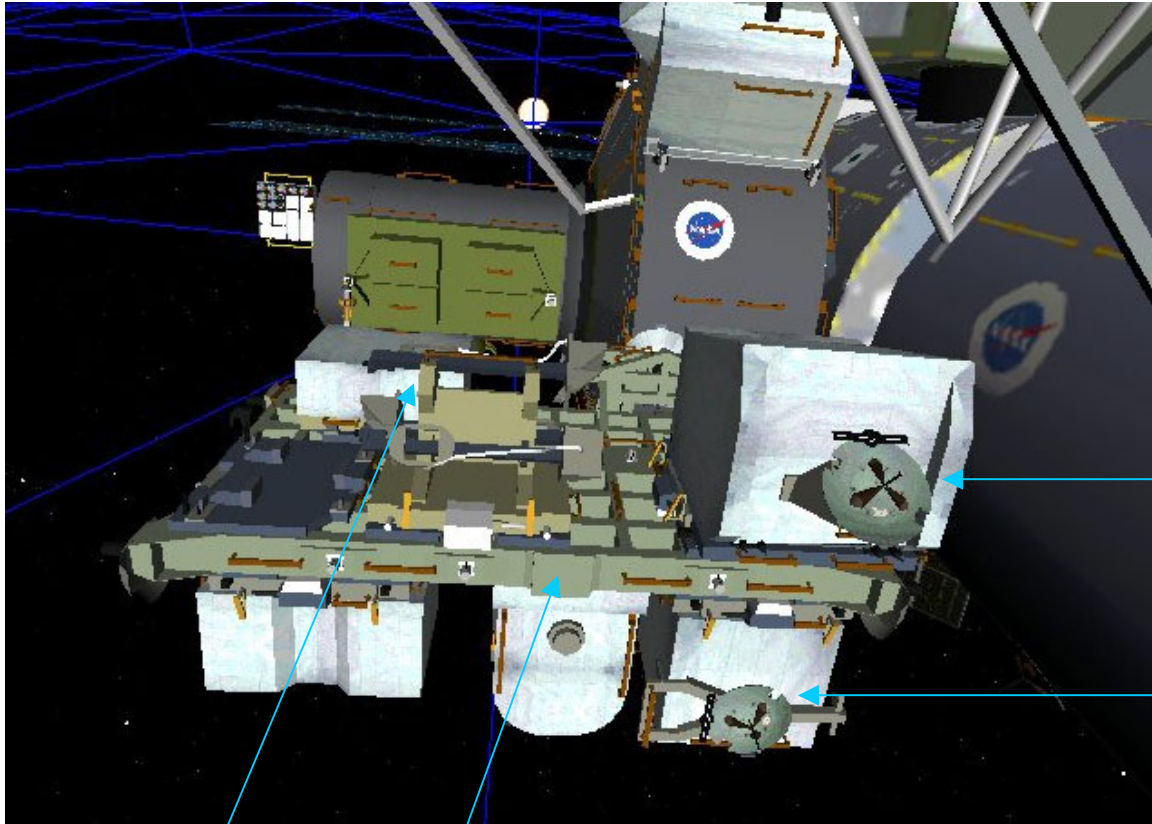


# ESP2 HR AND WIF LAYOUT (NADIR)





# ESP2 FINAL CONFIGURATION

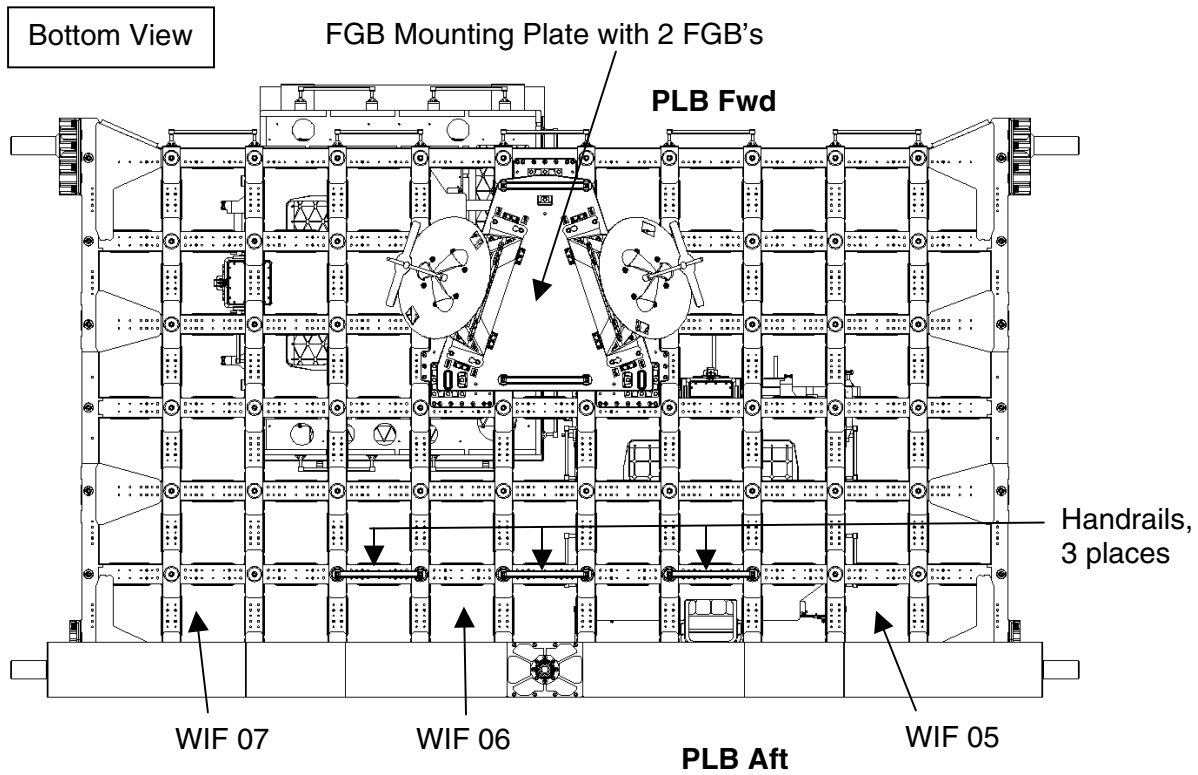
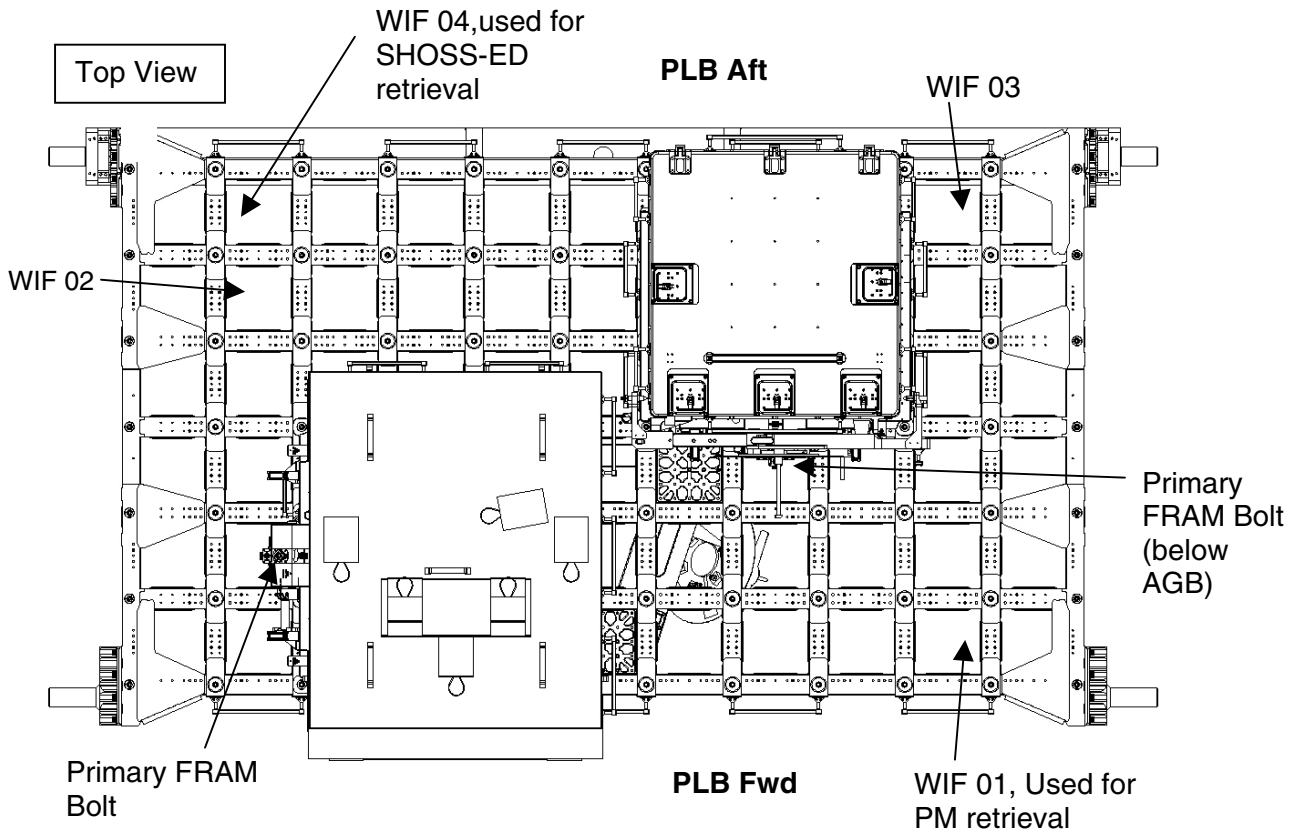


Pump  
Module  
with FGB

SHOSS-ED  
with AGB

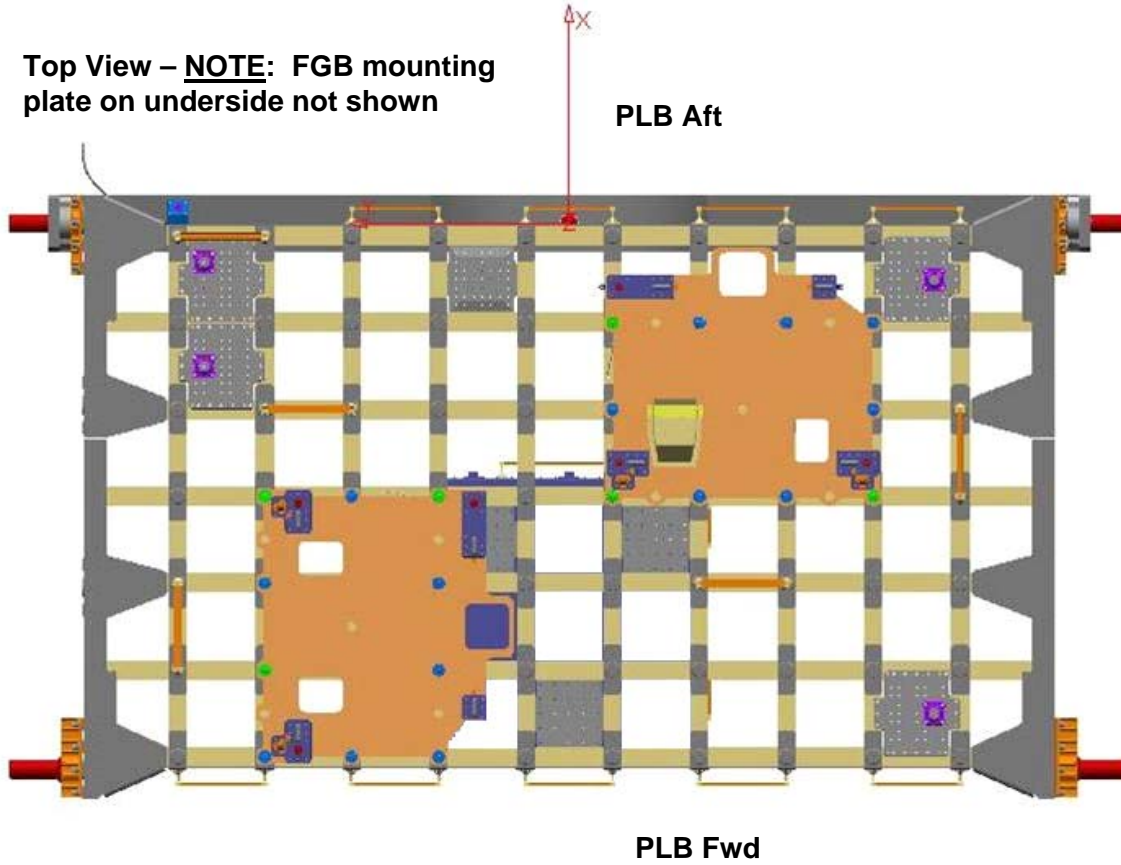
VSSA Stanchion and FRGF removed

# ICC LAUNCH CONFIG (TOP AND BOTTOM VIEWS)

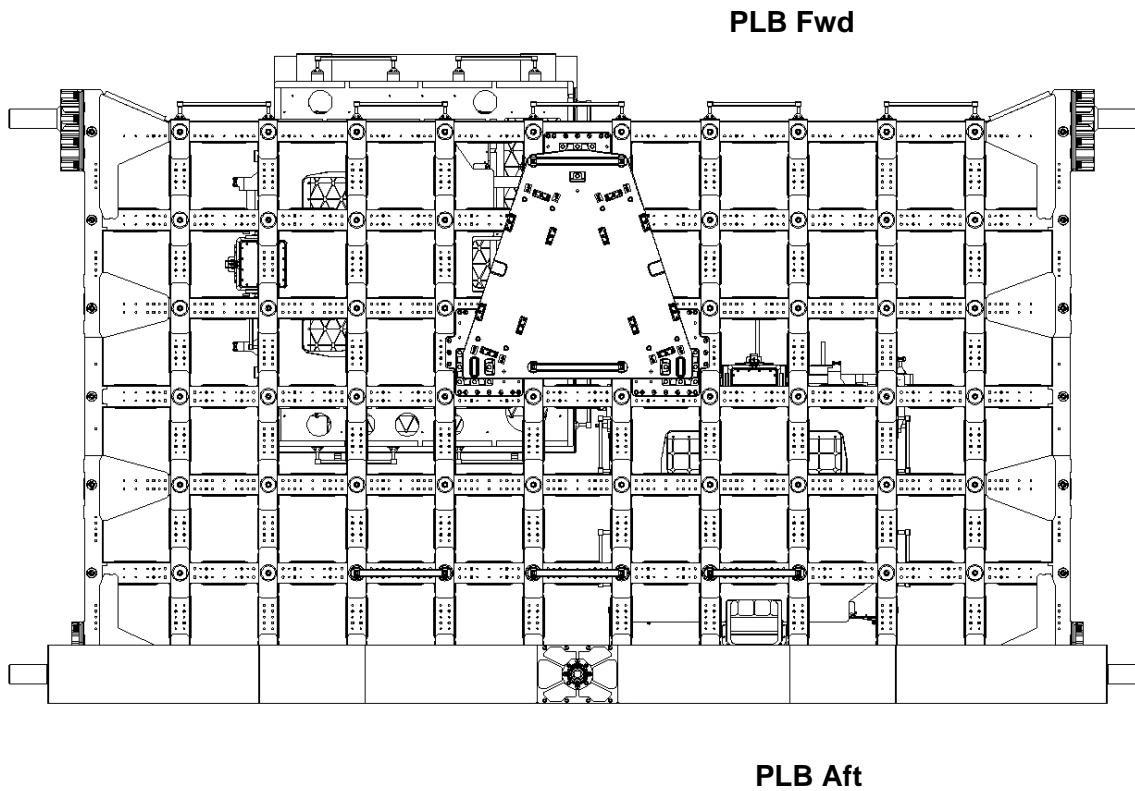


# ICC LANDING CONFIG

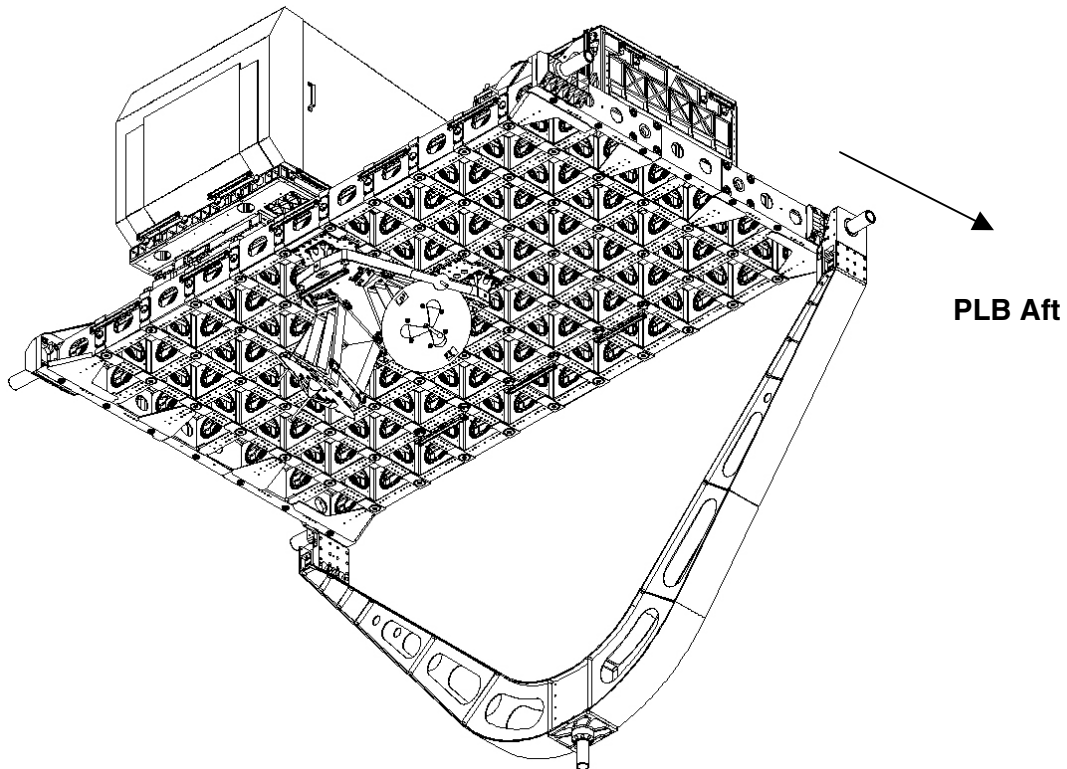
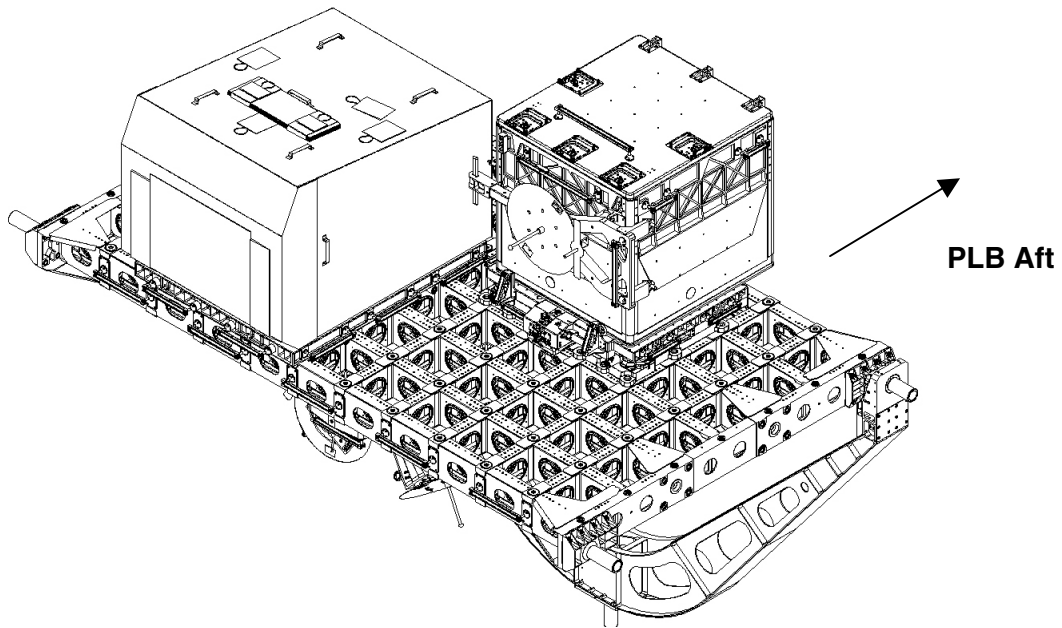
Top View – **NOTE:** FGB mounting plate on underside not shown



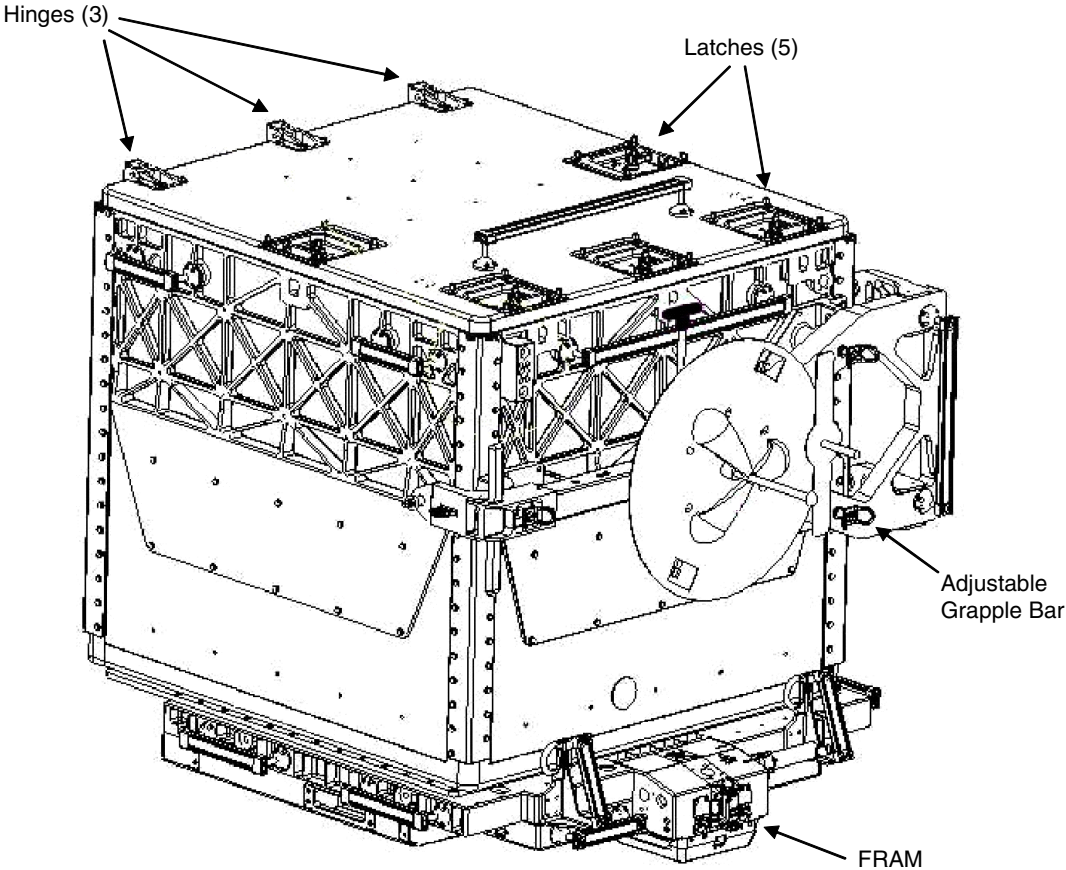
Bottom View – **NOTE:** ORUs still shown on upper side (instead of PFRAMs only)



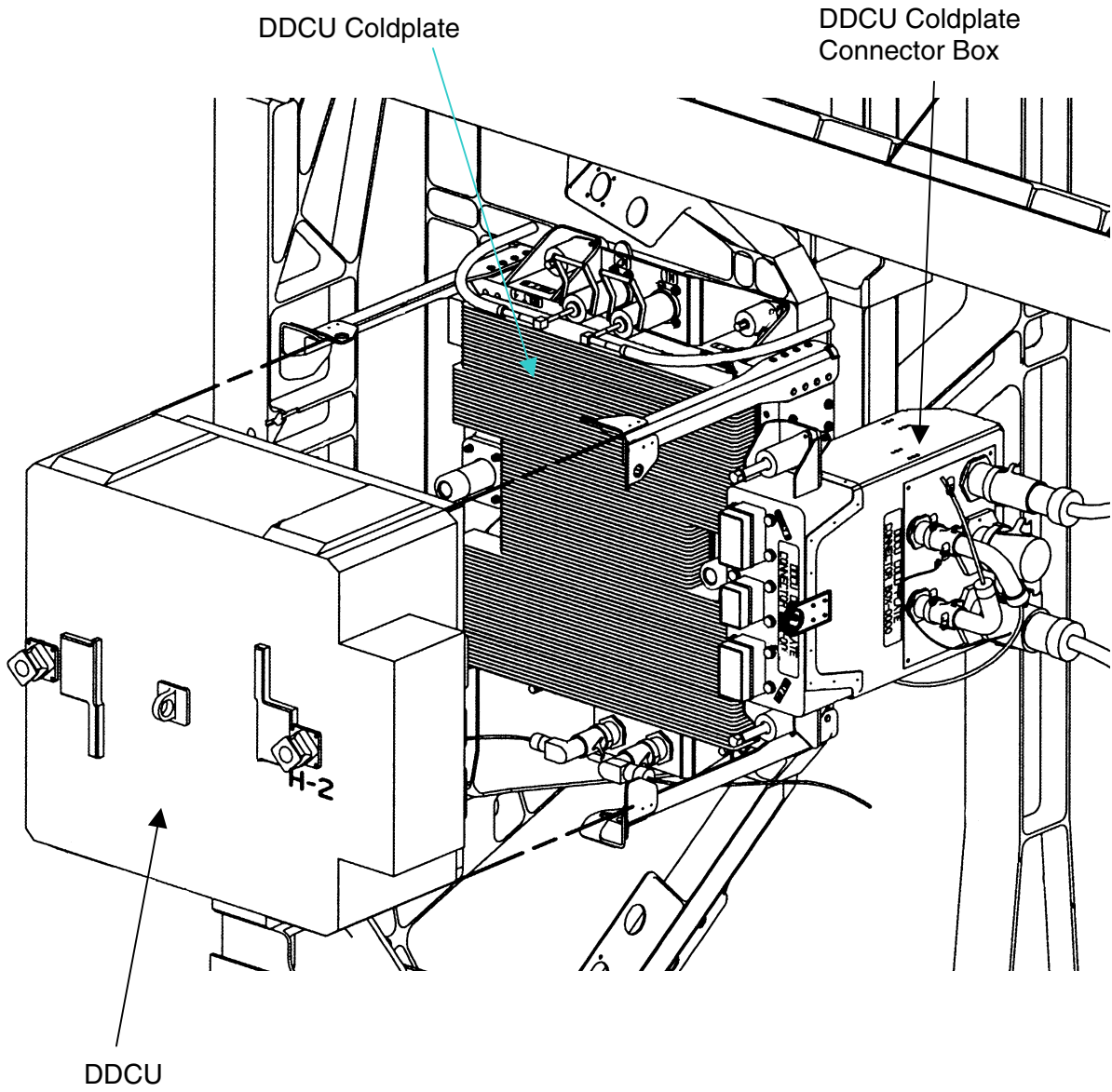
# ICC LAYOUT



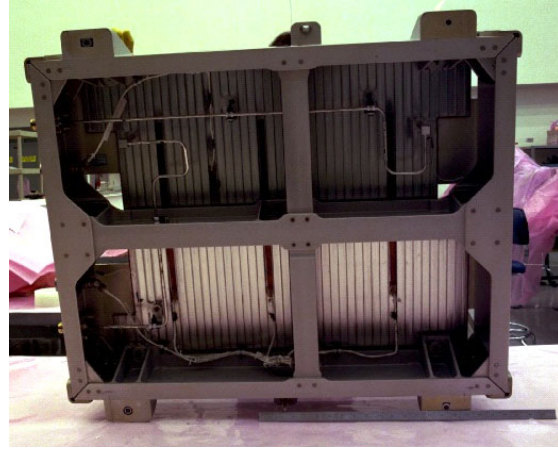
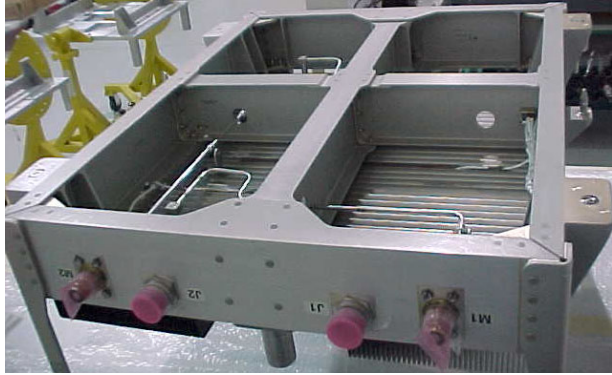
SHOSS-ED WITH AGB



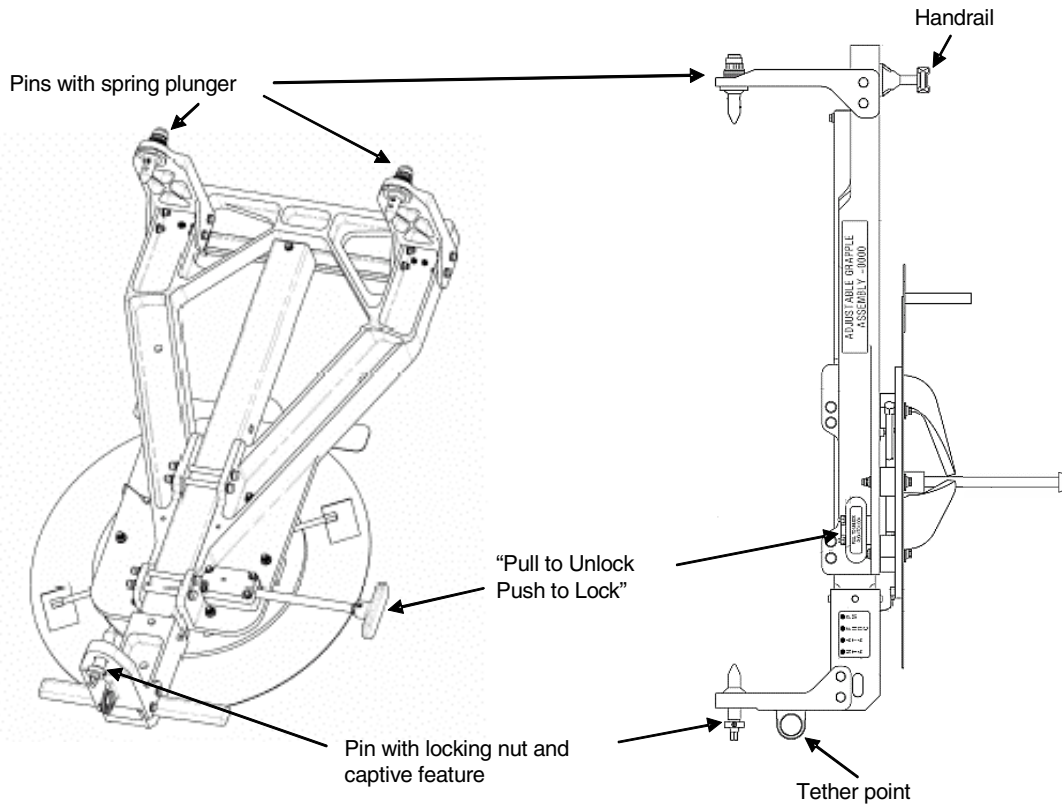
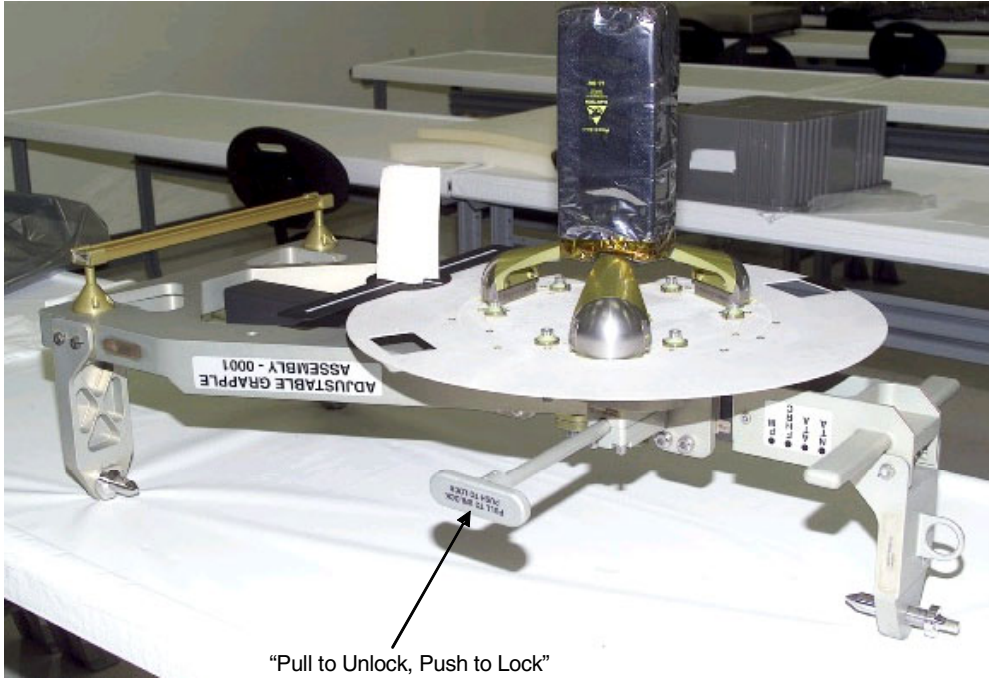
# DDCU COLDPLATE (INSIDE SHOSS-ED BOX)



# MBSU COLDPLATE (INSIDE SHOSS-ED BOX)

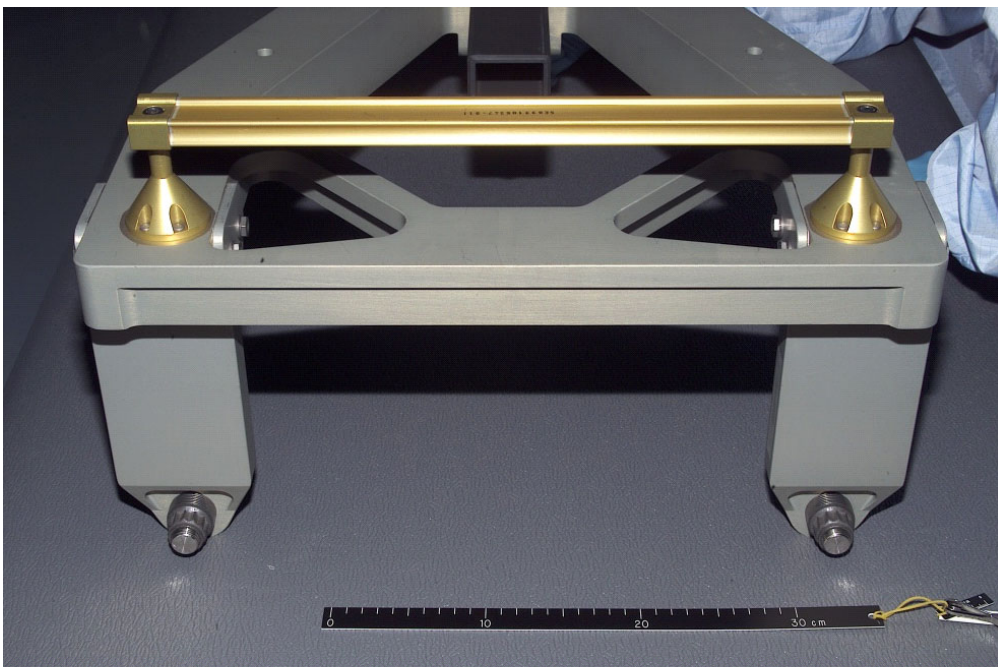
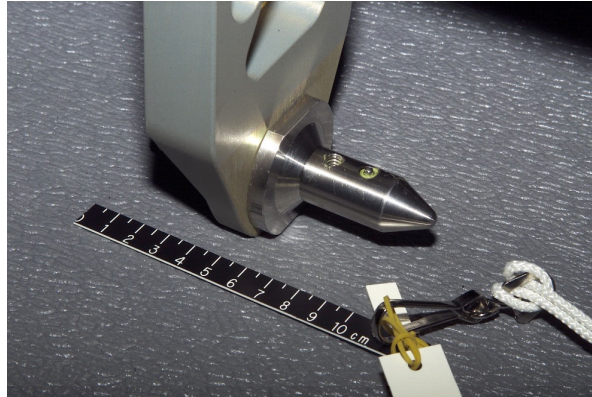


# ADJUSTABLE GRAPPLE BAR

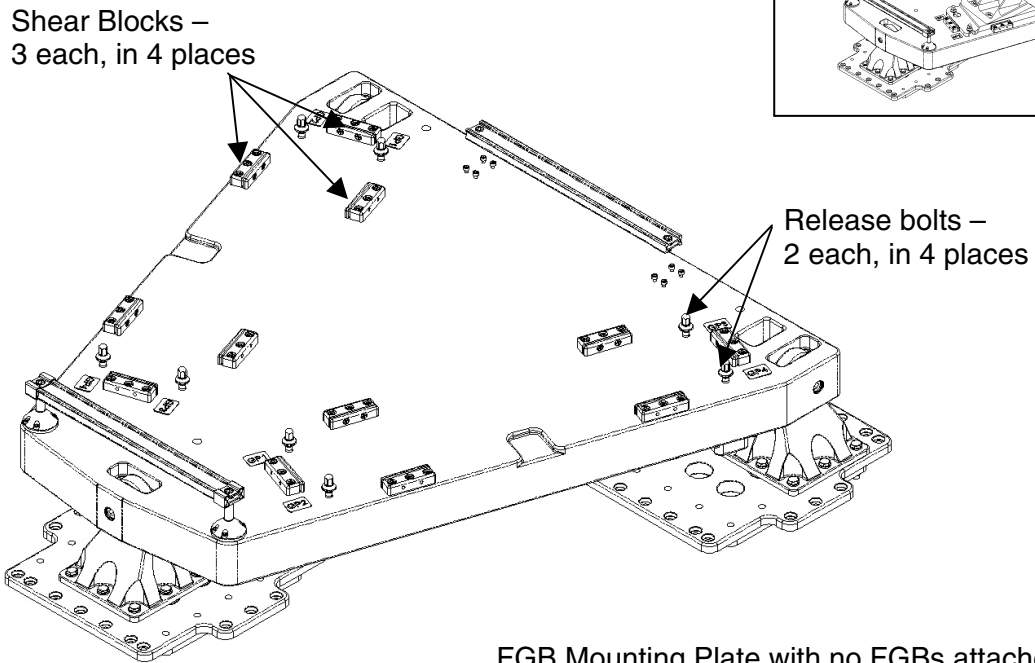
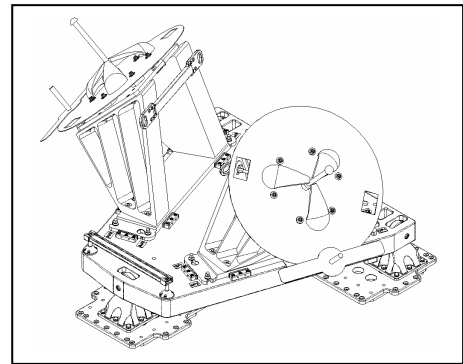
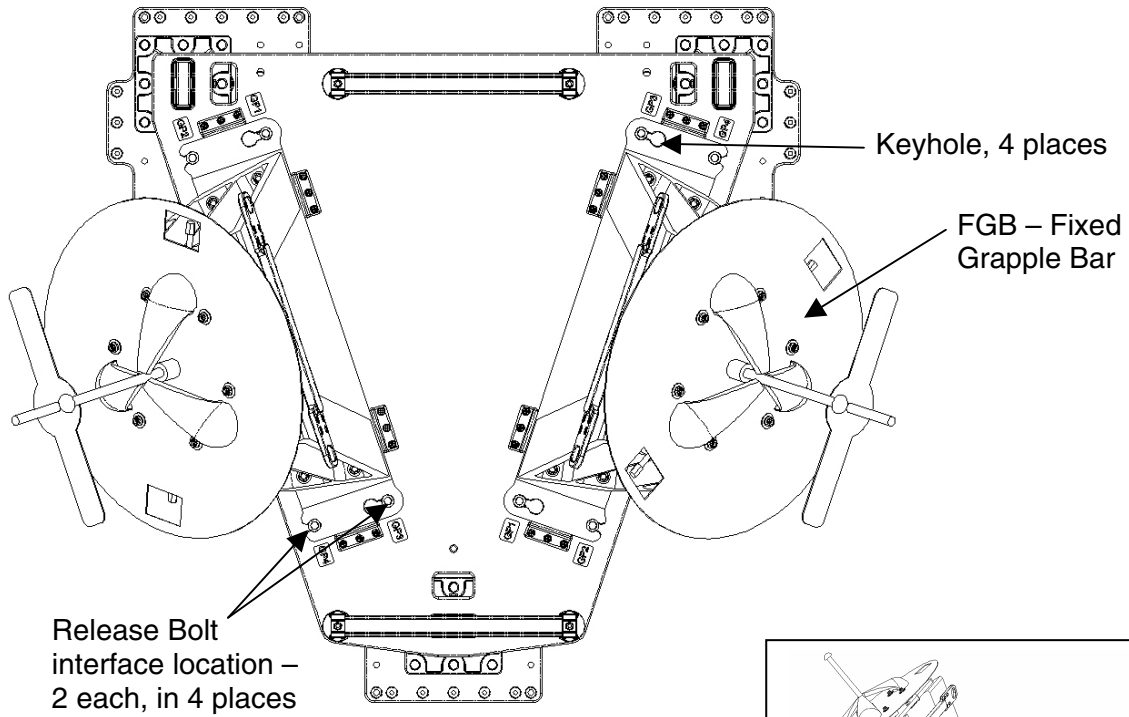




# ADJUSTABLE GRAPPLE BAR PINS



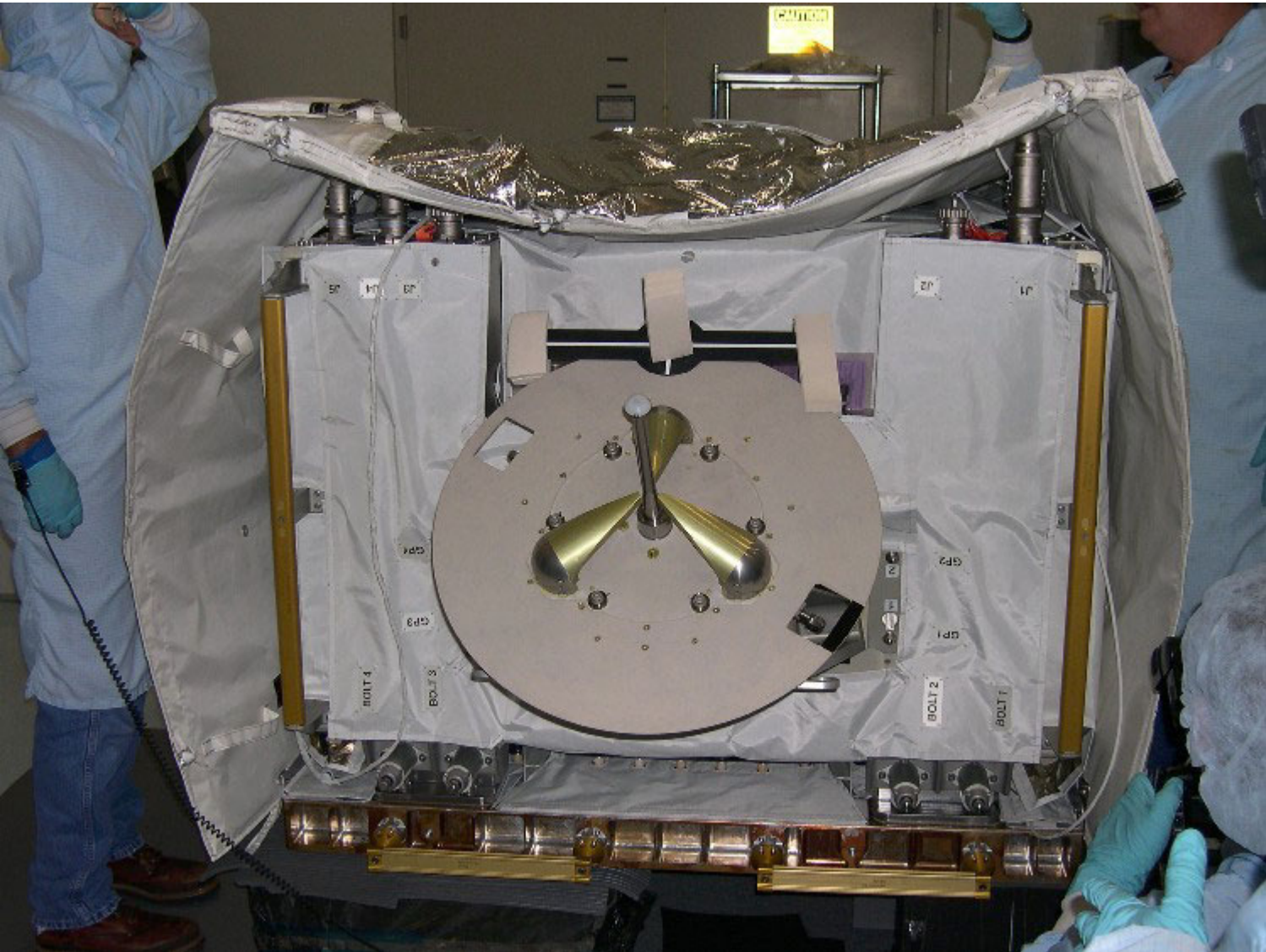
# FGB MOUNTING PLATE



**FGB INSTALL LOCATION ON PUMP MODULE**



**FGB INSTALLED ON PUMP MODULE**



**PLASTIC FGB BASE SIMULATOR (MOUNTED ON PUMP MODULE)**

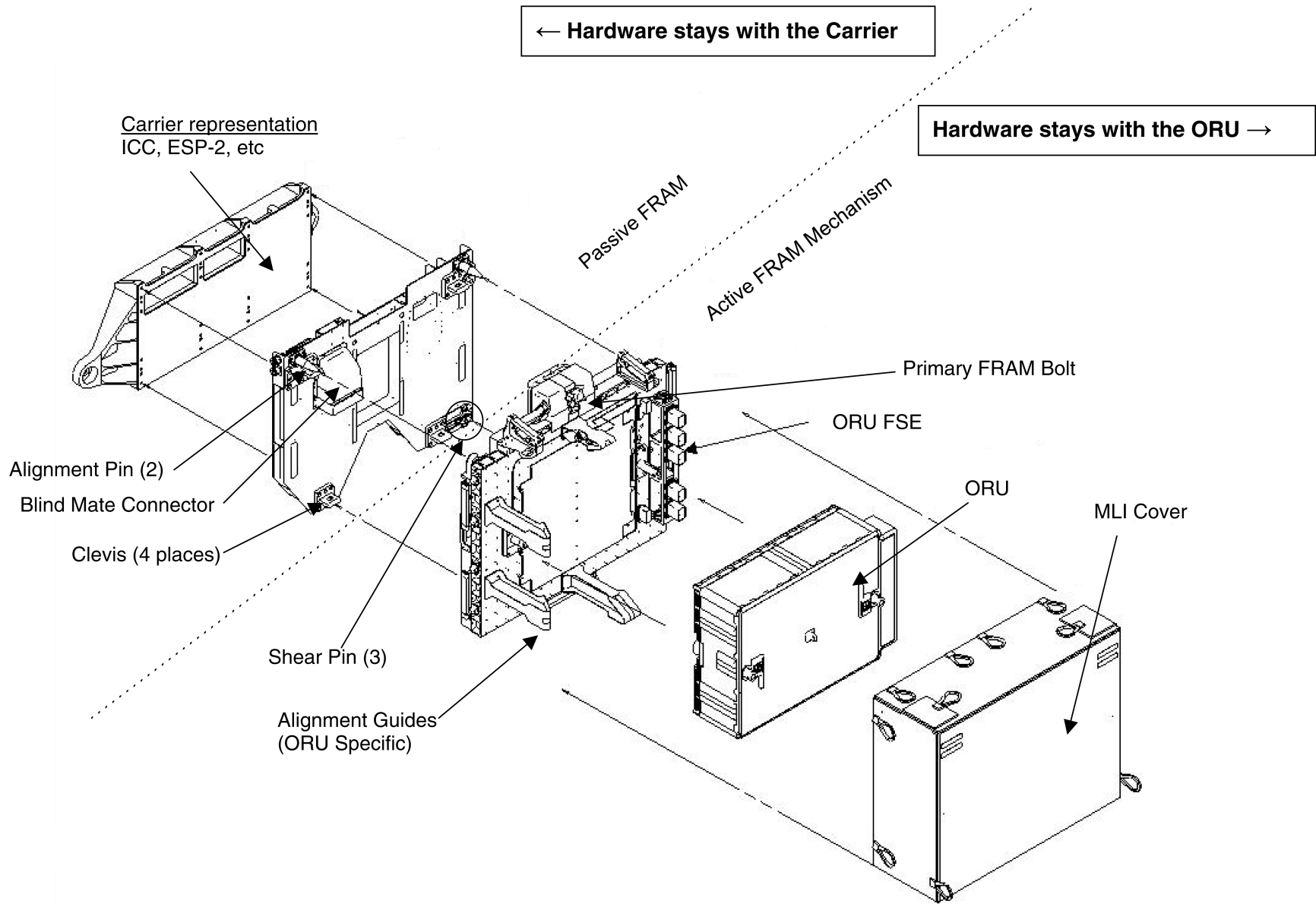


**FGB Base Simulator**

**Detail of FGB Base Keyhole (3 places)**

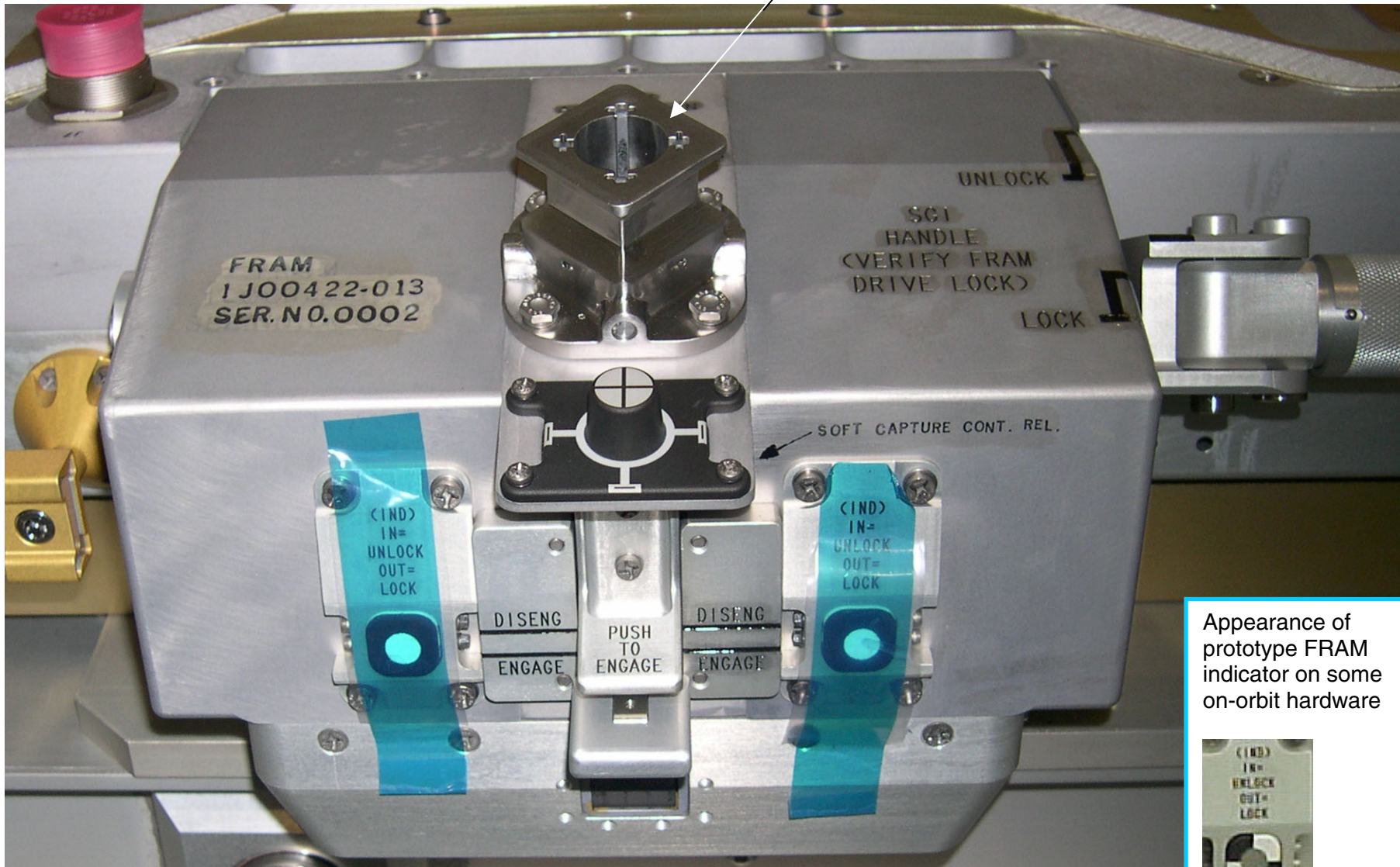


# FRAM STRUCTURAL COMPONENT OVERVIEW



# FLIGHT RELEASABLE ATTACHMENT MECHANISM (FRAM)

Primary Fram Bolt

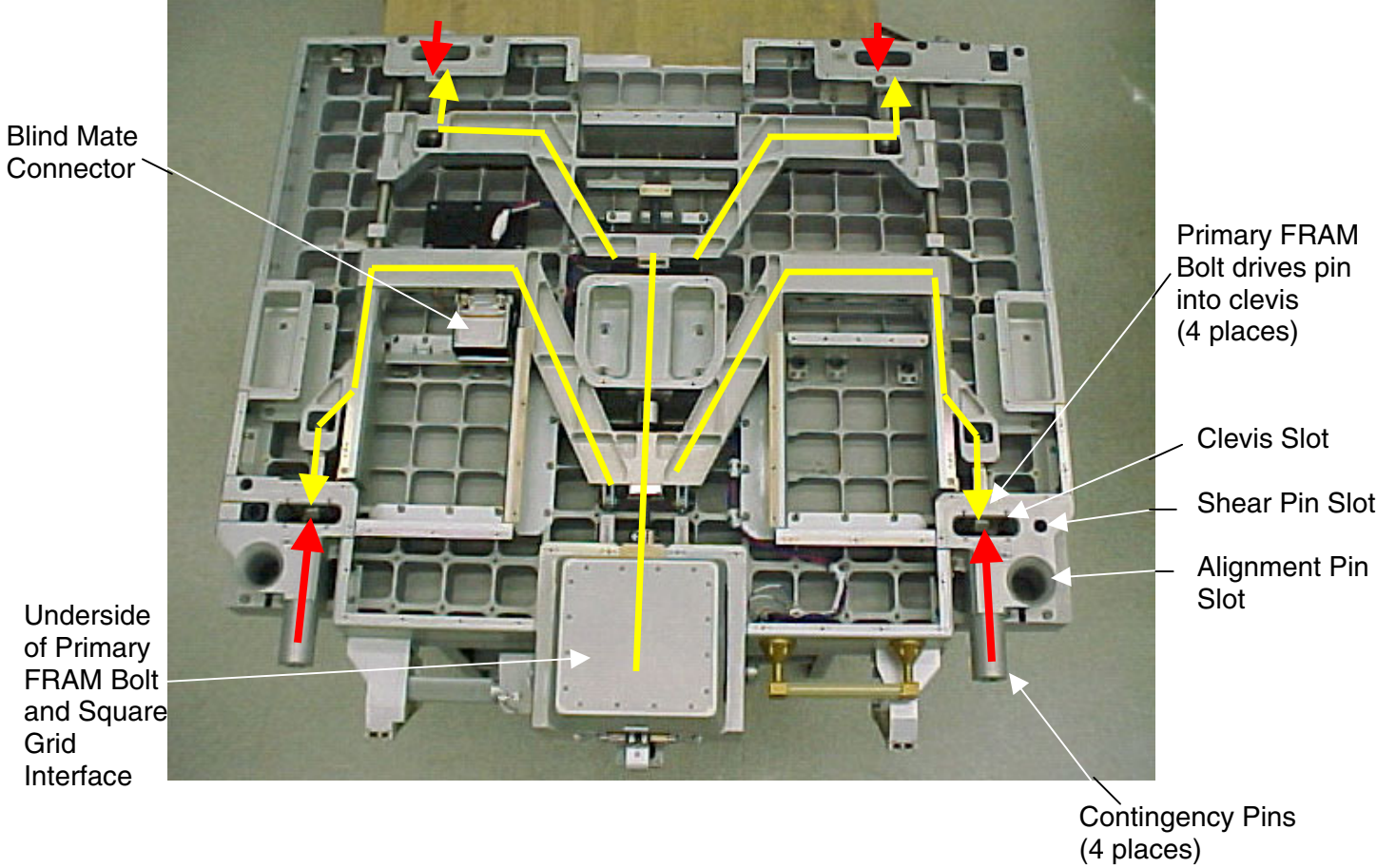


Appearance of prototype FRAM indicator on some on-orbit hardware

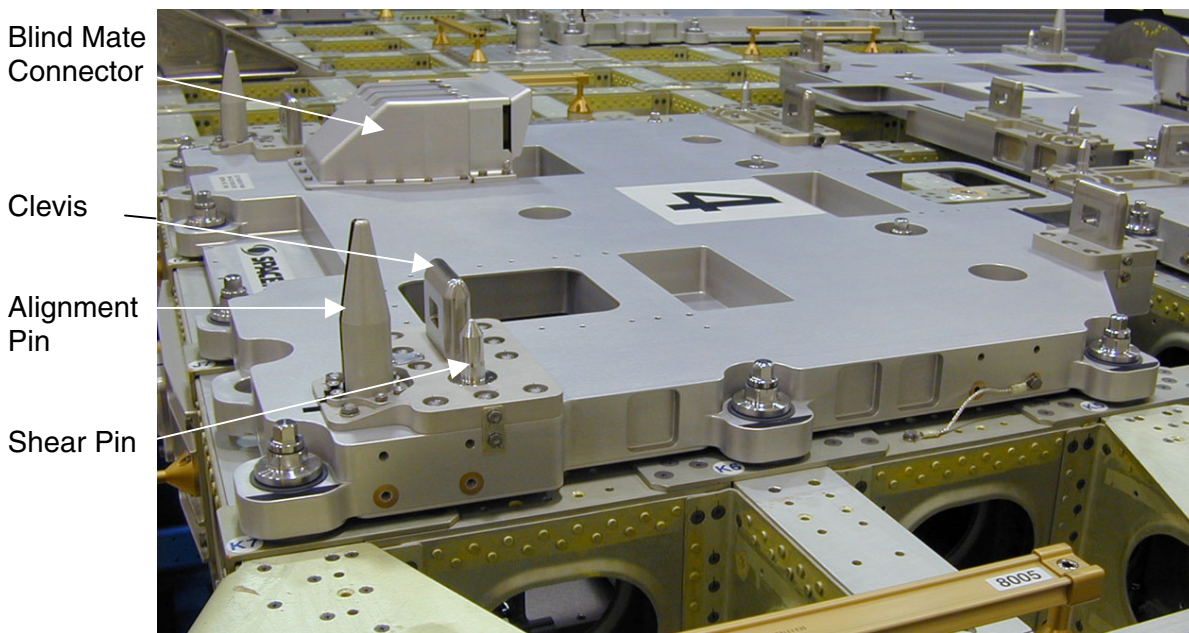
**NOTE:** On Primary FRAM indicator, "OUT" is extended 1/8 inch. "IN" is flush with the surrounding box

# FRAM ACTIVE AND PASSIVE INTERFACES

## Underside of Active FRAM (without covering)



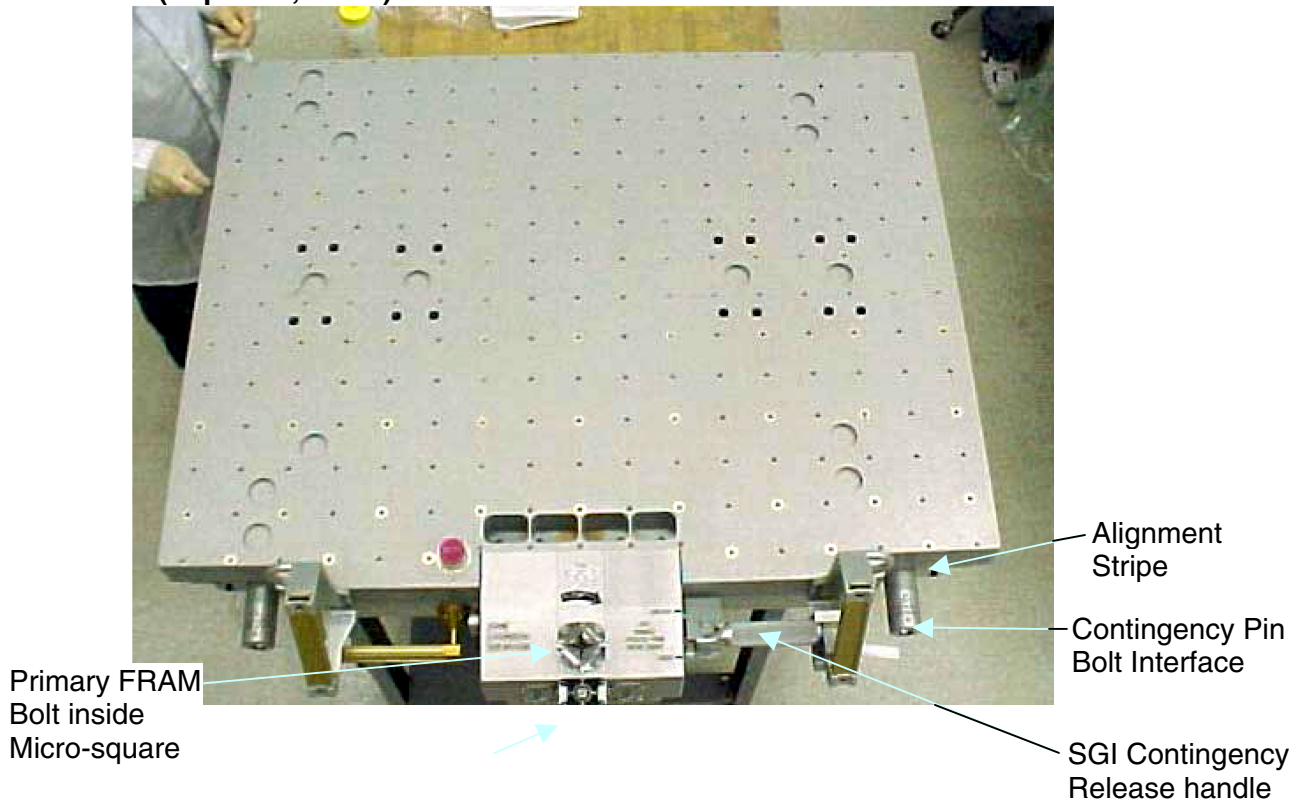
## Passive FRAM (top side)



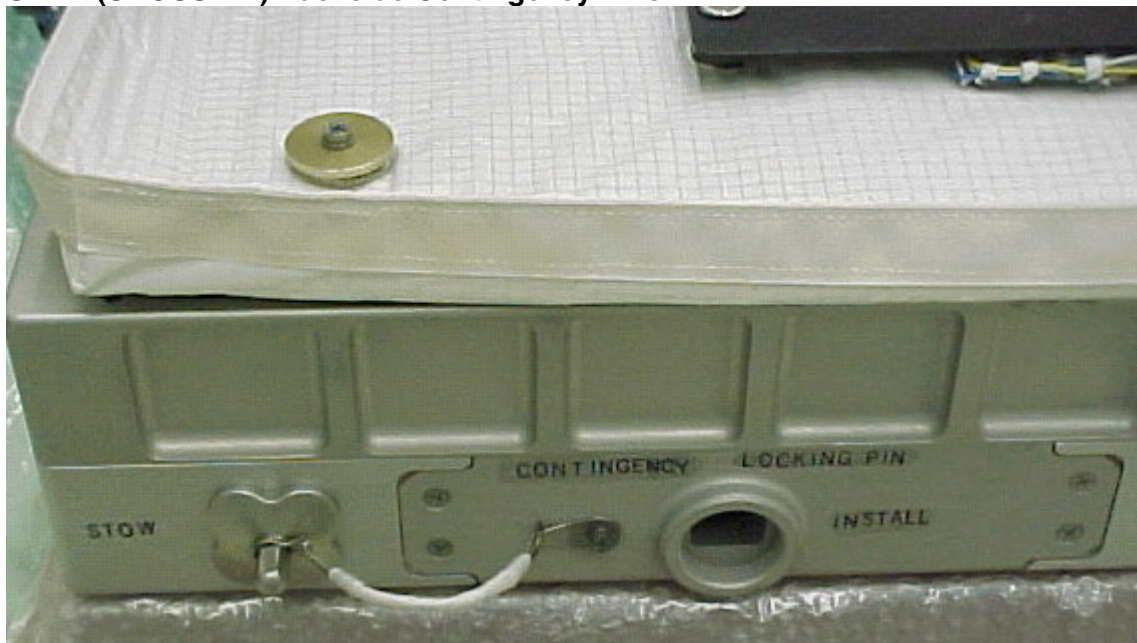


# ACTIVE FRAM

Active FRAM (Top Side, Front)

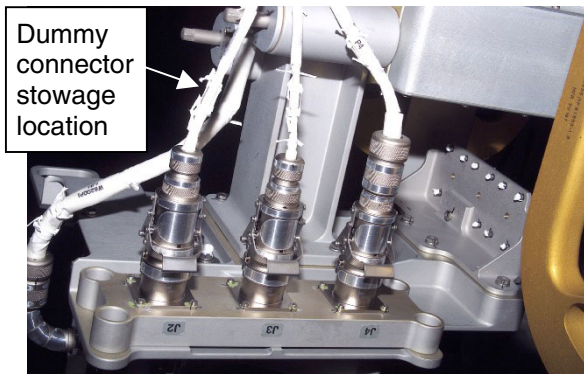
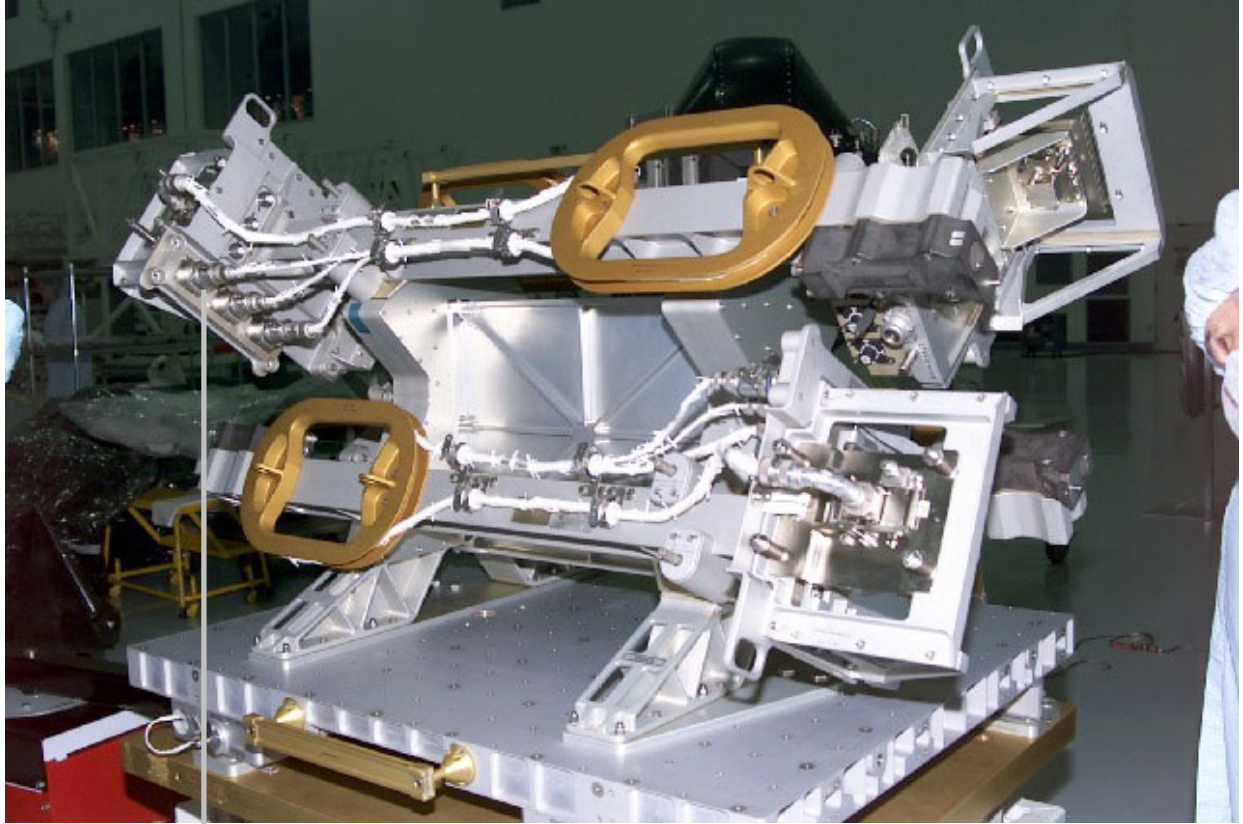


SAPA (SHOSS-ED) Backside Contingency Pins

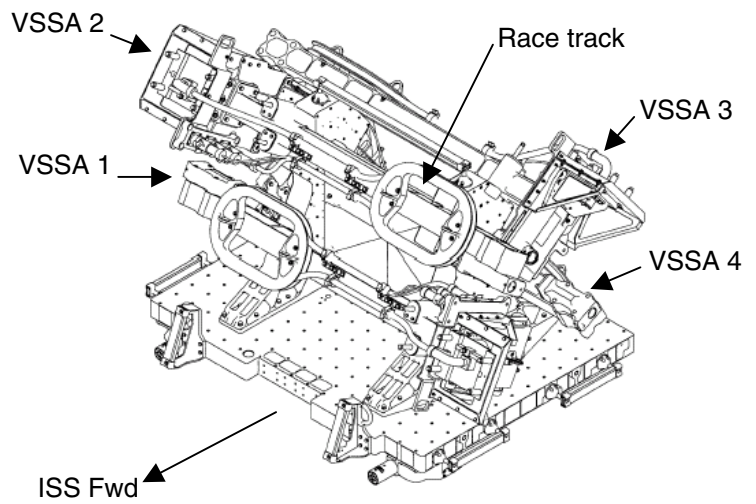


NOTE: Pump Module uses a LAPA with backside Contingency Pin interface similar to front side

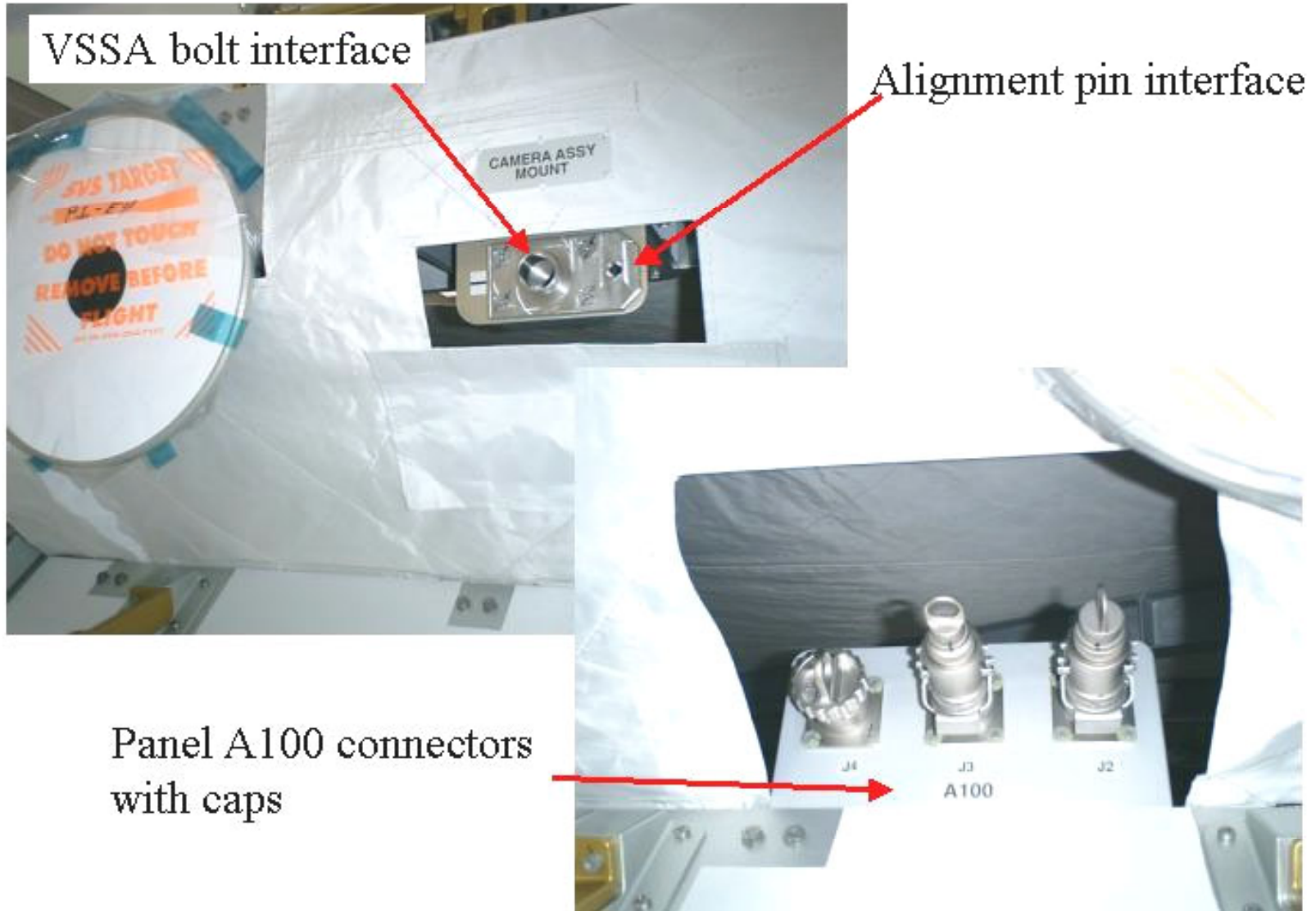
# VSSA STANCHIONS ON ESP2



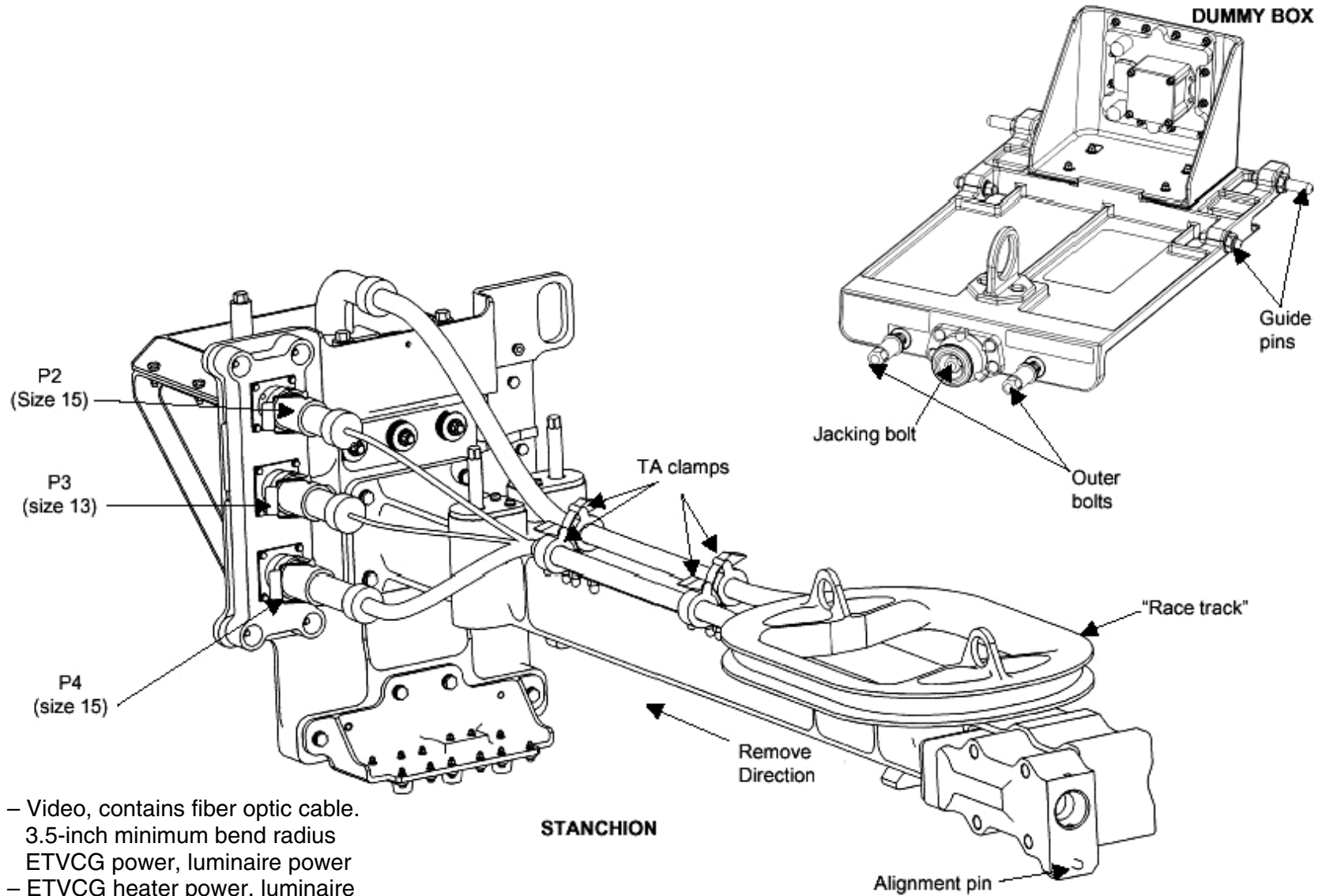
DETAIL OF STANCHION CONNECTORS



# CAMERA INSTALL CP9



# VIDEO STANCHION

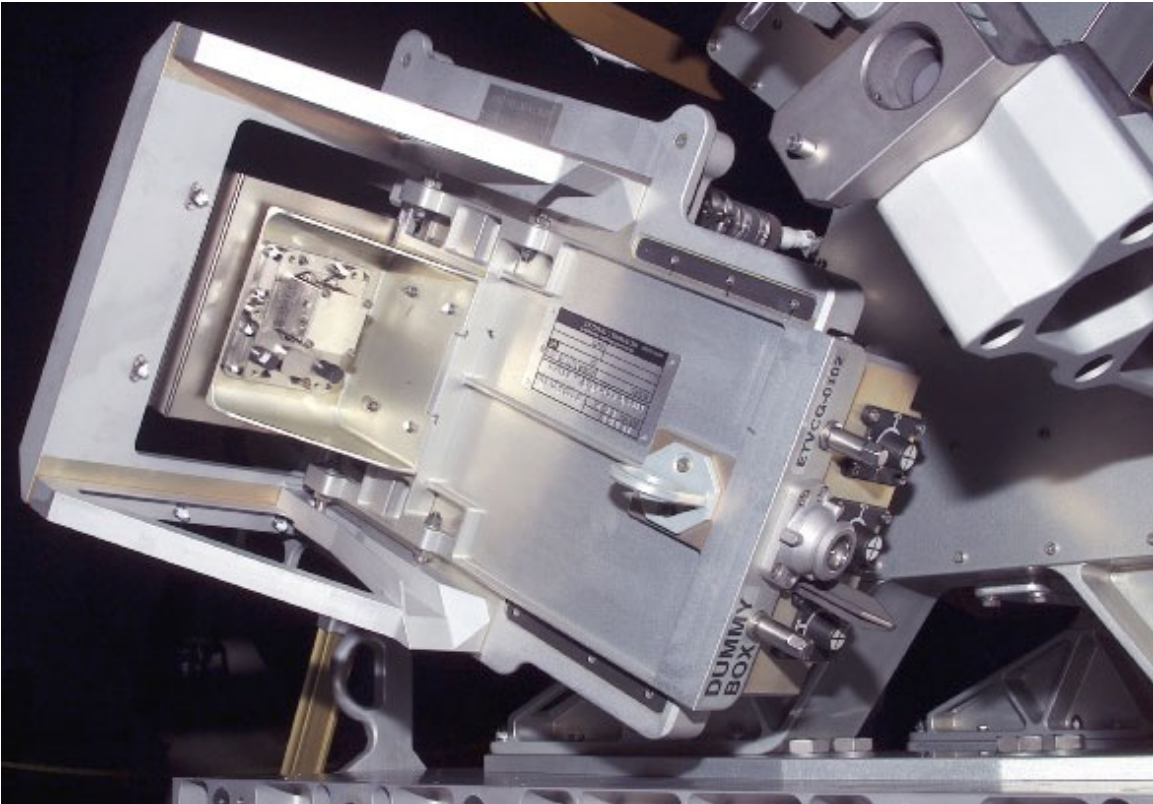
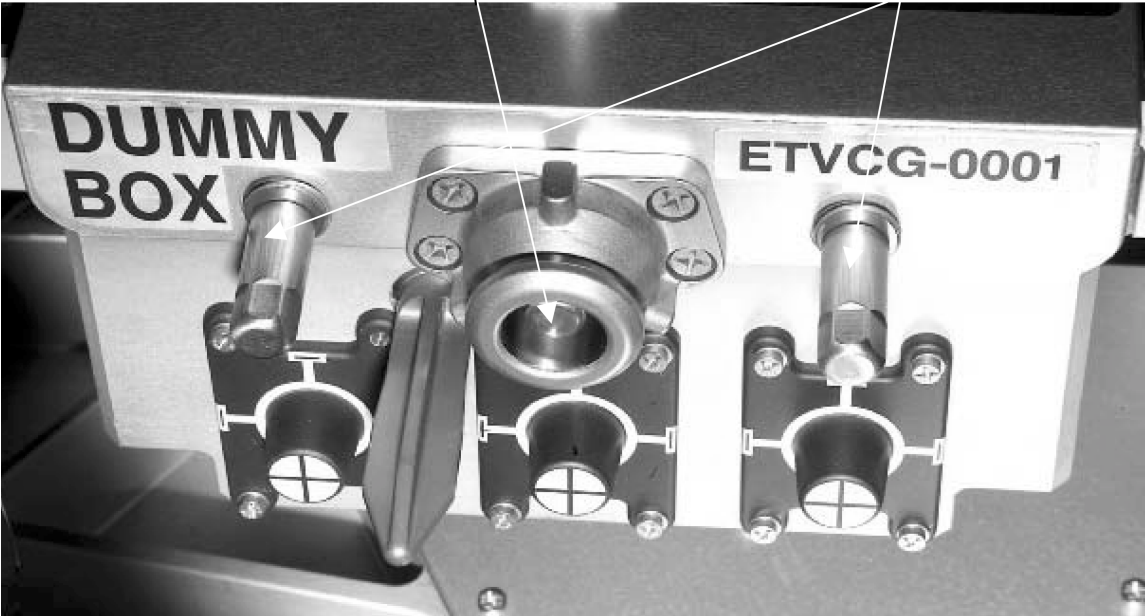


- P2 – Video, contains fiber optic cable.  
3.5-inch minimum bend radius  
ETVCG power, luminaire power
- P3 – ETVCG heater power, luminaire  
heater power
- P4 – Data

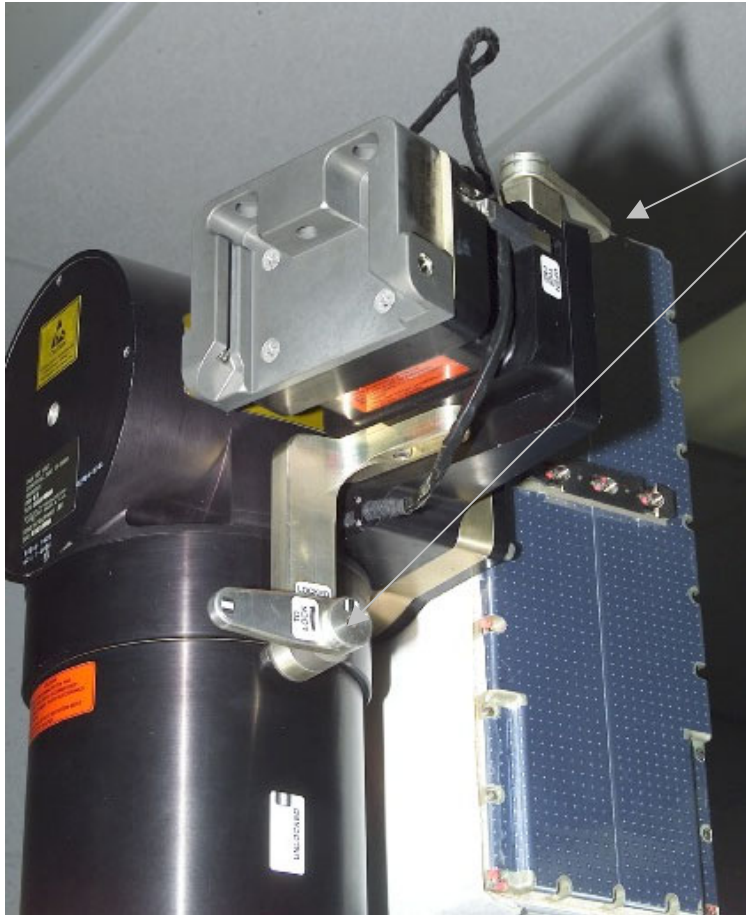
VSSA DUMMY BOX

Center Jack Bolt in Micro-conical

Outer bolts



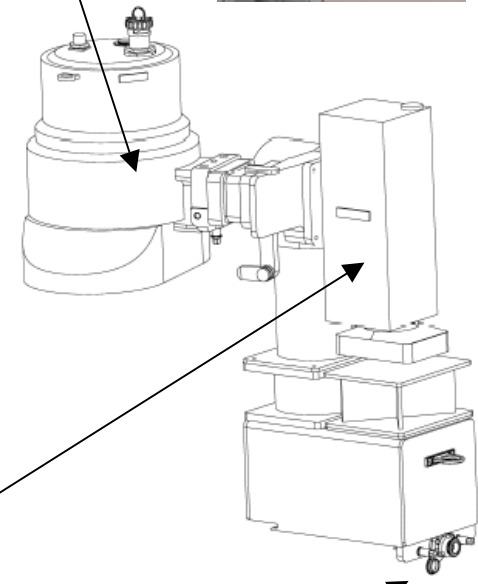
# ETVCG COMPONENTS



Pan (below) and Tilt (above)  
Release Levers

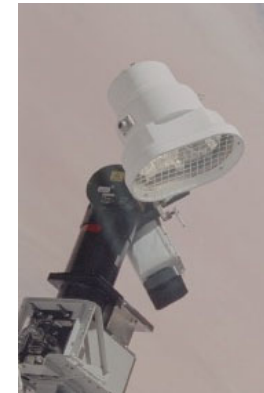


Luminaire

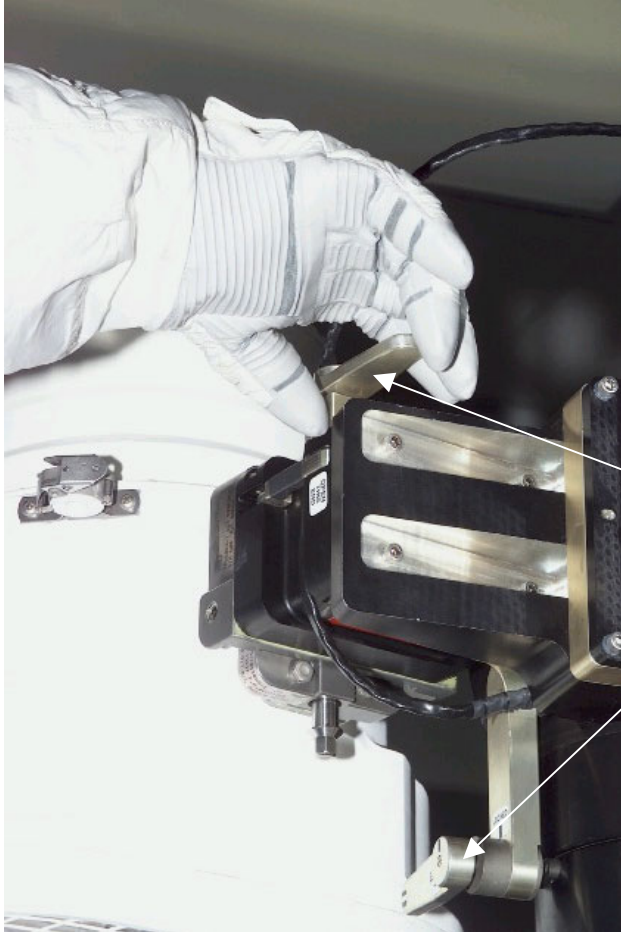


Camera

Outer bolts and center  
Jack-bolt in Micro-conical



# ETVCG PAN AND TILT RELEASE LEVERS

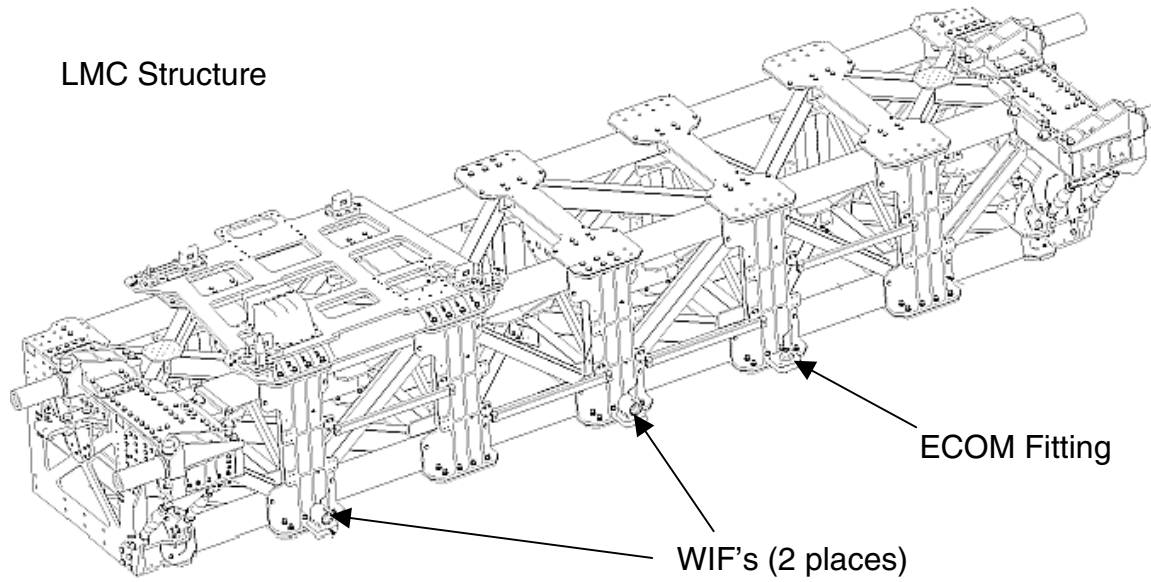
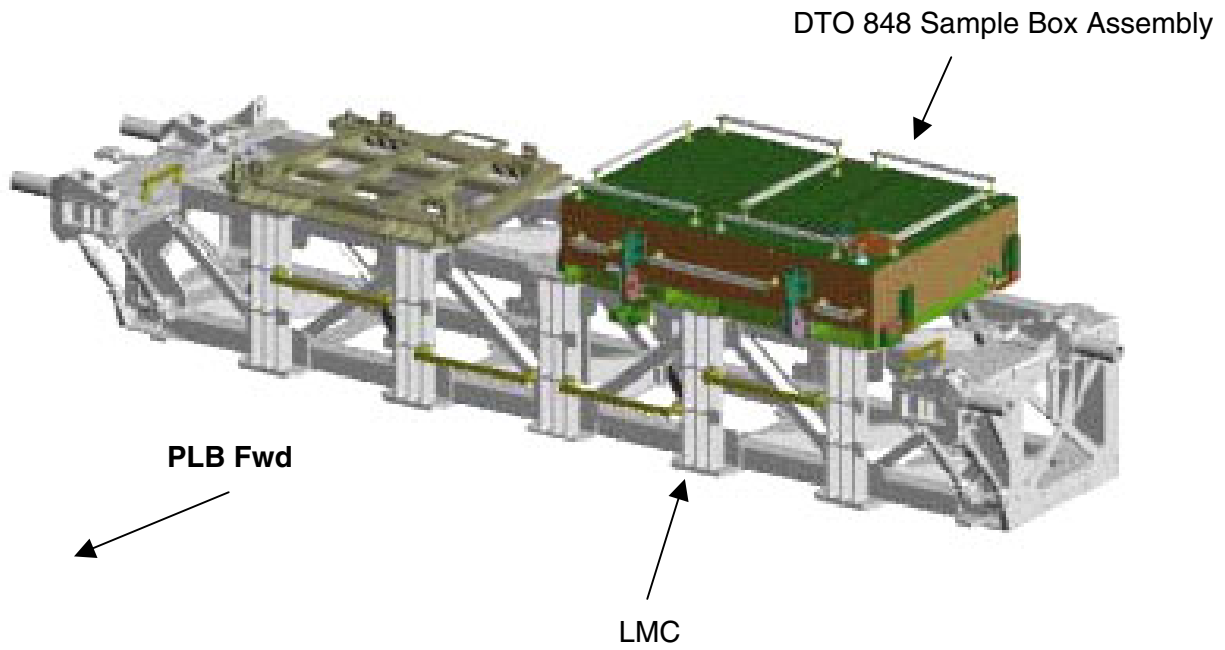


Release Levers  
(90° rotation)

Detail of Release Lever  
showing labels

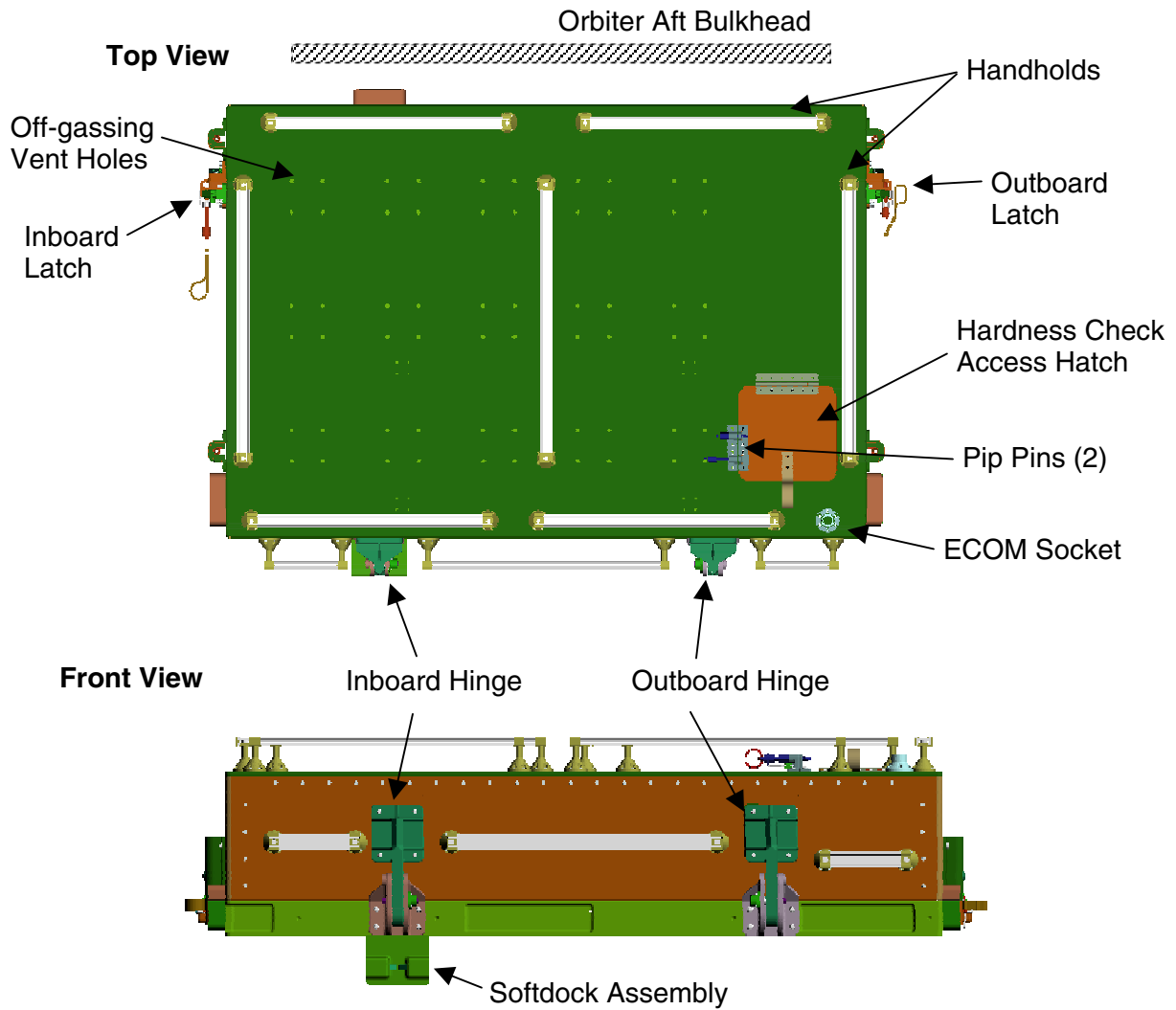


# LMC LAYOUT

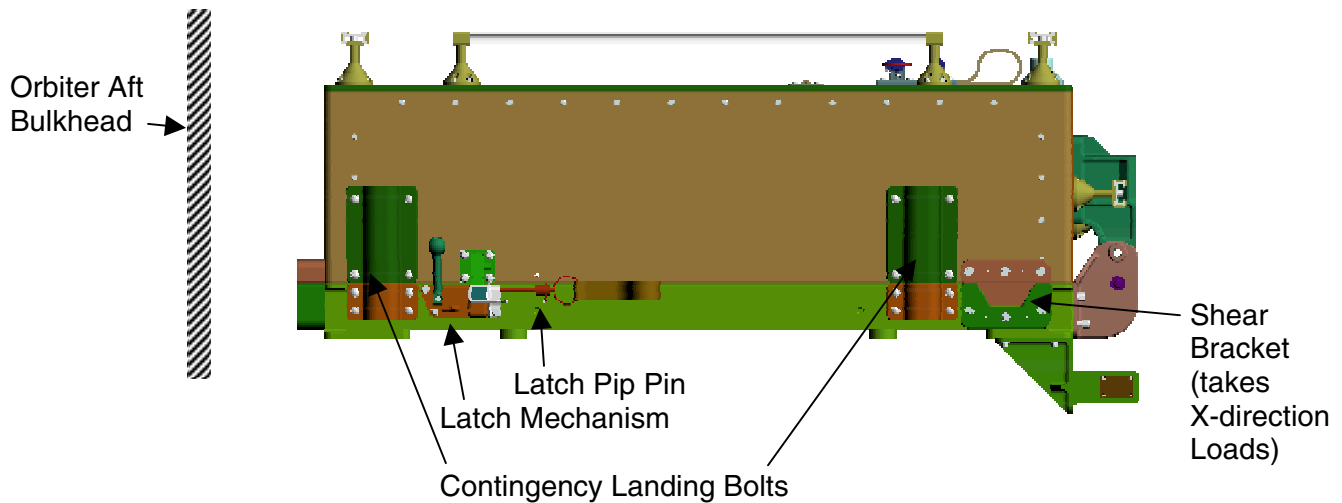




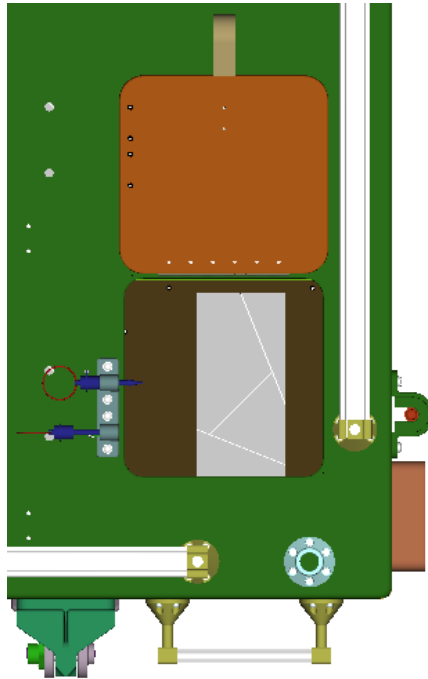
# DTO 848 TPS REPAIR SAMPLE BOX



## Inboard Side View (Outboard side view is mirror image)

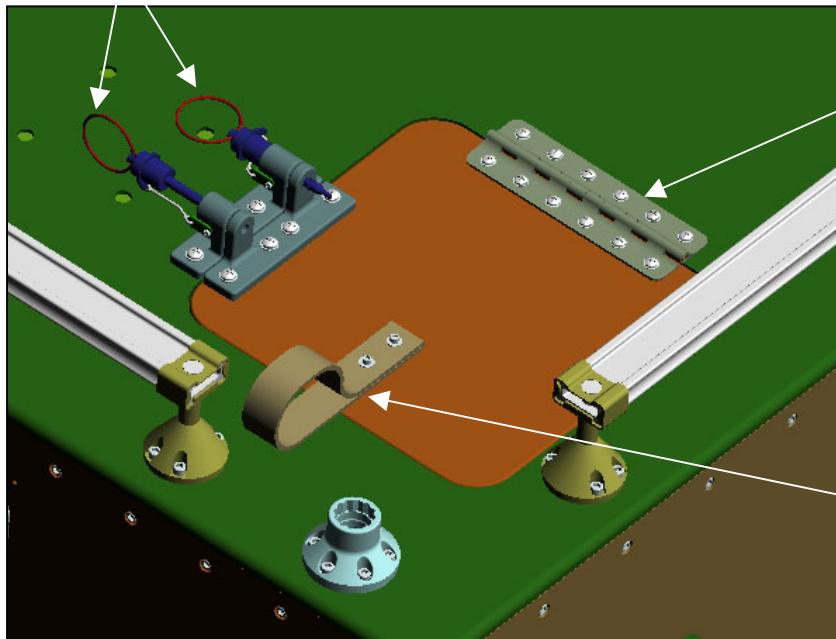


# DTO 848 SAMPLE BOX ACCESS HATCH



Allows access to a single tile sample for the Durometer Hardness Test

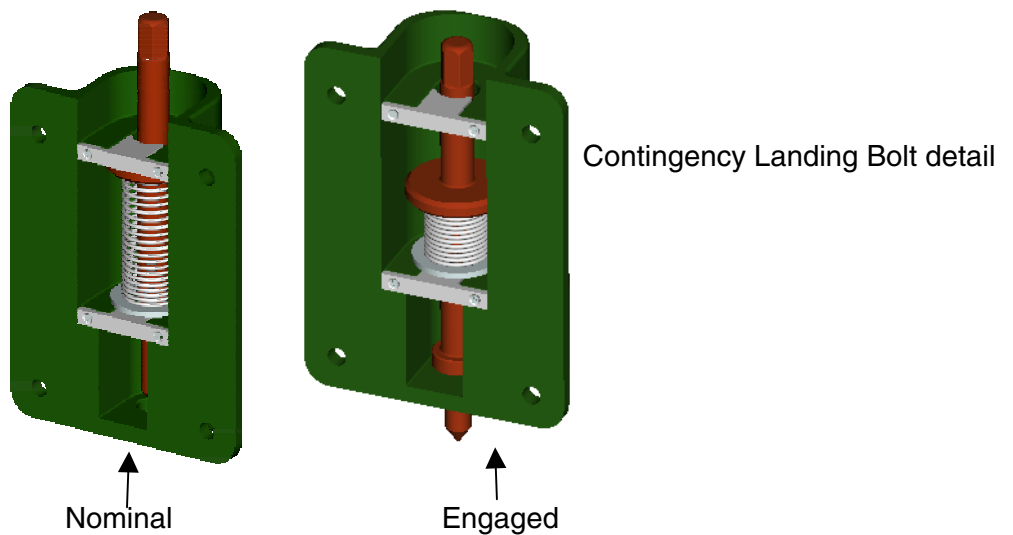
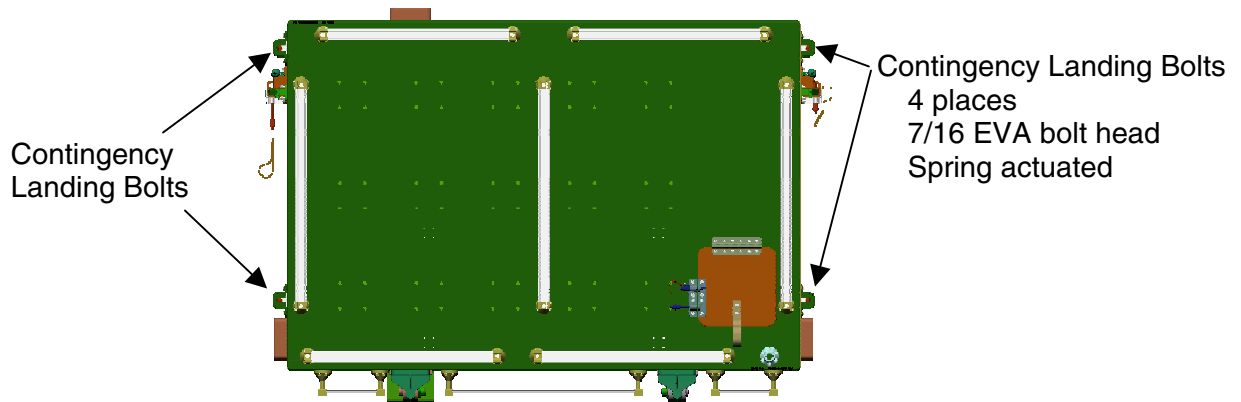
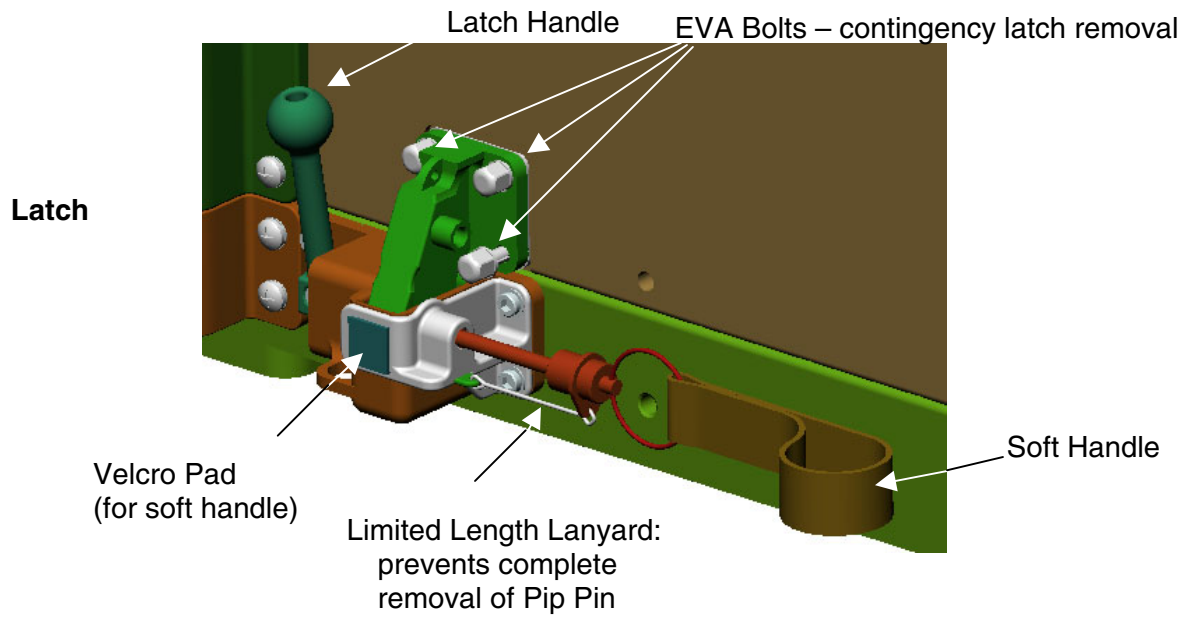
Pip Pins (2) with limited length lanyard preventing full removal of pins



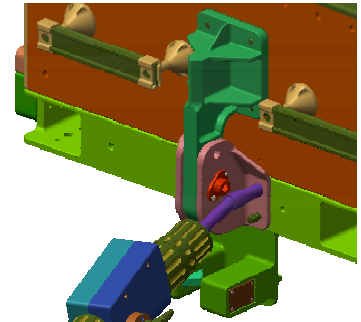
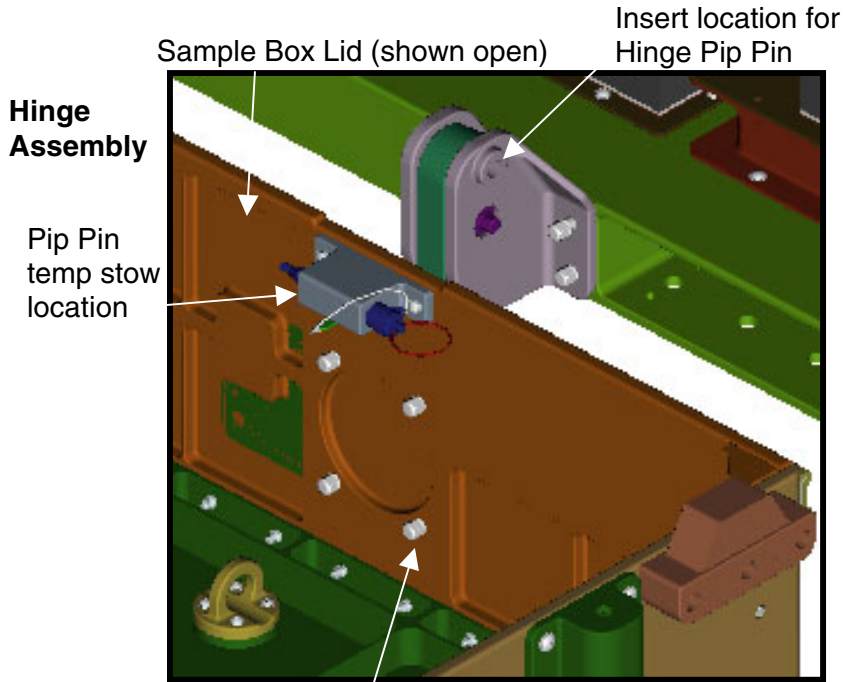
Hinge

Soft Loop Handle with Velcro to secure lid in open and closed positions

# DTO 848 SAMPLE BOX COMPONENTS

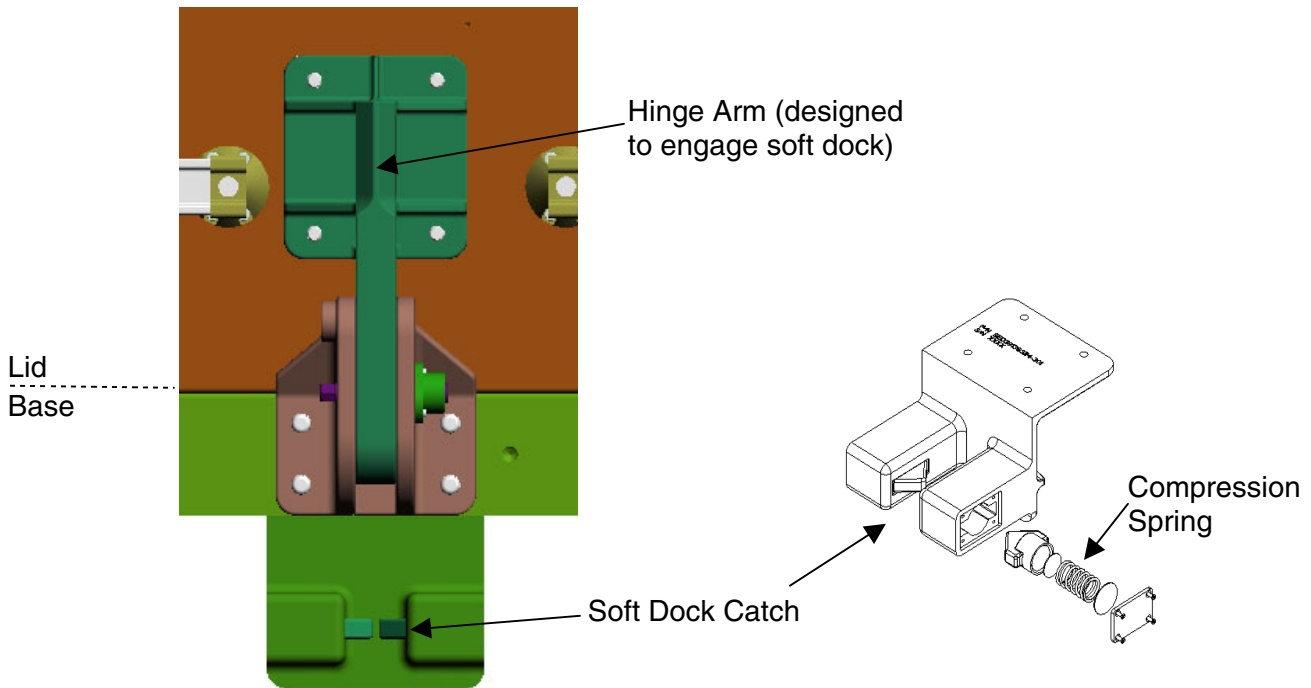


# DTO 848 SAMPLE BOX COMPONENTS (Cont)

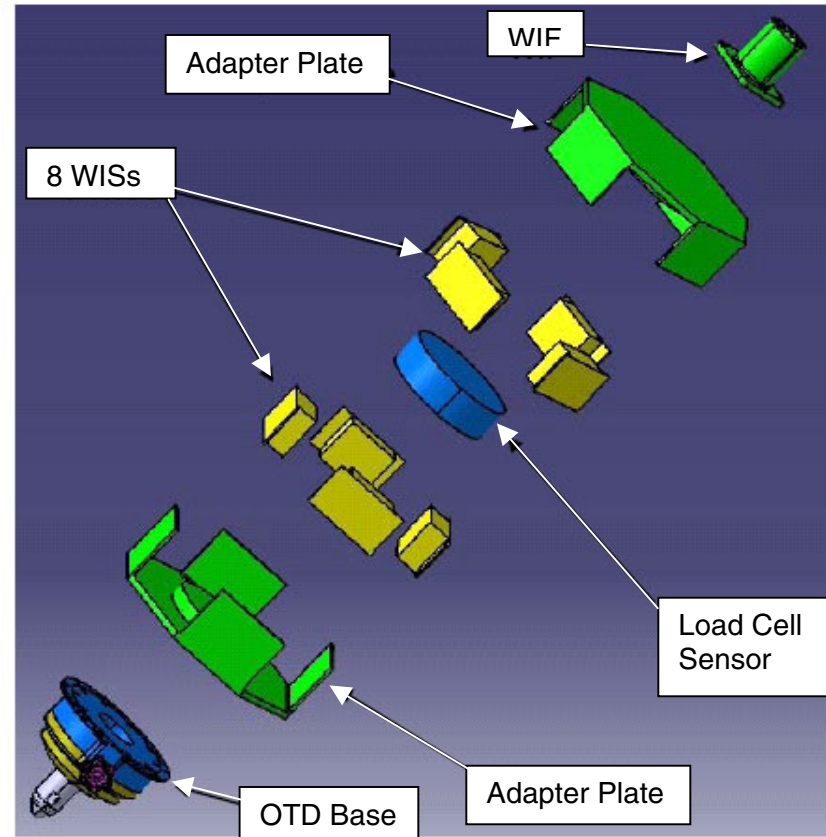
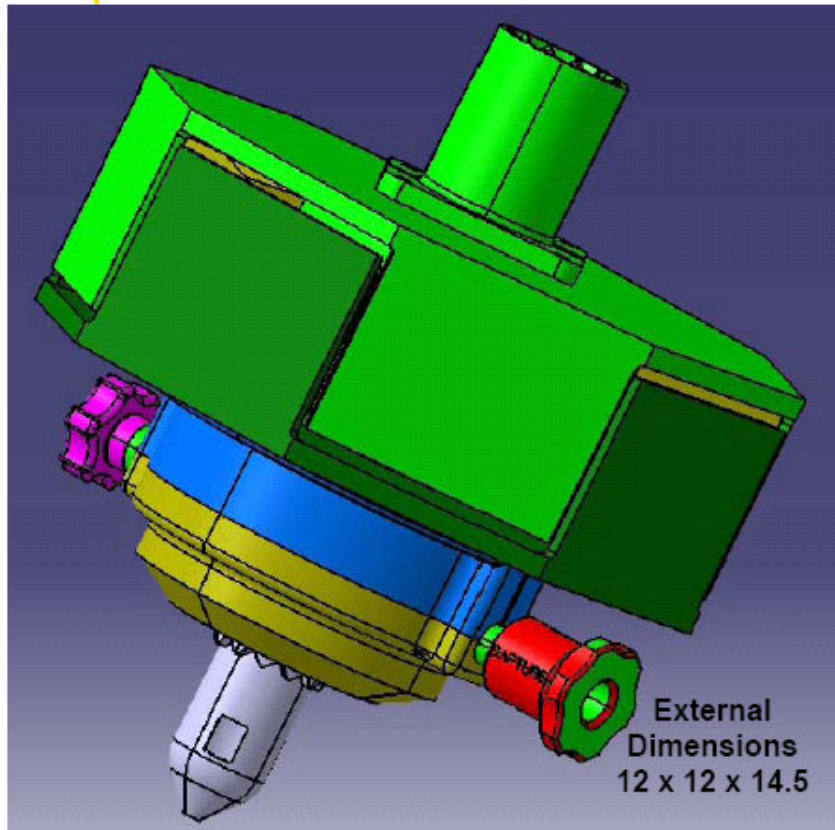


EVA Bolts (4) accessible when lid open

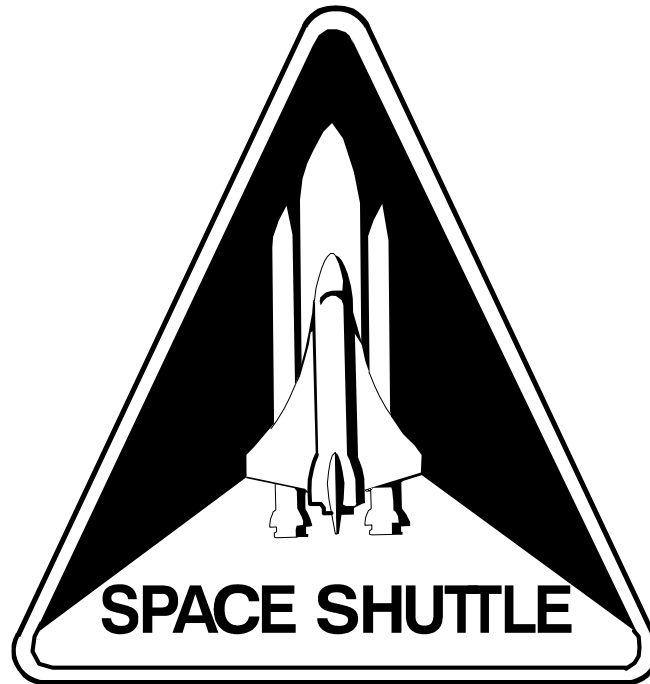
Soft Dock – retains lid in open position prior to locking with pip pins



# DTO 849 WS STABILIZATION LOAD CELL CONCEPT



WIS – Wireless Instrumentation System  
OTD – ORU Transfer Device (EVA Crane)  
Worksite – Interface



**EVA  
CHECKLIST**

**STS  
121**