Space Shuttle Program
FLIGHT DATA FILE

JSC-48024-128

# EVA Checklist

# STS-128 Flight Supplement

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

## Final
## August 5, 2009

**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

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MISSION OPERATIONS DIRECTORATE

# EVA CHECKLIST
# STS-128 FLIGHT SUPPLEMENT

FINAL
August 5, 2009

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| Incorporates the following: | | | |
|---|---|---|---|
| 482#: | EVA FS-00286 | EVA FS-00296 | EVA FS-00306 |
| | EVA FS-00287 | EVA FS-00297 | EVA FS-00307 |
| | EVA FS-00288 | EVA FS-00298 | EVA FS-00308 |
| | EVA FS-00289 | EVA FS-00299A | EVA FS-00309A |
| | EVA FS-00290 | EVA FS-00300 | EVA FS-00310A |
| | EVA FS-00291 | EVA FS-00301 | EVA FS-00311A |
| | EVA FS-00292 | EVA FS-00302 | EVA FS-00312 |
| | EVA FS-00293 | EVA FS-00303 | EVA FS-00313 |
| | EVA FS-00294 | EVA FS-00304A | EVA FS-00314A |
| | EVA FS-00295 | EVA FS-00305 | EVA FS-00315 |

## AREAS OF TECHNICAL RESPONSIBILITY

| | | |
|---|---|---|
| Book Manager | DX32/P. Dum | 281-244-6447 |

EVA CHECKLIST
STS-128 FLIGHT SUPPLEMENT

## *LIST OF EFFECTIVE PAGES*

FINAL 08/05/09


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| FS ii | * | 128/FIN |
| iii | * | generic |
| iv | * | generic |
| FS v | * | 128/FIN |
| FS vi | * | 128/FIN |
| FS vii | * | 128/FIN |
| FS viii | * | 128/FIN |
| FS ix | * | 128/FIN |
| FS x | * | 128/FIN |
| FS xi | | 128/FIN |
| FS xii | | 128/FIN |
| FS xiii | | 128/FIN |
| FS xiv | | 128/FIN |
| FS xv | | 128/FIN |
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| FS xvii | | 128/FIN |
| FS xviii | | 128/FIN |
| 1-1 | | generic |
| 1-2 | | generic |
| 1-3 | | generic |
| 1-4 | | generic |
| 1-5 | | generic |
| 1-6 | | generic |
| 1-7 | | generic |
| 1-8 | | generic |
| 1-9 | | generic |
| 1-10 | | generic |
| TEMP FS 2-1 | | 128/FIN |
| TEMP FS 2-2 | | ALL/FIN |
| 2-3 | | generic |
| 2-4 | | generic |
| TEMP FS 2-5 | | 128/FIN |
| TEMP FS 2-6 | | ALL/FIN |
| FS 2-7 | | 128/FIN |
| FS 2-8 | | 128/FIN |
| FS 2-9 | | 128/FIN |
| FS 2-10 | | 128/FIN |
| FS 2-11 | | 128/FIN |
| FS 2-12 | | 128/FIN |
| FS 2-13 | | 128/FIN |
| FS 2-14 | | 128/FIN |
| FS 2-15 | | 128/FIN |
| FS 2-16 | | 128/FIN |
| 3-1 | | generic |
| 3-2 | | generic |
| 3-3 | | generic |
| 3-4 | | generic |
| 3-5 | | generic |
| 3-6 | | generic |
| 3-7 | | generic |
| 3-8 | | generic |
| 3-9 | | generic |
| CC 3-10 | | generic |
| CC 3-11 | | generic |
| 3-12 | | generic |
| 4-1 | | generic |
| 4-2 | | generic |
| 4-3 | | generic |
| 4-4 | | generic |
| 4-5 | | generic |
| 4-6 | | generic |
| 4-7 | | generic |
| 4-8 | | generic |
| 4-9 | | generic |
| 4-10 | | generic |
| 4-11 | | generic |
| 4-12 | | generic |
| 5-1 | | generic |
| 5-2 | | generic |
| 5-3 | | generic |
| 5-4 | | generic |
| A6-1 | | generic |
| CC A6-2 | | generic |
| 6-3 | | generic |
| CC 6-4 | | generic |
| FS 7-1 | | 128/FIN |
| FS 7-2 | | 128/FIN |
| FS 7-3 | | 128/FIN |
| FS 7-4 | | 128/FIN |
| FS 7-5 | | 128/FIN |
| FS 7-6 | ⊗ | 128/FIN |
| FS 7-7 | | 128/FIN |
| FS 7-8 | | 128/FIN |
| FS 7-9 | | 128/FIN |
| FS 7-10 | ⊗ | 128/FIN |
| FS 7-11 | ⊗ | 128/FIN |
| FS 7-12 | ⊗ | 128/FIN |
| FS 7-13 | ⊗ | 128/FIN |
| FS 7-14 | ⊗ | 128/FIN |
| FS 7-15 | | 128/FIN |
| FS 7-16 | ⊗ | 128/FIN |
| FS 7-17 | | 128/FIN |
| FS 7-18 | | 128/FIN |
| FS 7-19 | | 128/FIN |
| FS 7-20 | ⊗ | 128/FIN |


* – Omit from flight book
⊗ – Flight copies of this page contain color

FS 7-21 ..... 128/FIN
FS 7-22 ..... 128/FIN
FS 7-23 ..... 128/FIN
FS 7-24 ..... ⊗ 128/FIN
FS 7-25 ..... 128/FIN
FS 7-26 ..... 128/FIN
FS 7-27 ..... 128/FIN
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FS 7-29 ..... ⊗ 128/FIN
FS 7-30 ..... ⊗ 128/FIN
FS 7-31 ..... 128/FIN
FS 7-32 ..... ⊗ 128/FIN
FS 7-33 ..... 128/FIN
FS 7-34 ..... ⊗ 128/FIN
FS 7-35 ..... ⊗ 128/FIN
FS 7-36 ..... 128/FIN
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FS 7-39 ..... ⊗ 128/FIN
FS 7-40 ..... 128/FIN
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FS 7-42 ..... 128/FIN
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FS 7-44 ..... ⊗ 128/FIN
FS 7-45 ..... ⊗ 128/FIN
FS 7-46 ..... ⊗ 128/FIN
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FS 7-48 ..... 128/FIN
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FS 7-50 ..... ⊗ 128/FIN
FS 7-51 ..... ⊗ 128/FIN
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FS 7-53 ..... ⊗ 128/FIN
FS 7-54 ..... 128/FIN
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FS 7-56 ..... 128/FIN
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FS 7-64 ..... ⊗ 128/FIN
FS 7-65 ..... 128/FIN
FS 7-66 ..... ⊗ 128/FIN
FS 7-67 ..... 128/FIN
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FS 7-69 ..... 128/FIN
FS 7-70 ..... ⊗ 128/FIN
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FS 7-73 ..... 128/FIN
FS 7-74 ..... ⊗ 128/FIN
FS 7-75 ..... ⊗ 128/FIN
FS 7-76 ..... ⊗ 128/FIN
FS 7-77 ..... ⊗ 128/FIN
FS 7-78 ..... 128/FIN
FS 7-79 ..... 128/FIN
FS 7-80 ..... 128/FIN
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FS 7-82 ..... 128/FIN
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FS 7-85 ..... 128/FIN
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FS 7-87 ..... ⊗ 128/FIN
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FS 7-89 ..... ⊗ 128/FIN
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FS 7-91 ..... 128/FIN
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FS 7-93 ..... 128/FIN
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FS 7-99 ..... ⊗ 128/FIN
FS 7-100 ..... ⊗ 128/FIN
FS 7-101 ..... ⊗ 128/FIN
FS 7-102 ..... 128/FIN
FS 7-103 ..... ⊗ 128/FIN
FS 7-104 ..... 128/FIN
FS 7-105 ..... ⊗ 128/FIN
FS 7-106 ..... 128/FIN
FS 7-107 ..... ⊗ 128/FIN
FS 7-108 ..... ⊗ 128/FIN
FS 7-109 ..... 128/FIN
FS 7-110 ..... ⊗ 128/FIN
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FS 7-141 ..... ⊗ 128/FIN
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TEMP FS 8-2b ..... 128/FIN
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FS 8-11 ..... 128/FIN
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FS 8-16 ..... 128/FIN
FS 8-17 ..... 128/FIN
FS 8-18 ..... 128/FIN
FS 8-19 ..... 128/FIN
FS 8-20 ..... 128/FIN
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9-3 ..... generic
9-4 ..... generic
9-5 ..... generic
9-6 ..... generic
TEMP FS 10-1 ..... 128/FIN
TEMP FS 10-2 ..... ALL/FIN
10-3 ..... generic
10-4 ..... generic
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10-5 ..... generic
10-6 ..... generic
10-7 ..... generic
10-8 ..... generic
10-9 ..... generic
10-10 ..... generic
10-11 ..... generic
10-12 ..... generic
10-13 ..... generic
10-14 ..... generic
FS CC 10-15 ..... 128/FIN
FS CC 10-16 ..... ⊗ 128/FIN
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11-2 ..... generic
11-3 ..... generic
11-4 ..... generic
12-i ..... generic
12-ii ..... generic
TEMP FS 12-1 ..... 128/FIN
TEMP FS 12-2 ..... ALL/FIN
12-3 ..... generic
12-4 ..... generic
12-5 ..... generic
12-6 ..... generic
12-7 ..... generic
12-8 ..... generic
12-9 ..... generic
12-10 ..... generic
12-11 ..... generic
12-12 ..... generic
12-13 ..... generic
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12-18 ..... generic
12-19 ..... generic
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12-21 ..... generic
12-22 ..... generic
12-23 ..... generic
12-24 ..... generic
12-25 ..... generic
12-26 ..... generic
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FS 13-2 ..... 128/FIN
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14-2 ..... generic
14-3 ..... generic
14-4 ..... generic
14-5 ..... generic
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14-8 ..... generic


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| 14-9 | generic | FS 16-27 | 128/FIN |
| 14-10 | generic | FS 16-28 | 128/FIN |
| 14-11 | generic | FS 16-29 ⊗ | 128/FIN |
| 14-12 | generic | FS 16-30 ⊗ | 128/FIN |
| 14-13 | generic | FS 16-31 ⊗ | 128/FIN |
| 14-14 | generic | FS 16-32 ⊗ | 128/FIN |
| 14-15 | generic | FS 16-33 ⊗ | 128/FIN |
| 14-16 | generic | FS 16-34 ⊗ | 128/FIN |
| 14-17 | generic | FS 16-35 ⊗ | 128/FIN |
| 14-18 | generic | FS 16-36 ⊗ | 128/FIN |
| 14-19 | generic | FS 16-37 ⊗ | 128/FIN |
| 14-20 | generic | FS 16-38 ⊗ | 128/FIN |
| 14-21 | generic | FS 16-39 ⊗ | 128/FIN |
| 14-22 | generic | FS 16-40 ⊗ | 128/FIN |
| 15-1 | generic | FS 16-41 ⊗ | 128/FIN |
| 15-2 | generic | FS 16-42 ⊗ | 128/FIN |
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| 15-4 | generic | FS 16-44 | 128/FIN |
| 15-5 | generic | FS 16-45 | 128/FIN |
| 15-6 | generic | FS 16-46 | 128/FIN |
| 15-7 | generic | FS 16-47 | 128/FIN |
| 15-8 | generic | FS 16-48 | 128/FIN |
| 15-9 | generic | FS 16-49 | 128/FIN |
| 15-10 | generic | FS 16-50 | 128/FIN |
| 15-11 | generic | FS 16-51 | 128/FIN |
| 15-12 | generic | FS 16-52 | 128/FIN |
| 15-13 | generic | FS 16-53 | 128/FIN |
| 15-14 | generic | FS 16-54 | 128/FIN |
| 16-i | generic | FS 16-55 | 128/FIN |
| 16-ii | generic | FS 16-56 ⊗ | 128/FIN |
| TEMP FS 16-1 | 128/FIN | FS 16-57 | 128/FIN |
| TEMP FS 16-2 | 128/FIN | FS 16-58 | 128/FIN |
| FS 16-3 | 128/FIN | FS 16-59 ⊗ | 128/FIN |
| FS 16-4 | 128/FIN | FS 16-60 ⊗ | 128/FIN |
| FS 16-5 ⊗ | 128/FIN | FS 16-61 ⊗ | 128/FIN |
| FS 16-6 | 128/FIN | FS 16-62 | 128/FIN |
| FS 16-7 | 128/FIN | FS 16-63 | 128/FIN |
| FS 16-8 | 128/FIN | FS 16-64 | 128/FIN |
| FS 16-9 | 128/FIN | FS 16-65 ⊗ | 128/FIN |
| FS 16-10 | 128/FIN | FS 16-66 ⊗ | 128/FIN |
| FS 16-11 | 128/FIN | FS 16-67 ⊗ | 128/FIN |
| FS 16-12 | 128/FIN | FS 16-68 ⊗ | 128/FIN |
| FS 16-13 | 128/FIN | FS 16-69 | 128/FIN |
| FS 16-14 | 128/FIN | FS 16-70 | 128/FIN |
| FS 16-15 ⊗ | 128/FIN | FS 16-71 | 128/FIN |
| FS 16-16 | 128/FIN | FS 16-72 | 128/FIN |
| FS 16-17 | 128/FIN | FS 16-73 | 128/FIN |
| FS 16-18 | 128/FIN | FS 16-74 | 128/FIN |
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| FS 16-20 | 128/FIN | FS 16-76 ⊗ | 128/FIN |
| FS 16-21 | 128/FIN | FS 16-77 | 128/FIN |
| FS 16-22 | 128/FIN | FS 16-78 | 128/FIN |
| FS 16-23 | 128/FIN | FS 16-79 | 128/FIN |
| FS 16-24 | 128/FIN | FS 16-80 ⊗ | 128/FIN |
| FS 16-25 | 128/FIN | FS 16-81 ⊗ | 128/FIN |
| FS 16-26 | 128/FIN | FS 16-82 ⊗ | 128/FIN |

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|---|---|---|
| FS 16-83 | ⊗ | 128/FIN |
| FS 16-84 | | 128/FIN |
| FS 16-85 | | 128/FIN |
| FS 16-86 | ⊗ | 128/FIN |
| FS 16-87 | ⊗ | 128/FIN |
| FS 16-88 | | 128/FIN |
| 17-1 | | generic |
| 17-2 | | generic |
| FS 18-1 | | 128/FIN |
| FS 18-2 | ⊗ | 128/FIN |
| FS 18-3 | ⊗ | 128/FIN |
| FS 18-4 | ⊗ | 128/FIN |
| FS 18-5 | ⊗ | 128/FIN |
| FS 18-6 | ⊗ | 128/FIN |
| FS 18-7 | ⊗ | 128/FIN |
| FS 18-8 | ⊗ | 128/FIN |
| FS 18-9 | ⊗ | 128/FIN |
| FS 18-10 | ⊗ | 128/FIN |
| FS 18-11 | ⊗ | 128/FIN |
| FS 18-12 | ⊗ | 128/FIN |
| FS 18-13 | ⊗ | 128/FIN |
| FS 18-14 | ⊗ | 128/FIN |
| FS 18-15 | ⊗ | 128/FIN |
| FS 18-16 | ⊗ | 128/FIN |
| FS 18-17 | ⊗ | 128/FIN |
| FS 18-18 | ⊗ | 128/FIN |
| FS 18-19 | ⊗ | 128/FIN |
| FS 18-20 | ⊗ | 128/FIN |
| FS 18-21 | ⊗ | 128/FIN |
| FS 18-22 | ⊗ | 128/FIN |
| FS 18-23 | ⊗ | 128/FIN |
| FS 18-24 | ⊗ | 128/FIN |
| FS 18-25 | ⊗ | 128/FIN |
| FS 18-26 | ⊗ | 128/FIN |
| FS 18-27 | ⊗ | 128/FIN |
| FS 18-28 | ⊗ | 128/FIN |
| FS 18-29 | ⊗ | 128/FIN |
| FS 18-30 | ⊗ | 128/FIN |
| FS 18-31 | ⊗ | 128/FIN |
| FS 18-32 | ⊗ | 128/FIN |
| FS 18-33 | ⊗ | 128/FIN |
| FS 18-34 | ⊗ | 128/FIN |
| FS 18-35 | ⊗ | 128/FIN |
| FS 18-36 | ⊗ | 128/FIN |
| FS 18-37 | ⊗ | 128/FIN |
| FS 18-38 | ⊗ | 128/FIN |
| FS 18-39 | | 128/FIN |
| FS 18-40 | ⊗ | 128/FIN |
| FS 18-41 | ⊗ | 128/FIN |
| FS 18-42 | ⊗ | 128/FIN |
| FS 18-43 | ⊗ | 128/FIN |
| FS 18-44 | ⊗ | 128/FIN |
| FS 18-45 | ⊗ | 128/FIN |
| FS 18-46 | ⊗ | 128/FIN |
| FS 18-47 | ⊗ | 128/FIN |
| FS 18-48 | ⊗ | 128/FIN |
| FS 18-49 | ⊗ | 128/FIN |
| FS 18-50 | ⊗ | 128/FIN |
| FS 18-51 | ⊗ | 128/FIN |
| FS 18-52 | ⊗ | 128/FIN |
| FS 18-53 | ⊗ | 128/FIN |
| FS 18-54 | ⊗ | 128/FIN |
| FS 18-55 | | 128/FIN |
| FS 18-56 | ⊗ | 128/FIN |
| FS 18-57 | ⊗ | 128/FIN |
| FS 18-58 | ⊗ | 128/FIN |
| FS 18-59 | ⊗ | 128/FIN |
| FS 18-60 | ⊗ | 128/FIN |
| FS 18-61 | ⊗ | 128/FIN |
| FS 18-62 | ⊗ | 128/FIN |
| FS 18-63 | ⊗ | 128/FIN |
| FS 18-64 | ⊗ | 128/FIN |
| FS 18-65 | ⊗ | 128/FIN |
| FS 18-66 | ⊗ | 128/FIN |
| FS 18-67 | ⊗ | 128/FIN |
| FS 18-68 | ⊗ | 128/FIN |
| FS 18-69 | ⊗ | 128/FIN |
| FS 18-70 | ⊗ | 128/FIN |
| FS 18-71 | ⊗ | 128/FIN |
| FS 18-72 | ⊗ | 128/FIN |
| FS 18-73 | ⊗ | 128/FIN |
| FS 18-74 | ⊗ | 128/FIN |
| FS 18-75 | ⊗ | 128/FIN |
| FS 18-76 | | 128/FIN |
| FS 18-77 | ⊗ | 128/FIN |
| FS 18-78 | | 128/FIN |
| FS 18-79 | ⊗ | 128/FIN |
| FS 18-80 | ⊗ | 128/FIN |
| 19-i | | generic |
| 19-ii | | generic |
| 19-1 | | generic |
| 19-2 | | generic |
| 19-3 | | generic |
| 19-4 | | generic |
| 19-5 | | generic |
| 19-6 | | generic |
| 19-7 | | generic |
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| 19-9 | | generic |
| 19-10 | | generic |
| 19-11 | | generic |
| 19-12 | | generic |
| 19-13 | | generic |
| 19-14 | | generic |
| 20-1 | * | generic |
| 20-2 | * | generic |

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EVA CUE CARDS


| Title | Ref. Page | Card No. |
|---|---|---|
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| NOD3 CH 2/3 AVIONICS CABLE ROUTING (Back)... | FS CC 7-147 | EVA-7b/128/O/A |
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**AIRLOCK PREP** (50 min)

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

AIRLOCK CONFIG

1. √Inner hatch Equal vlv (two) – OFF

AW18A

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

**EMU CHECKOUT PREP** (30 min)

| | | |
|---|---|---|
| Airlock | 1. | LTG FLOOD (four) – on |
| | 2. | If necessary, remove Airlock Floor Bag from Airlock |
| | 3. | Unbuckle SCU straps, Velcro SCU to wall |
| Vol H (MD23R) | 4. | Unstow Inboard Bag and temp stow in Airlock for use later in EMU C/O<br>Unstow Helmet Lights from Outboard Bag and install on EMU 3009 (Fg)<br>Unstow Helmet Lights from Inboard Bag and install on EMU 3015 (Ol) |
| Airlock | 5. | Disconnect helmets from EMUs, temp stow |
| | 6. | √DIDB restraint bags (one per suit) installed |
| | 7. | Remove Comm Caps from LTA Restraint Bags (aka Kangaroo Pouches) |
| | 8. | Connect Comm Caps Ol 1 (Fg 1) to EMU 3015 (3009) electrical harnesses |
| | 9. | Disconnect LTA Restraint Bag straps from AAP |
| | 10. | Roll and temp stow LTA Restraint Bags on bottom of AAPs |
| | 11. | Unstow 2 ISS EVA Cuff Checklists (Ol, Fg) from SODF locker<br>Install Ol, Fg C/L on EMUs, left arm |

## LTA RESTRAINT STRAP REMOVAL (15 min)

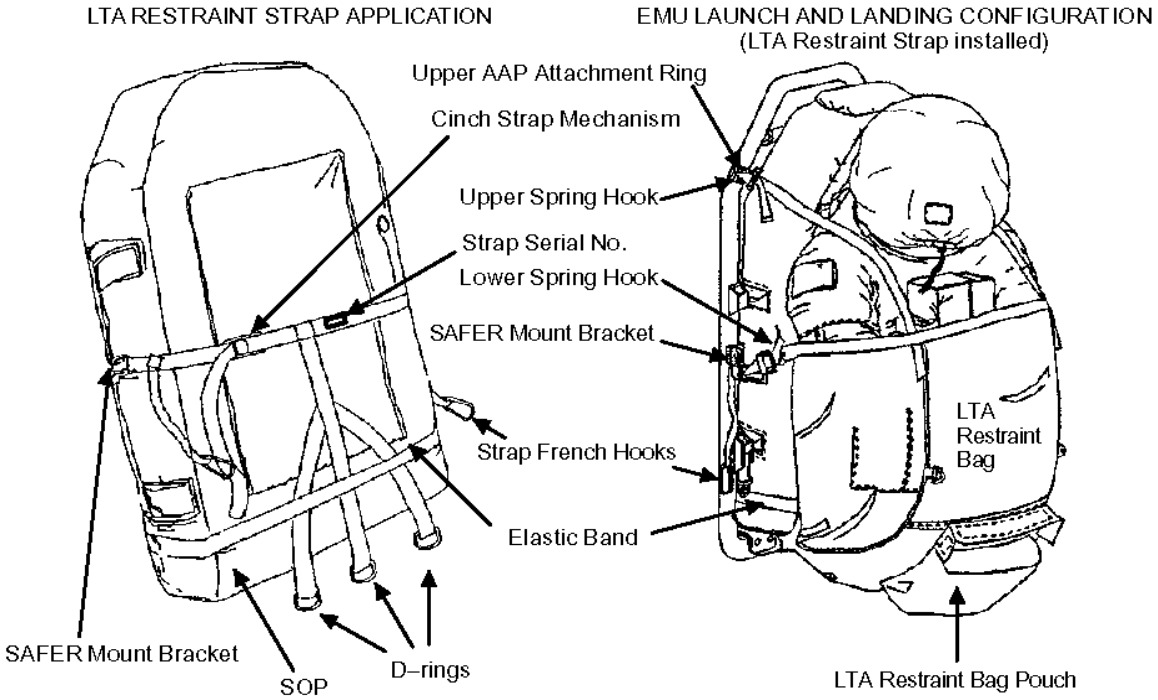
NOTE
May be performed on EMU 1 and 2 simultaneously.
Perform steps as reqd for current EMU config

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

## LTA RESTRAINT STRAP INSTALLATION (15 min)

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

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




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

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

BOTH EMUs/ DCM

1. √SCOFs and Donning Handles stowed
2. √PWR – SCU
3. √PURGE vlv – op (up)
4. √WATER – OFF, switch guard installed
5. √O2 ACT – OFF
6. √OI, Fg CCAs temp stowed for transfer (in arm)
7. Remove EMU Servicing Kit s/n 5002, from Vol H Inboard Bag and temp stow
8. Stow EMU Equipment Bag (Danny Bag) in Vol H Inboard Bag and restow in Vol H
9. Configure/verify items according to tables below:

**Table 1: EMU Contents**

| EMU 3015 (OI) | EMU 3009 (Fg) |
|---|---|
| ☐ DIDB Restraint Bag (verified during EMU C/O) | ☐ DIDB Restraint Bag (verified during EMU C/O) |
| ☐ Comm Cap (OI 1) (installed during EMU C/O) | ☐ Comm Cap (Fg 1) (installed during EMU C/O) |
| ☐ Helmet (√sun shade down, cover installed) | ☐ Helmet (√sun shade down, cover installed) |
| ☐ Valsalva | ☐ Valsalva |
| | ☐ Fresnel Lens |
| ☐ Helmet Lights | ☐ Helmet Lights |
| ☐ EMU Gloves (OI 1) | ☐ EMU Gloves (Fg 1) |
| ☐ Cuff C/L | ☐ Cuff C/L |
| ☐☐ Wrist Mirror (2) | ☐☐ Wrist Mirror (2) |
| ☐ EMU Battery (verify s/n at REBA Installation) | ☐ EMU Battery (verify s/n at REBA Installation) |
| ☐ CCC (LiOH, verify s/n at REBA Installation) | ☐ CCC (LiOH, verify s/n at REBA Installation) |
| ☐ LTA | ☐ LTA |
| ☐ LCVG | ☐ LCVG |

10. Remove EVA Task Mesh bag from Fg ECOK (A/L Floor Bag). Tie Fg ECOK to Bag D
11. Gather items listed per table 2 from A/L Floor Bag and Bag D, put into EVA Task Mesh Bag

**Table 2: EVA Task Mesh Bag Contents**

| From Airlock Floor Bag |
|---|
| ☐ EMU LiOH Canister (1) – Report s/n to **MCC-H** as comm permits |
| ☐☐ 85-ft Safety Tethers (s/n 1001, 1004) |
| ☐ EVA/Task CTB (in A/L Floor Bag) |
| ☐ BMRRM Anti Rotation Latch Tool (s/n 1003) |
| ☐ Fastener Retention Tool (s/n 1002) |
| ☐☐☐☐ Caps (ATA) (4) |
| ☐ EMU Battery (s/n 2082) |
| ☐☐ EMU LiOH Canister (2) – Report s/n to **MCC-H** as comm permits |
| ☐☐ NH3 DTED Protective Containers (2) |
| **From Bag D, CTB 1488 (St)** |
| ☐☐ MSS Camera Cover (2) |
| ☐☐☐ EVA Plug Protective Cover w/tether ring (3) |

12. Gather items listed below and configure Bag D per table 3

**Table 3: Bag D Contents**

**Items Launched in Bag D**

☐☐☐ EMU Gloves – 3 pair (Ol 2, Fg 2, Fr)

☐ CTB 1488 (St)
- ☐ EMU Boots –1 pair
- ☐ EMU Lower Arms – 1 pair
- ☐ SSER Antenna Cable

☐ ½ CTB 1490 (St)
- ☐ EMU Gloves – 1 pair (St 1)
- ☐ Comm Cap – (St 1)

☐ ECOK (St) – Mesh Bag

**Add to St ECOK from Bag D:**
- **☐☐ 2 LCVGs – (St 1, St 2)**

**Add to St ECOK from ½ CTB 1490 (St):**
- **☐ EMU Gloves – (St 2)**
- **☐ Comm Cap – (St 2)**

☐☐☐ St EVA 1, Cont 1, Cont 2 Ziplock Bag
- ☐☐☐ 2 per bag, MAGs (w/Ziplock Bags)
- ☐☐☐ TCUs (top, bottom)
- ☐☐☐ Socks (pair)
- ☐☐☐ Wristlets (pair)
- ☐☐☐ Comfort Gloves (pair)
- ☐☐ Hair Restraint (pair)
- ☐☐☐ Croakie

EVA 1 Bag only:
- ☐ EV identifier stripes (EV3)
- ☐ Mission patch (STS-128)
- ☐ US flag
- ☐☐ Fresnel Lens

Cont 1 Bag only:
- ☐☐ EV identifier stripes (EV1, EV2)
- ☐☐ Mission patch (Exp 20, Exp 21)
- ☐ US flag
- ☐☐ Fresnel Lens

Cont 2 Bag only:
- ☐☐ EV identifier stripes (EV1, EV2)
- ☐☐ Mission patch (Exp 20, Exp 21)
- ☐ US flag

WL ORLAN Fresnel Lenses
- ☐☐ Fresnel Lens

☐ ECOK (Ol) – Mesh Bag

☐☐☐ Ol EVA 1, 2 & 3 Ziplock Bags
- ☐☐☐ 2 per EVA, MAGs (w/Ziplock Bags)
- ☐☐☐ TCUs (top, bottom)
- ☐☐☐ Socks (pair)
- ☐☐☐ Wristlets (pair)
- ☐☐☐ Comfort Gloves (pair)

EVA 2 bag only:
- ☐ EV identifier stripes (EV1)
- ☐ Mission patch (STS-128)
- ☐ US flag

☐ 6 DIDBs (leave near top of bag for FD3 fill)

**Add to Bag D from Temp Stow Location**

☐ EMU Servicing Kit s/n 5002

**Add to Bag D from FDF and SODF Lockers**

☐ ISS EVA Systems Checklist (no colored stripe)
☐ FDF: EVA Checklist (Orange stripe)
☐ Consumables Tracking CC/Battery Recharge Graphic
☐ Expedited Suit Doffing/Emergency Transfer CC
☐ Cuff C/L (St)
☐ Ammonia Contamination CC

**Tied to Bag D**

☐ ECOK (Fg) – Mesh Bag

☐☐ Fg EVA 2 & 3 Ziplock Bags
- ☐☐ 2 per EVA, MAGs (w/Ziplock Bags)
- ☐☐ TCUs (top, bottom)
- ☐☐ Socks (pair)
- ☐☐ Wristlets (pair)
- ☐☐ Comfort Gloves (pair)
- ☐☐ Moleskin

EVA 3 bag only:
- ☐ EV identifier stripes (EV2)
- ☐ Mission patch (STS-128)
- ☐ Swedish flag

☐ Mesh Bag – 1

**POST-DOCKING EVA TRANSFER AND RECONFIG** (60 min)

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

1. Transfer following EVA equipment from Shuttle to ISS:

| 1.Item | Initial Location (On Shuttle) | Final Destination (On ISS) |
|---|---|---|
| ☐ EMU 3015 (Ol) | Shuttle A/L | E-Lk Aft EDDA |
| ☐ EMU 3009 (Fg) | Shuttle A/L | Node 1 |
| ☐ 5MLE Bag D | Middeck | Node 1 |
| ☐ EVA Task Mesh Bag | Middeck | Node 1 |

2. Gather following items and stow in EVA Return Mesh Bag for eventual transfer back to Shuttle:

| Item | Initial Location (On ISS) |
|---|---|
| ☐ ISS EVA Systems Checklist | Crew Preference |
| ☐ Ammonia Contamination Cue Card | IV Bag |
| ☐ ☐ (2) NH3 DTED Protective Containers | Contamination Detection Kit In IV Bag |

3. Deploy items from EVA Task Mesh Bag as follows. Additional items will be deployed during EVA Tool Config

| Item | Initial Location | Final Destination (On ISS) |
|---|---|---|
| ☐ EMU Battery s/n 2082 | EVA Task CTB in EVA Task Mesh Bag | M-O2 1038 |
| ☐ ☐ EMU LiOH Canisters (2) | | M-O2 1038 |
| ☐ ☐ NH3 DTED Protective Containers (2) | | Contamination Detection Kit In IV Bag – See step 4 |
| ☐ EMU LiOH Canister (1) | EVA Task Mesh Bag | EMU 3005 (St) Ref. 1.515 EMU Metox/LiOH/ Battery Replacement |

4. Remove tape from new NH3 Protective Containers

5. Retrieve the following items from Bag D and deploy at indicated ISS locations:

| Item | Initial Location (On ISS) | Final Location (On ISS) |
|---|---|---|
| ☐ Cuff Checklist (St) | Bag D | EMU 3005 (St) Left Arm |
| ☐ ISS EVA Systems Checklist (no colored stripe) | | Crew Pref |
| ☐ FDF: EVA Checklist (Orange stripe) | | Crew Pref |
| ☐ Ammonia Contamination Cue Card | | IV Bag |
| ☐ Consumables Tracking Cue Card & Battery Recharge Graphic | | Crew Pref |
| ☐ Expedited Suit Doffing & Emergency Transfer Cue Card | | Crew Pref |
| CTB 1488 (St) | Bag D | Bag D |
| ☐ EMU Boots s/n 231 | CTB 1488 | MO-2 1010 |
| ☐ EMU Lower Arms s/n 371/372 | | MO-2 1010 |
| ☐ SSER Antenna Cable (in CTB lid) | | EMU Equipment Bag |
| ½ CTB 1490 (St) | Bag D | Bag D |
| ☐ EMU Gloves s/n 6283 (St 1) – pair<br>☐ EMU Glove Covers – pair | ½ CTB 1490 | EMU 3005 (St)<br>Stow covers in EMU Cover CTB: A/L1DO – behind closeout |
| ☐ Comm Cap s/n 1202 (St 1) | | EMU 3005 (St)<br>Install in suit |
| ☐ St ECOK | Bag D | Near Bag D |
| ☐ Fg ECOK | Tied to Bag D | Bag D |

6. Install EMU TV Assembly (from EVA Return Mesh Bag) on EMU 3015 (OI) (reference 1.403 REBA Powered Hardware Checkout for cable routing)

7. Time permitting, proceed to REBA Install, REBA Powered Hardware Checkout, and EVA Tool Config

During REBA INSTALLATION:

8. Verify and report installed LiOH and EMU Batteries per s/ns on:
   <u>STS-128 EVA CONSUMABLES TRACKING CUE CARD</u>

**EMU SWAP FOR EVA 2** (St → Fg) (45 min)

NOTE

This procedure assumes the following procedures have been completed following EVA 1:
{1.240 POST EVA} (SODF: ISS EVA SYS: EVA PREP/POST)
{1.605 BSA BATTERY RECHARGE - term} (SODF: ISS EVA SYS: BATTERY OPS)
{1.605 BSA BATTERY RECHARGE - init} (SODF: ISS EVA SYS: BATTERY OPS)

EMU 3005 (St)

1. Connect waist ring to HUT
2. Reconnect gloves
3. Remove EMU TV; temp stow in ISS Equipment Lock
4. Remove Helmet Lights and stow in EVA Return mesh bag
5. Remove Comm Cap (St 1); stow in St ECOK
6. √Sun shades down, cover installed
7. Remove EMU from Fwd EDDA
   Report stowage location to **MCC-H** as comm permits

EMU 3009 (Fg)

8. Install on Fwd EDDA
9. Install EMU TV (reference 1.403 REBA Powered Hardware Checkout for cable routing)
10. Install REBA per STS-128 EVA CONSUMABLES TRACKING CUE CARD (reference 1.307 REBA Installation/Removal)

EMU 3015 (Ol)

11. Install EMU Battery and LiOH Canister (CCC) per STS-128 EVA CONSUMABLES TRACKING CUE CARD. Place expended LiOH (CCC) in EVA Return Mesh Bag
12. Place LCVG s/n 3191 (St 1) in St ECOK
13. Remove Signal Conditioner s/n 121 from old EMU Servicing Kit and ziplock bag labelled “WL ORLAN Fresnel Lenses” from St ECOK. Place the signal conditioner and ziplock bag in WL ECOK (expected to be in JLP) and stow St ECOK nearby

**POST EVA EMU RECONFIG AND TRANSFER** (150 min)

NOTE

Figures in the Nominal Sizing Matrix FS 12-29 may be used for reference.
This procedure assumes the following procedure has been completed following EVA 3:
{1.240 POST EVA} (SODF: ISS EVA SYS: EVA PREP/POST)

| | | |
|---|---|---|
| EMU 3015 | 1. | Reconnect gloves |
| | 2. | Remove Helmet Lights and EMU TV<br>Install on EMU 3006 |
| | 3. | √Helmet installed, sun shades down, cover installed |
| | 4. | Insert OI LCVG into EMU 3015 |
| | 5. | Connect LTA to EMU |
| | 6. | Disconnect Boots s/n 230; temp stow |
| | 7. | Disconnect Legs s/n 233/234 and Leg Sizing Rings s/n 121/122 from LTA |
| | 8. | Retrieve Legs s/n 185/186 and Leg Sizing Rings s/n 141/142 from EVA Return mesh bag<br>Install on EMU<br>Stow Legs s/n 233/234 and Leg Sizing Rings s/n 121/122 in MO-2 1010 using covers just removed |
| | 9. | Install Boots s/n 230 on EMU |
| | 10. | Remove EMU 3015 from aft EDDA and temp stow for transfer to shuttle |
| EMU 3009 | 11. | Remove the following and stow in MO-2 s/n 1038:<br>☐ Metox Canister<br>☐ EMU battery (s/n 2080) |
| | 12. | Install Vent Port plugs |
| EMU 3005 | 13. | Install in aft EDDA |
| | 14. | Install EMU battery s/n 2079 |
| EMU 3009 | 15. | Remove helmet and disconnect Comm Cap s/n 1170 (Fg)<br>Reinstall helmet |
| EMUs 3005, 3009 | 16. | Remove helmet from EMU 3005 and install Comm Cap s/n 1170 (Fg)<br>Reinstall helmet |
| | 17. | Remove Fg LTA from EMU 3009 and St LTA from EMU 3005 |
| | 18. | Place Fg LCVG in EMU 3005 |
| | 19. | Install Fg LTA on EMU 3005 and St LTA on EMU 3009 |

20. Remove Arm Rings s/n 142/158, Lower Arms s/n 351/352, and EMU gloves s/n 6283 (St 1), all connected to each other, from EMU 3005; temp stow

21. Remove EMU gloves s/n 6197 (Fg 1) from EMU 3009; temp stow

22. Remove Lower Arms s/n 377/378 from EMU 3009. Take covers from Lower Arms s/n 309/310 (in EVA Return mesh bag), install on Lower Arms s/n 377/378, and stow in MO-2 1010. Temp stow Lower Arms s/n 309/310

23. Remove Arm Rings s/n 122/123 from EMU 3009 and install on EMU 3005

24. Install Lower Arms s/n 309/310 on EMU 3005 and then EMU gloves s/n 6197 (Fg 1)

25. Install arm assemblies (arm ring, lower arm, gloves) for St on EMU 3009

26. On EMU 3005 Helmet, put sun shades down, install cover

27. Remove EMU 3005 s/n 1078 from aft EDDA and temp stow for transfer to shuttle

28. Gather items listed below into specified bags. Transfer bags and EMUs to shuttle. Report transfer complete to **MCC-H**

**EVA Return Mesh Bag**

- ☐ EVA Task CTB
  - ☐ EMU Battery s/n 2076
  - ☐☐ EMU LiOH Canister (2)
  - ☐ BMRRM Tool (s/n 1003)
  - ☐ Fastener Retention Tool (s/n 1002)
  - ☐☐ NH3 DTED Protective Containers (2)
- ☐ EMU LiOH Canister
- ☐☐ Helmet Light Assemblies (2) (s/n 1004, 1006)
- ☐ ISS EVA Systems Checklist (no colored stripe)
- ☐ FDF: EVA Checklist (Orange stripe)
- ☐ Consumables Tracking Cue Card/Battery Recharge Graphic
- ☐ Expedited Suit Doffing/Emergency Transfer Cue Card
- ☐ Old Ammonia Contamination Cue Card

| **EMU 3015 (OI)** | **EMU 3005 (Fg)** |
|---|---|
| ☐ DIDB Restraint Bag | ☐ DIDB Restraint Bag |
| ☐ Comm Cap (OI 1) | ☐ Comm Cap (Fg 1) |
| ☐ Helmet (√sun shade down, cover installed) | ☐ Helmet s/n 1078 (√sun shade down, cover installed) |
| ☐ Valsalva | ☐ Valsalva |
| | ☐ Fresnel Lense |
| ☐ EMU Gloves (OI 1) | ☐ EMU Gloves (Fg 1) |
| ☐ Cuff C/L | ☐ Cuff C/L |
| ☐☐ Wrist Mirror (2) | ☐☐ Wrist Mirror (2) |
| ☐ EMU Battery | ☐ EMU Battery |
| ☐ CCC | ☐ CCC |
| ☐ LTA | ☐ LTA |
| ☐ LCVG | ☐ LCVG |

## **POST EVA EMU RECONFIG AND TRANSFER** (150 min) (Cont)

| **Bag D** | |
|---|---|
| **Items Returning in Bag D** | **From EVA Return Mesh Bag** |
| ☐☐☐ EMU Gloves – 3 pair (Ol 2, Fg 2, Fr)<br>☐ EMU Servicing Kit s/n 5005<br><br>☐ ECOK (Ol) – Mesh Bag<br>☐☐☐ Ol EVA 1, 2 & 3 Ziplock Bags<br>☐☐☐ 2 per EVA, MAGs (w/Ziplock Bags)<br>☐☐☐ TCUs (top, bottom)<br>☐☐☐ Socks<br>☐☐☐ Wristlets<br>☐☐☐ Comfort Gloves<br>EVA 2 bag only:<br>☐ EV identifier stripes (EV1)<br>☐ Mission patch (STS-128)<br>☐ US flag<br>☐ ECOK (Fg) – Mesh Bag<br>☐☐ Fg EVA 2 & 3 Ziplock Bags<br>☐☐ 2 per EVA, MAGs (w/Ziplock Bags)<br>☐☐ TCUs (top, bottom)<br>☐☐ Socks<br>☐☐ Wristlets<br>☐☐ Comfort Gloves<br>☐☐ Moleskin<br>EVA 3 bag only:<br>☐ EV identifier stripes (EV2)<br>☐ Mission patch (STS-128)<br>☐ Swedish flag<br><br>☐ CTB 1488 (St)<br><br>☐ 1/2 CTB 1490 (St)<br>**From EVA Return mesh bag**<br>**☐ ☐ Comm Caps – 2 (Mk 2, Wk 1)** | ☐☐ LCVGs – (Ko 1, Wf 2) |

## **EVA UNPACK AND STOW** (60 min)

NOTE
This procedure assumes that transfer items were preconfigured per POST EVA EMU RECONFIG AND TRANSFER

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

| Item | Initial Location (After Transfer) | Final Destination (On Shuttle) |
|---|---|---|
| EMU 3015 (OI) | | Stbd – AAP |
| EMU 3005 (Fg) | | Port – AAP |
| EMU Servicing Kit | Bag D | Vol H Inboard (MD23R) |
| ☐☐ Helmet Light Assemblies | EVA Return Mesh Bag | Vol H Inboard (1)<br>Vol H Outboard (1) |
| EVA Task CTB<br>☐ EMU Battery s/n 2076<br>☐☐ EMU LiOH Canister (2)<br>☐ BMRRM Tool (s/n 1003)<br>☐ Fastener Retention Tool (s/n 1002)<br>☐☐ NH3 DTED Protective Containers (2) | | Airlock Floor bag |
| ☐ ISS EVA Systems Checklist (no colored stripe) | | SODF Locker |
| ☐ Expedited Suit Doffing/Emergency Transfer Cue Card | | |
| ☐ Consumables Tracking Cue Card/Battery Recharge Graphic | | |
| ☐ Ammonia Contamination Cue Card | | |
| ☐ FDF: EVA Checklist (Orange stripe) | | FDF Locker |
| ☐☐ 85-ft Safety Tethers (s/n 1003,1006) | | Airlock Floor bag |
| ☐ EMU LiOH Canister | | |

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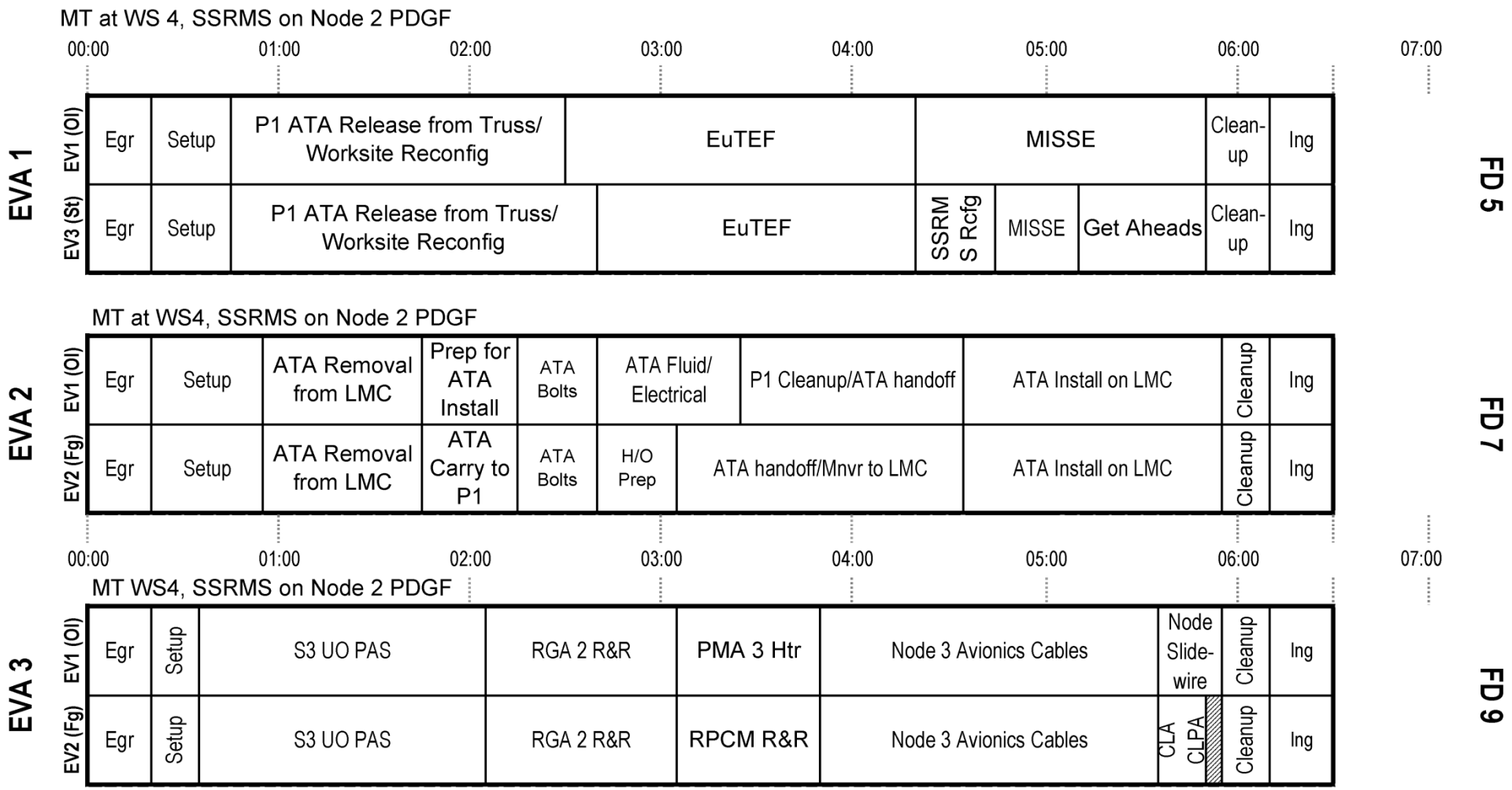
## STS-128 ISS-17A EVA TIMELINES



## EVA 1 SUMMARY TIMELINE

| TIME | IV | EV1 (FF) | EV2 (FF/SSRMS) |
|---|---|---|---|
| 00:00-00:05 | | POST DEPRESS (00:05) | POST DEPRESS (00:05) |
| 00:05-00:20 | | EGRESS (00:15) | EGRESS (00:15) |
| 00:20-00:45 | | P1 ATA RELEASE FROM TRUSS (02:10)<br>• P1 ATA Worksite Setup (00:25)<br>• P1 ATA Release from Truss (01:30) | P1 ATA RELEASE FROM TRUSS (02:20)<br>• P1 ATA Worksite Setup (00:25)<br>• P1 ATA Release from Truss (01:30) |
| 00:45-02:15 | | | |
| 02:15-02:30 | | • P1 ATA Worksite Reconfig (00:15) | • P1 ATA Worksite Reconfig (00:25) |
| 02:30-03:20 | | MISSE 6/EUTEF RETRIEVAL SETUP (00:50) | EUTEF PREP FOR REMOVAL (00:40) |
| 03:20-04:20 | | EUTEF RETRIEVAL AND STOW ON LMC (01:00) | EUTEF RETRIEVAL AND STOW ON LMC (01:00) |
| 04:20-05:50 | | MISSE 6 RETRIEVAL AND STOW IN PLB (01:30) | SSRMS RECONFIG (00:25)<br>MISSE 6 BENT PEC STOW IN PLB SIDEWALL CARRIER (00:25)<br>GET-AHEADS (00:40) |
| 05:50-06:10 | | CLEANUP (00:20) | CLEANUP (00:20) |
| 06:10-06:30 | | INGRESS (00:20) | INGRESS (00:20) |
| 06:30 | | | |

# EVA 1 BRIEFING CARD

EV1 _____
EV2 _____
IV _____
R1/M1 _____

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

**Flight Day Prior to EVA – General Briefing (All)**

1. EVA Prep
   - ❑ Get-up Plan – clothing and EMU equipment bag – EV1
   - ❑ Prebreathe protocol review (Notes and Warnings) – IV
   - ❑ Equipment lock activities – IV responsibilities
   - ❑ Suit donning plan – special requests – EV's, IV's
   - ❑ SAFER, MWS, tools, C-Lk positions, bag stowage – EV2
   - ❑ Airlock depress review – IV

2. EV Crew Procedure Review – EV1
   - ❑ Egress Plan
   - ❑ Order of tasks (summary timeline)
   - ❑ Translation plan, fairleads, and tether swaps
   - ❑ Hazards
   - ❑ Ingress Plan

3. Robotics – R1/M1
   - ❑ SRMS/SSRMS initial position, maneuvers, clearances
   - ❑ Coordinate Frames
   - ❑ SRMS/SSRMS comm protocol review – expected calls, use first names
   - ❑ GCA – when, where, handover language
   - ❑ Cameras
   - ❑ Contingencies
     - Suit anomalies while ingressed

**Flight Day Prior to EVA – Additional Briefing (EV, IV)**

4. Communications – CDR, IV
   - ❑ Overall setup: Big loop, A/G2, S/G2, ICOM, Hardline, remind EV crew when mode swapping
   - ❑ EV/IV comm protocol review – Use EV1(2) for DCM sw throws (all time in A/L), use first names otherwise

5. General Procedure Review – EV1
   - ❑ Get-ahead tasks
   - ❑ Constraints – ground and flight – IV
   - ❑ Notes, Cautions, and Warnings review – IV
   - ❑ Contingency procedures – crib sheet

6. Emergencies Review – EV1
   - ❑ Emergency suit doff and power down during EVA prep
   - ❑ Loss of comm
   - ❑ EMU malfunctions
   - ❑ Lost tools
   - ❑ Lost crewmember
   - ❑ DCS
   - ❑ Abort and Terminate scenarios, protocols
   - ❑ Hand signal reviews

7. Post EVA – IV's
   - ❑ Suit doffing responsibilities
   - ❑ Post EVA plan

√Expedited Suit Doffing cue card pre-positioned for EVA day

# EVA 1 BRIEFING CARD (Cont)

**EVA Day, prior to Prebreathe Protocol**

1. Reminders
   - ❑ Translate slow (then space is like water). Relax grip
     - o Be extra careful on non-standard routes or orientations
     - o Don't hop
   - ❑ Tether Discipline
     - o Check all gates closed and hooks locked; check reel locked/unlocked
     - o Local tether when stopped. Check tethers before you leave
     - o When something is attached to a tether, don't grab the tether by the hook
     - o Good pull tests
   - ❑ APFR ops
   - ❑ Be disciplined when tired
   - ❑ Hazards: Payloads, etc
   - ❑ Openness: When you have boot or glove pain let us know
   - ❑ OK for IV and ground to check on us. If you need update, ask
   - ❑ Monitor safety tether. Hold peanut when necessary
   - ❑ Let mistakes pass
   - ❑ If you get a mal, read the caution and warning message so everyone knows what it is
   - ❑ Manage frustration (slow down, if needed)
   - ❑ Cold soak before ingress
   - ❑ Verify PGT settings. PGT collars are easy to bump
   - ❑ Read turns, torque, green light
   - ❑ SSRMS: Coordinate frames and positive GCA handovers
   - ❑ Review first post-egress steps
   - ❑ Review abort/terminate priorities and procedures
   - ❑ Glove Checks
   - ❑ Day/night reconfigurations
   - ❑ Translation Adaptation plan

**IV Checklist Verification Items**

1. Generic
   - ❑ Day/Night Cycles
     - • √Lights, visors, gloves and heaters, tethers, and MWS
   - ❑ √Load Alleviating Strap on Safety Tethers not damaged
     - • Crew report: "**Bail closed, slider locked, tether reel unlocked**"
   - ❑ √Safety Tether Crew Hook Slidelocks are locked
     - • Crew Report: "**Locked and locked**"
   - ❑ √Both SAFER valves down at egress
     - • Crew Report: "**Both handles down**"
   - ❑ √APFR locking collar Black-on-black and pull test
     - • Crew Report: "**Black-on-black, good pull test**"
   - ❑ √PGT Green light on for bolt engage
     - • May get Lo Torque msg at bolt release
     - • Crew Report: "**XX turns, green light, XX ft-lb"**
   - ❑ √Latches closed on lid, door, etc (i.e., √in landing config)
     - • Crew Report: "**XX Latches done**"
   - ❑ √Connectors for no bent pins, no FOD, inhibits in place
     - • Crew Report: "**Pins good, no FOD, good EMI band, good bend radius**"
     - • Crew Report: "**Are inhibits in place?**"

2. Task Specific
   - ❑ √Tethers and Tools clear prior to SSRMS ORU movement
     - • Each EV report: "**Tethers and tools clear**"

3. Tool inventory
   - ❑ √Tethers on MWS
   - ❑ Confirm all others as standard unless removed

# EVA 1 TOOL CONFIGURATION

## EV1

EMU D-rings
- ❑ Ext on left side
- ❑ Ext on right side
- ❑ Waist Tether (left Ext to MWS, √locked)
- ❑ Waist Tether (right D-ring to MWS, √locked)
- ❑ 85-ft Safety Tether (left D-ring, √locked)

MWS
- ❑ Small STS Trash Bag
  - ❑ Wire tie (secure trashbag to MWS, tether loop)
- ❑ 1 – Wire tie as tether loop
- ❑ 1 – RET (with PIP pin)
- ❑ 2 – RETs
- ❑ 1 – Adj Fuse Tether (tucked behind MWS)
  - ❑❑ 2 – 1/2" QD Caps
  - ❑❑ 2 – 1/4" QD Caps
- ❑ 1 – Adj Equipment Tether (across back of MWS)
- ❑ Swing Arm (right side)
  - ❑ 1 – RET (attach to PGT; block to swingarm)
    - ❑ 1 – PGT s/n 1002 w/6"-Ext-7/16"
- ❑ BRT (left side; ensure int tether not thru AFT)
  - ❑ 1 – RET
  - ❑❑ 2 – short wire ties

EMU Gloves
- ❑❑ 2 – Adj Equipment Tethers

**Prior to EVA, perform the following hardware inspections:**
1. RET cords for fraying
2. No red line visible, damage, or discoloration on safety and waist tether load alleviation straps
3. Inspect ISS trash bags for deformation/damage
4. Inspect EMU gloves for damage
5. Inspect BRT for loose screws

**Use BLUE RETs only**

## EV2

EMU D-rings
- ❑ Ext on left side
- ❑ Ext on right side
- ❑ Waist Tether (right Ext to MWS, √locked)
- ❑ Waist Tether (left D-ring to ERCM, √locked); Dbl Tether
- ❑ 85-ft Safety Tether (left Ext, √locked)

MWS
- ❑ Small Trash Bag
  - ❑ Wire tie (secure bayonet closed; tether loop)
- ❑ 1 – Wire tie as tether loop
- ❑ 1 – RET (with PIP pin)
- ❑ 1 – RET
- ❑ 1 – Adj Equipment Tether (on MWS D-ring for fairlead)
- ❑ 1 – RET (attach to WIF Adapter)
  - ❑ WIF Adapter (attach to wire tie loop w/MWSEE)
- ❑ Swing Arm (right side)
  - ❑ 1 – RET (attach block to PGT)
    - ❑ 1 – PGT s/n 1006 w/6"-Ext-7/16"
  - ❑ 1 – RET (attach to ratchet wrench)
    - ❑ EVA ratchet wrench w/2"-Ext-7/16" (no PW)
- ❑ BRT (left side)
  - ❑ 1 – RET
  - ❑❑ 2 – short wire ties

EMU Gloves
- ❑ 1 – Adj Equipment Tether (on left glove)

CREWLOCK
- ❑ D-ring extender on A/L D-ring

- ❑ Spare EV1 85-ft safety tether (stowed in crewlock)

- ❑ Sm-Sm RET (attached to Aft UIA tether point)
  - ❑ Long Wire Tie (for install on A/L external HR)

CREWLOCK
- ❑ D-ring extender on A/L D-ring

- ❑ Lg-Sm RET
  - ❑ ATA Crewlock Bag
    - ❑ EVA ratchet wrench w/2" Ext 7/16"
    - ❑ Round Torque Multiplier
      - ❑ 5/8" Proud Socket
    - ❑ Digital Camera w/bracket
    - ❑ BRS Pin Tool
    - ❑ Spare EV2 55-ft safety tether (stowed on bag outside)
    - ❑ Spare EV2 85-ft safety tether (stowed on bag outside)

- ❑ Lg-Sm RET
  - ❑ Small ORU Bag – MISSE
    - ❑ 1 – Adj Equipment Tether
      - ❑ BMRRM Anti-Rotation Latch Tool
    - ❑ 1 – Adj Equipment Tether
      - ❑ EVA Prybar
    - ❑ 1 – Adj Equipment Tether
      - ❑ EVA Hammer
    - ❑ 1 – Adj Equipment Tether
      - ❑ HST Fastener Retention Tool
    - ❑ 1 – Adj Equipment Tether
      - ❑ CLA Cover MLI Case
    - ❑ 1 – RET
      - ❑ CLA Cover (in MLI Case)
  - ❑ 1 – Adj Equipment Tether (stowed on bag outside)

- ❑ Lg-Sm RET
  - ❑ PMA3 Crewlock Bag
    - ❑ 1 – Wire tie caddy
      - ❑❑❑❑❑❑❑❑❑❑ – Short wire ties (in caddy)
    - ❑❑❑ 3 – PMA3 HTR Cable Caps (size 15,17,25 integrated together w/long wire tie)
    - ❑ 1 – MMOD Shield Handling Tool

## **EVA 1 TOOL CONFIGURATION** (Cont)

Staging Bag

- ❑ Adjustable Fuse Tether #1
  - ❑ Socket Caddy (hook #1)
    - ❑ 6" wobble EXT
    - ❑ RAD
  - ❑ Velcro/Tape Caddy (hook #2)
  - ❑ PGT s/n 1008 (hook #3)
    - ❑ PGT Battery s/n _____
  - ❑ Vice Grips (hook #4)
  - ❑ WIF Adapter (hook #5)
  - ❑ Empty (hook #6)
  - ❑ Empty (hook #7)
- ❑ Adjustable Fuse Tether #2
  - ❑ Spare Torque Wrench w/MLI (hook #1)
  - ❑ Connector Cleaner Tool Kit (hook #2)
  - ❑ Pin Straightener Assy (hook #3)
  - ❑ Probe (hook #4)
  - ❑ Empty (hook #5)
  - ❑ Empty (hook #6)
  - ❑ Empty (hook #7)
  - ❑ MMWS Key Strap Assembly (on wire tie to strap)

IV Bag

- ❑ 2 – Towels w/wire ties
- ❑ Contamination Detection Kit w/watch
- ❑ 2 – GP Caddy
  - ❑ 2 – Adj Thermal Mittens
- ❑ 3 – RET (black, must stay in IV bag)
  - ❑ Socket Caddy (hatch cont)
    - ❑ 1/2 socket 8-in ext (hatch)
  - ❑ DCM plug (2) (SAFER hardmount)

# EVA 1 INHIBIT PAD

Orbiter

TCS *(Prior to Egress)*
IV L12 1. √TCS POWER – OFF

TriDAR *(Prior to Egress)*
IV SSP2 1. √TRIDAR POWER – OFF

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

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

LMC EUTEF PFRAM *(Prior to Install on LMC)*
IV R1 1. √PL AFT MNC - OFF

Ground

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

USOS

PCU *(Prior to Egress)*

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

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

Lab Window *(Prior to MISSE and EUTEF Tasks)*
IV If EV crew less than 10 feet from window or in window FOV, close window shutter.

S-Band (SASA) Antennas *(Prior to Egress)*
**MCC-H** If EV crew < 3.6 feet from P1 SASA
1. S1 SASA – Active
2. P1 SASA – Powered down

TRRJ *(Prior to Egress)*
**MCC-H** 1. √P1 TRRJ DLA (1) – LOCKED at -40 degrees

ATA *(See Detailed Procedure for timing of inhibits)*
**MCC-H**/IV 1.104 P1 ATA REMOVAL AND REPLACEMENT PREP (SODF:ASSY OPS:17A)

PMA3 Heater Cable *(Prior to Egress)*
**MCC-H** 1. √RPCM N1RS2_B RPCs 1-5, 12-15, Open, Close Cmd Inh

## **EVA 1 INHIBIT PAD** (Cont)

USOS (Cont)

EuTEF
*(Prior to Egress)*

**COL-CC** 1. √PLEGpay Power Status (ETF_PLEGPAY_Pwr_Stat) – OFF
*(1:00 Prior to Driving Main FRAM Bolt)*
2. EuTEF FEEDER 1 Power – OFF
*(Prior to Driving Main FRAM Bolt – estimate 30 minutes for commanding)*
3. SOLAR FEEDER 1 Power – OFF
4. SOLAR and EuTEF FEEDER 2 (heater) Power – OFF
5. PDU 1 OUTLET 3 : SSPC 1 – OFF
SSPC 2 – OFF
SSPC 3 – OFF
SSPC 4 – OFF
6. PDU 2 OUTLET 3 : SSPC 1 – OFF
SSPC 2 – OFF
SSPC 3 – OFF
SSPC 4 – OFF
7. Sys Bus Cntl Stat – DISABLED
IV 8. PPSB PL OX 1 SWITCH – DISCHARGE
PPSB PL OX 2 SWITCH – DISCHARGE

MISSE 6
*(Prior to Demating Electrical Connectors)*

**COL-CC** 1. PDU 2 OUTLET 3 : SSPC 1 – OFF
SSPC 2 – OFF
SSPC 3 – OFF
SSPC 4 – OFF
2. Sys Bus Cntl Stat – DISABLED
IV 3. PPSB PL DN 1 SWITCH – DISCHARGE
PPSB PL DN 2 SWITCH – DISCHARGE

RSOS

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

IMPULSE *(Prior to Egress)*
IMCC-M 1. IMPULSE (ИПИ-100) – Is not activated

JEM

ICS-EF Antenna *(Prior to Egress)*
**SSIPC** 1. ICS MOD – OFF
2. ICS UPC – OFF
3. ICS HPA – OFF

## EVA 1 NOTES, CAUTIONS, WARNINGS

NOTES

1. Bolt install: Report torque and turns
2. Bolt release: Report torque and turns if different from published range
3. EVA connectors: After disconnection and prior to connection; verify pin and EMI band integrity; verify connector free of FOD
4. Inspect QDs for damage prior to mating
5. Toolbox doors must be closed with one latch per door when EV crew not in immediate vicinity
6. Avoid contact with OBSS striker bars (Vitrolube coating)
7. 85-ft safety tether retract force may affect body positioning

CAUTION

**ISS Constraints**

A. Avoid inadvertent contact with
   1. Grapple fixture shafts (drylube)
   2. PIP pins
   3. EVA Crane [PMA1]
   4. TCS Reflectors [PMA2,PMA3]
   5. APAS hardware [PMA2,PMA3]
   6. CETA Lights (Z-93 paint) [LAB,S1,Node 1]
   7. Deployed MISSEs [Columbus EPF]
   8. Passive UMAs
   9. MBS/SSRMS/SPDM/JEMRMS taped radiative surfaces: VDU, ACU, JEU, LEU, MCU, CRPCMs, and Cameras
   10. Deployed TUS cable [Nadir CETA rail]
   11. S0 aft face Radiator
   12. GPS Antennas (S13 paint) [S0,JLP]
   13. UHF Antennas [LAB,P1]
   14. ETCS Radiator flexhoses and panels [S1,P1]
   15. EETCS/PV Radiator flexhoses, bellows and panels [P6,P4,S4,S6]
   16. SASA RF Group [S1,P1]
   17. Heat pipe radiators [Z1]
   18. PCU cathode and HCA ports [Z1]
   19. Ku-Band Antenna (SGANT) dish [Z1]
   20. CMG cover/shells [Z1]
   21. SPDM SJEU, EP, OTCM, LEU, and LEE VDU Radiator surfaces
   22. Open CBM petal covers, LAB window shutter, and JPM window shutter
   23. FPMU [S1]
   24. OTSD
   25. JTVE, WVE/EVE, JEF VE Cameras [JEM]
   26. JEM A/L Target and Pins

CAUTION (Cont)

**ISS Constraints** (Cont)

A. Avoid inadvertent contact with (Cont)
   27. S0/Node 2 Fluid Tray Hardlines at Node 2 end are limited to 25 lb
   28. JEF ORUs and EFUs (paint & lubricant)
   29. MAXI front and top panel (paint)
   30. SEDA-AP sensors (HIT, SDOM, & AOM) and MPAC & SEED
   31. Trunnions and UCMs (paint & lubricant) [JEF Payloads]

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

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

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

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

CAUTION (Cont)

**ISS Constraints** (Cont)

E. For structural reasons
   1. Avoid vigorous body motions, quick grabs and kickoffs against tether restraints
   2. Avoid performing shaking motions (sinusoidal functions) more than four cycles
   3. Avoid kicking S1/P1 radiator beam. If any of these occur, wait 2 to 5 min to allow structural response to dissipate
   4. Avoid tool impact on ICS-EF sensor
   5. Avoid kicking MMOD shields between JLP and JPM

F. Other
   1. ITT Cannon connector: On demated connectors, do not rotate collar or manipulate cable/connector using collar or connector tool
   2. WIS Antennas: Do not use as handholds [Node 1,Lab,P6,Z1]
   3. Lubricant from Ku-Band SGANT gimbals [Z1], CMGs [Z1], and RTAS Ground Strap fasteners [P6,P4,S4,S6] can contaminate EMU
   4. MLI handholds are not rated for crewmember translation loads
   5. CBM petal covers may not be used as handholds unless both launch restraint pins are engaged
   6. Prevent inadvertent contact of the tether shuttle with ETRS when the P3 Tether Shuttle Stop is raised away from the rail

CAUTION (Cont)

**Shuttle Constraints**

A. Avoid inadvertent contact with
   1. OBSS and SRMS Composite Sections Joint Torque Arms, Grapple Fixture Shafts, and Cable Harnesses
   2. LCS (silver Teflon) and LDRI (silver Teflon) and ITVC (gold foil) [OBSS]
   3. WVS Antenna [ODS Truss & PLB Sill]
   4. Payload Bay and Camera wire harnesses, cables, cable guides, and connectors

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

CAUTION (Cont)

**HTV/HTV EP Constraints**

A. Avoid inadvertent contact with
   1. EVA Cover [HTV] (does not meet EVA kick loads)
   2. Wheel guide [HTV] (snag hazard)
   3. HBCS (berthing camera) [HTV EP]
   4. HCSM (solid lubricant) [HTV EP]
   5. HCAM (solid lubricant) [HTV EP]
   6. EP PIU (solid lubricant and Black/White Paint) [HTV EP]

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

WARNING

**ISS Constraints**

A. Avoid inadvertent contact with
   1. Grapple fixture targets and target pins
   2. SSU, ECU, beta gimbal platform, mast canister, SAW blanket boxes unless the beta gimbal is locked and the motor is turned off
   3. Stay inboard of SARJ when active
   4. Stay 2 ft from S1/P1 radiator beam rotational envelope when beam is free to rotate
   5. Stay 5 ft from moving MT on face 1
   6. SOLAR and EuTEF [COL EPF]
   7. ICS-EF sensors

B. Handrails
   1. Handrails previously used for MISSE attachment may not be used as a safety tether point [A/L endcone 564 & 566, A/L Tank 2 nad/fwd & port/fwd, P6 5389]

C. Pinch
   1. NZGL connector linkage. Use caution when mating/locking
   2. ITT Cannon Connector rotating housing
   3. EV side of IV Hatch during Hatch operation (also snag hazard) [A/L]
   4. LAB window shutter and CBM petal cover and JPM window shutter linkages during operation
   5. JEMRMS HRM capture latches
   6. JEM Cameras (JVTEs, EVE, WVE, & JEF VEs)
   7. JEM EFBM capture latches
   8. JEM EFU latching arms
   9. JEF SSE latch
   10. ICS-EF antenna boom
   11. SEDA-AP Mast

WARNING (Cont)

**ISS Constraints** (Cont)

D. QDs
   1. If QD is in FID when valve is opened (bail fwd), QD will leak and fluid line may whip
   2. Do not rotate if in mated/valve open config

E. RF radiation exposure
   1. Stay 3.6 ft from S-Band (SASA) high gain Antenna when powered [S1,P1]
   2. Stay 1.3 ft from S-Band (SASA) low gain Antenna when powered [S1,P1]
   3. Stay 1 ft from UHF Antenna when powered [LAB,P1]
   4. Stay 0.3 ft from fwd/aft JPM PROX antenna

F. Sharp Edges
   1. Inner edges of WIF sockets
   2. APFR active WIF probes
   3. Mating surfaces of EVA connectors Avoid side loads during connector mating
   4. Back side of MMOD shield fasteners
   5. Spring loaded captive EVA fasteners (e.g., 6B-boxes, BMRRM, RTAS, SARJ Covers); the end of the spring may protrude
   6. PMA umbilical launch restraints-exposed bolt threads
   7. Adjustable Fuse Tether (Fish Stringer) buckles stowed in Node Bag
   8. Nickel coated braided copper Ground Straps may contain frayed wires [P6,P4,S4,S6]
   9. SPDM OTCM gripper jaws

WARNING (Cont)

**ISS Constraints** (Cont)

F. Sharp Edges (Cont)
   10. Solar Array Blanket Box [P6,S6]
   11. Keep hands away from SSRMS LEE/POA/SPDM LEE/JEMRMS EE opening, snares, and PDGF curvic coupling (teeth)
   12. Fastener threads on back of Z1 U-jumper male FQD panel, if nutplate cap missing
   13. Outboard MT rail attachment lug near P6 handrail 5333 and gap spanner
   14. P2 connector on EWIS box TAA-06 [Zenith/Forward Corner 1 of P5 – SARJ at 0 deg]
   15. Port/Aft portion of A/L circular HR [HR 0506]
   16. Interior of JEMRMS HRMs
   17. JEM A/L hatch corners
   18. ICS-EF AHM gears
   19. MAXI Visual Star Camera

G. Thermal
   1. EVA connectors with booties may become hot if left uncovered. Handling may need to be limited
   2. PMA handrails may be hot. Handling may need to be limited
   3. Turn off glove heaters when comfortable temp reached to prevent bladder damage. Do not pull fingers out of gloves when heaters are on
   4. Uncovered trunnion pins may be hot
   5. SSRMS/MBS/SPDM/JEMRMS/JVTE/ JEF VE operating cameras and lights may radiate large amounts of heat

WARNING (Cont)

**ISS Constraints** (Cont)

G. Thermal (Cont)

6. Stay ≥ 1 ft away from PMAs and MMOD shields > 270 degF if EMU sun visor up; limit time to 15 min or less if > 300 degF
7. Stay at least 0.5 ft away from PMA and MMOD shields > 325 degF
8. Do not touch EMU protective visor if temp has been < -134 degF for > 15 min
9. No EMU TMG contact with PMAs and MMOD shields > 320 degF
10. No EMU boot contact with foot restraint when temp < -120 degF or > 200 degF
11. Columbus end cones may violate touch temperature constraints when $-75 \leq \beta \leq -60$ or $60 \leq \beta \leq 75$V
12. PDGF surfaces may not meet touch temperature requirements for unlimited contact when $\beta \leq -70$ or $\beta \geq 70$
13. JPM port end cones and JLP port nadir may violate touch temperature constraints when $\beta > 60$ deg

H. Electrical Shock

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

WARNING (Cont)

**ISS Constraints** (Cont)

H. Electrical Shock (Cont)

   - MBS Cross-Connect jumpers (translate past these using UMA handrails) include S0 EVA Power Cables (inside S0 Bay 00 Face 4, Bay 01 Face 3) ESP-2 jumper (inside S0 Bay 03 Face 4)

2. Do not touch SPDM CLPA 1 electrical connector prior to camera installation

WARNING (Cont)

**Shuttle Constraints**

A. Arcing/Molten Debris

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

B. Pinch

1. PRLA operation [PLB]

C. RF radiation exposure

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

WARNING (Cont)

**Shuttle Constraints** (Cont)

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

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

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

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

WARNING (Cont)

**HTV/HTV EP Constraints**

A. Avoid inadvertent contact with
   1. HTV solar array panels (kick loads can shatter panel and generate sharp edges) [HTV]
   2. HTV fwd RCS thrusters [HTV]

B. Pinch
   1. HSM connector moving parts (pinch hazard and dry film lube) [HTV EP]
   2. EP wheels (pinch point) [HTV EP]

C. RF radiation exposure
   1. Stay 0.7 ft from IOS-N antenna [HTV]
   2. Stay 0.7 ft from IOS-Z antenna [HTV]
   3. Stay 0.3 ft from PLS-Z antenna [HTV]

D. Thermal
   1. EP/HTV handrails may be hot Handling may need to be limited

## EGRESS (00:15)

| IV/SSRMS | EV1 (Ol) | EV2 (St) |
|---|---|---|
| 1. Start recorders<br>2. √Initial Condition<br><br>3. WVS Software:<br>Select page – RF camera<br>Sel 'Advanced Controls'<br>S-Band Level (two) – Max<br>(required after EV1 and EV2 egress airlock) | **Initial Condition:**<br>Left waist tether to A/L D-ring extender<br>√Bails closed, sliders locked<br><br><u>EGRESS</u> (00:15)<br>1. Open A/L thermal cover<br>2. Egress A/L; avoid MMOD strike<br>3. Connect 85-ft safety tether to A/L fwd anchor point<br>√Both bails closed, sliders locked<br>√Reel unlocked<br>4. Release waist tether from A/L D-ring<br>5. Reposition A/L HR wire tie or install new long wire tie as reqd to cover HR no-touch area<br><br>6. Receive anchor hook of EV2 85-ft safety tether; connect to A/L aft anchor point<br>√Anchor bail closed, slider locked<br>7. Give EV2 GO to release EV2 waist tether<br><br>8. Receive ATA crewlock bag from EV2; stow on BRT<br><br>9. √SAFER MAN ISOL vlv – OP (dn) and HCM (dn)<br>√ERCA LED – On (if no video signal)<br>10. Inspect gloves | **Initial Condition:**<br>Right waist tether to forward UIA D-ring<br>√Bails closed, sliders locked<br><br><u>EGRESS</u> (00:15)<br><br>1. Transfer anchor hook of EV2 85-ft safety tether to EV1<br>√Load alleviating bail closed, slider locked<br>√Reel unlocked<br><br>2. On EV1 GO, release waist tether from UIA D-ring<br>3. Transfer ATA crewlock bag to EV1 (Lg/Sm RET stays in crewlock; attach sm hook to A/L DRE)<br>4. Reposition MISSE small ORU bag near hatch<br>5. Egress A/L<br>6. Close A/L thermal cover<br><br>7. √SAFER MAN ISOL vlv – OP (dn) and HCM (dn)<br>√ERCA LED – On (if no video signal)<br>8. Inspect gloves<br><br>9. Perform translation adaptation |

## P1 ATA RELEASE FROM TRUSS (02:20)

| IV/SSRMS | EV1 (OI) | EV2 (St) |
|---|---|---|
| 1. Verify P1 ATA REMOVAL AND REPLACEMENT PREP Parts 1 and 2 complete (SODF: ASSY OPS: 17A); EV crew GO to close/demate M1, M2, M3 and M4 | P1 ATA WORKSITE SETUP (00:25)<br>1. Translate to P1 ATA via aft S0 route; fairlead on S0 HRs 3434 (P) and 3519 (P)<br>2. Translate zenith over ATA<br>3. Stow ATA crewlock bag on P1 HR 3619<br><br>P1 ATA RELEASE FROM TRUSS (01:30)<br>4. Open shroud on port side of ATA<br>5. Preposition adj fuse tether to P1 HR 3607<br>6. BRT to P1 HR 3609 for QD operations<br>7. On IV/MCC GO, open thermal bootie, open TA clamps as reqd and close valve on QD F2/M3/M2 for NTA line – BLOCK B<br>8. Demate QD F2/M3/M2 from ATA M2 – **BLOCK C**; close thermal bootie around QD, stow clear of worksite<br>9. Install 1/4" QD cap on ATA M2<br><br>10. Open thermal bootie, open TA clamps as reqd and close valve on QD F174/M4 for NH3 line – BLOCK B<br>11. Demate QD F174 from ATA M4 – **BLOCK C**; close thermal bootie around QD, stow clear of worksite<br>12. Install 1/2" QD cap on ATA M4 | P1 ATA WORKSITE SETUP (00:25)<br>1. Translate to P1 ATA via nadir route; fairlead on S0 HR 3543 (R) and fwd of camera/light stanchion<br><br>P1 ATA RELEASE FROM TRUSS (01:30)<br>2. Ratchet Wrench: CCW, 2" -Ext-7/16"<br>3. BRT to P1 HR 3606 for bolt operations as reqd<br>4. Release Bolt 1 (nadir/stbd) free float, ~16 turns to a hardstop, √two white lines visible<br>5. Translate to port side of ATA; BRT to P1 HR 3610 for QD operations<br>6. On IV/MCC GO, open thermal bootie, open TA clamps as reqd and close valve on QD F1/M2/M1 for NTA line – BLOCK B<br>7. Demate QD F1/M2/M1 from ATA M1 – **BLOCK C**; close thermal bootie around QD, stow clear of worksite<br><br>8. Open thermal bootie, open TA clamps as reqd on QD F175/M3<br>9. Attach adjustable fuse tether hook to 1/2" SPD on QD F175/M3 and remove – BLOCK A<br>10. Close valve on QD F175/M3 for NH3 line – BLOCK B<br>11. Demate QD F175 from ATA M3 – **BLOCK C**; close thermal bootie around QD, stow clear of worksite<br>12. BRT to P1 HR 3621 for APFR relocation<br>13. Relocate APFR from P1-01 to P1-03 [6,WW,K,4]<br>□ Verify Black on Black<br>□ Perform pull test<br><br>14. Ingress APFR<br>15. Ratchet wrench: CCW, 2" -Ext-7/16"<br>or<br>PGT: **B6/CCW2/30.5**<br>(24.0 ft-lb, 30 RPM)<br>6" -Ext-7/16" |
| 2. Verify P1 ATA REMOVAL AND REPLACEMENT PREP Part 4 complete (SODF: ASSY OPS: 17A); EV crew GO to demate electrical connectors P634 and P635 | 13. Install 1/2" QD cap on ATA QD M3<br>14. Install 1/4" QD cap on ATA QD M1<br>15. Relocate adj fuse tether to NTA, to stow cables clear of the worksite<br>16. On IV/MCC GO, open TA clamps as reqd and demate connector P634 from ATA J1<br>17. Open TA clamps as reqd and demate connector P635 from ATA J2<br>18. Stow electrical cables on adj fuse tether<br>19. Use adj equipment tether to close shroud around exposed QDs | |

## P1 ATA RELEASE FROM TRUSS (02:20) (Cont)

| IV/SSRMS | EV1 (OI) | EV2 (St) |
|---|---|---|
| | 20. Retrieve ATA crewlock bag from P1 HR 3619; stow on BRT | 16. Release Bolt 2 (nadir/port), ~16 turns to hardstop, √two white lines visible |
| | 21. Connect long waist tether to P1-04 APFR roll pedal; verify setting [8,QQ,G,11]<br>22. Ingress APFR<br>23. Retrieve ratchet wrench w/2-in ext 7/16" from ATA crewlock bag<br>24. Reposition APFR as required to access Bolt 4<br>25. Ratchet wrench: CCW, 2" -Ext-7/16"<br>or<br>PGT: **B6/CCW2/30.5**<br>(24.0 ft-lb, 30 RPM)<br>6" -Ext-7/16" | 17. Attach RET to port/nadir ATA HR; lock RET to keep tether from retracting |
| 3. Verify SSRMS at pregrapple position | 26. Release Bolt 4 (zenith/stbd), ~16 turns to a hardstop, √two white lines visible | |
| | 27. Reposition APFR as required to access Bolt 3<br>28. On EV2 GO:<br>Ratchet wrench: CCW, 2" ext- 7/16"<br>29. Break torque on Bolt 3 (zenith/port) | 18. When in two-handed positive control of ATA, give EV1 GO to release Bolt 3 |
| | 30. PGT: **B7/CCW2/30.5**<br>(25.5 ft-lb, 30 RPM)<br>6" -Ext-7/16"<br>31. Release Bolt 3 (zenith/port),13.5-14.5 turns (bolt pops up when fully released) | |
| SSRMS: ATA Grapple | 32. Lift ATA aft, away from S0 (expect to overcome soft dock force)<br>33. Reposition ATA for SSRMS grapple of FGB<br>34. Give SSRMS GO to grapple ATA | 19. Lift ATA aft, away from S0 (expect to overcome soft dock force)<br>20. Reposition ATA for SSRMS grapple of FGB<br>21. Give SSRMS GO to grapple ATA<br>22. When grapple confirmed, retract and remove tether |
| | 35. Inspect gloves | 23. Egress APFR<br>24. Inspect gloves |

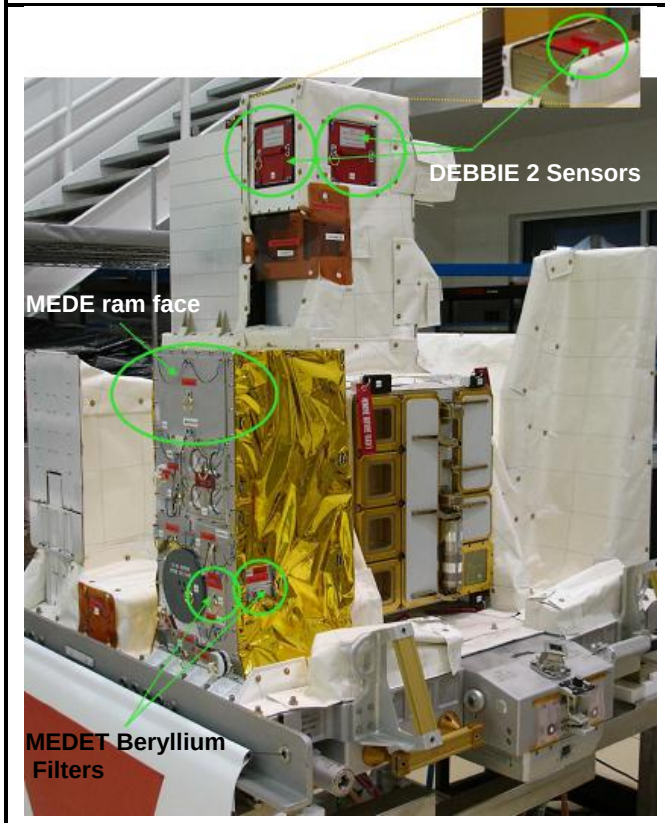
## P1 ATA RELEASE FROM TRUSS (02:20) (Cont)

| IV/SSRMS | EV1 (OI) | EV2 (St) |
|---|---|---|
| | P1 ATA WORKSITE RECONFIG (00:15) | P1 ATA WORKSITE RECONFIG (00:25) |
| SSRMS: GCA to APFR Installation Position | 36. Stow ratchet wrench in ATA crewlock bag<br>37. Reposition APFR as required and egress | 25. GCA SSRMS to APFR installation position as reqd<br>26. Retrieve WIF Adapter from MWS and install in SSRMS LEE as follows:<br>❑ Tether point facing same direction as LEE<br>❑ Install PIP Pin<br>❑ Install hitch pin through narrow shank side<br>❑ Perform pull test<br><br>27. Reconfigure APFR to [__,NN,F,6]<br>28. Remove APFR from WIF P1-03 and install in WIF Adapter on SSRMS [12,NN,F,6]<br>□ Verify Black on Black<br>□ Perform pull test |
| | 38. Receive ratchet wrench and RET from EV2 and stow in ATA crewlock bag<br>39. Stow both spare 85-ft safety tether and spare 55-ft safety tether on P1 HR 3607<br><br>40. Inspect gloves | 29. Transfer ratchet wrench and RET to EV1<br><br>30. Retrieve spare 55-ft safety tether from HR 3607 and temp stow on SSRMS<br>□ Attach anchor hook to LEE handrail<br>□ Attach load alleviating hook to APFR toe loop |
| SSRMS: MNVR to EuTEF | | √Both bails closed, sliders locked<br>√Reel unlocked<br>31. Give SSRMS operator GO to mnvr SSRMS to EUTEF ingress location on COL<br>32. Retrieve spare 85-ft safety tether from HR 3607; attach load alleviating hook to left D-ring extender, anchor hook to MWS<br>√Load alleviating bail closed, slider locked<br>√Reel unlocked<br><br>33. Inspect gloves |

## MISSE 6/EUTEF RETRIEVAL SETUP (00:50)

| IV/SSRMS | EV1 (OI) | EV2 (St) |
|---|---|---|
| 1. Verify SSRMS at EuTEF Backoff Position<br><br>SSRMS: GCA to APFR Ingress Position | <u>RETRIEVE MISSE SMALL ORU BAG FROM A/L</u> (00:20)<br>1. Translate to A/L, removing fairleads<br>2. Remove digital camera from ATA crewlock bag and temp stow on A/L HR<br>3. Perform ATA crewlock bag inventory<br><br>4. Open thermal cover<br>5. Stow ATA crewlock bag in crewlock using Lg/Sm RET<br>6. Retrieve spare 85-ft safety tether from crewlock; attach load alleviating hook to right D-ring extender, anchor hook to MWS<br>√Load alleviating bail closed, slider locked<br>√Reel unlocked<br>7. Retrieve MISSE small ORU bag and stow on BRT (Lg/Sm RET goes with bag)<br>8. Egress A/L and close thermal cover<br><br>9. √SAFER MAN ISOL vlv – OP (dn) and HCM (dn)<br>√ERCA LED – On (If no video signal)<br><br>10. Retrieve digital camera from A/L HR; stow on swingarm with RET<br><br>11. Inspect gloves | <u>EUTEF RETRIEVAL SETUP</u> (00:40)<br>1. Remove fairlead (R) from S0 HR 3543<br>2. Translate to Lab HR 0208 (aft end cone); set fairlead (P)<br>3. Translate to NOD2 HR 0306 (nadir/port translation path on Lab/NOD2 starts with Lab HR 0200)<br>4. Tether swap to spare 85-ft safety tether on NOD2 HR 0306<br>√Both bails closed, sliders locked<br>√Reel unlocked<br>5. Stow A/L 85-ft safety tether on NOD2 HR 0306<br>6. Translate to EuTEF SSRMS ingress location, forward of MPLM, then zenith to Columbus translation path<br>7. When SSRMS ready for APFR ingress, translate to aft side of EuTEF FRAM<br>8. Tether swap to 55-ft safety tether on SSRMS LEE handrail<br>√Both bails closed, sliders locked<br>√Reel unlocked<br>9. Stow spare 85-ft safety tether on COL HR 0934<br>10. Attach long waist tether to APFR Ingress Aid attach point<br>11. GCA SSRMS to APFR Ingress position<br>12. Ingress APFR<br><br>13. Inspect gloves |

## MISSE 6/EUTEF RETRIEVAL SETUP (00:50) (Cont)

| IV/SSRMS | EV1 (OI) | EV2 (St) |
|---|---|---|
|  <br><br>2. If SSRMS > 10 min away from EuTEF, direct EV1 to photograph MISSE 6 | <u>EUTEF RETRIEVAL SETUP</u> (00:15)<br>12. Translate to ESP-2; fairlead (P) around aft/port trunnion pin<br>13. Translate to Lab HR 0232; set fairlead (P)<br>14. Translate to NOD2 HR 0307 (nadir/port translation path on Lab/NOD2 starts with Lab HR 0200)<br>15. Tether swap to spare 85-ft safety tether on NOD2 HR 0307<br>√Both bails closed, sliders locked<br>√Reel unlocked<br>16. Stow A/L 85-ft safety tether on NOD2 HR 0307<br>17. Translate to EuTEF, forward of MPLM, then zenith to Columbus translation path; set fairlead (P) clear of grapple fixture<br>18. Inspect gloves<br><br><u>PHOTOGRAPH EUTEF</u> (00:15)<br>19. Photograph EuTEF with digital camera (<u>NOTE</u>: Stbd DEBBIE 2 sensor will not be visible until EuTEF is removed from EPF)<br><br>20. On IV/MCC GO, translate to MISSE 6 to photograph areas of interest<br><br><u>PHOTOGRAPH PECS</u> (00:15)<br>21. Photograph deployed PECs with digital camera (both sides, normal to surface)<br>22. Stow MISSE small ORU bag on COL HR 0936 (performed only if MISSE photos taken at this time)<br><br>23. Inspect gloves | |

## EUTEF RETRIEVAL AND STOW ON LMC (01:00)

| IV | EV1 (OI) | EV2 (St) |
|---|---|---|
| 1. Verify all EUTEF/MISSE 6 inhibits are in place<br>COL-CC:<br>PDU 1 OUTLET 3:<br>SSPC1,SSPC2,SSPC3,SSPC4 (4) – OFF<br><br>PDU 2 OUTLET 3:<br>SSPC1,SSPC2,SSPC3,SSPC4 (4) – OFF<br>Sys Bus Cntl Stat – DISABLED<br><br>On MCC GO:<br>IV:<br>PPSB PL OX 1 SWITCH IN DISCHARGE<br>PPSB PL OX 2 SWITCH IN DISCHARGE<br><br>PPSB PL DN 1 SWITCH IN DISCHARGE<br>PPSB PL DN 2 SWITCH IN DISCHARGE<br><br>SSRMS: GCA to COL Backoff Position<br><br>SSRMS: MNVR to LMC | CAUTION<br>Avoid contact with PL hardware above FRAM<br><br>EUTEF REMOVAL AND TRANSFER TO PLB (00:45)<br>1. Translate to fwd edge of COL zenith EPF for access to EuTEF FRAM primary bolt<br><br>2. PGT: **A7/CCW2/30.5**<br>(9.2 ft-lb, 30 RPM)<br>6" -Ext-7/16"<br><br>3. On EV2 and IV GO:<br>Release primary FRAM bolt ~11 turns to hard stop (push ~10 lb to release locking tabs)<br>4. √Status indicator 'in'<br>5. Visually verify EuTEF is clear; GCA EV2 clear of structure<br>6. Photograph EuTEF stbd DEBBIE 2 sensor<br>7. Inspect gloves<br><br>EUTEF INSTALL ON LMC (00:15)<br><br>WARNING<br>Avoid contact with SSPTS cable connectors (2-ft Keep-out Zone)<br><br>8. If not completed, stow MISSE small ORU bag near MISSE worksite on COL HR 0936<br>9. Retrieve EV2 spare 85-ft safety tether reel for relocation to port PLB sill; attach long waist tether to tether reel<br>10. Translate to port side of ODS; fairlead (R) on port ODS HR to keep both safety tethers clear of SSRMS trajectory and PFRAM worksite<br>11. Translate to port side of LMC in PLB; stow EV2 spare 85-ft safety tether on zenith/port side of LMC | CAUTION<br>Avoid contact with PL hardware above FRAM<br><br>EUTEF REMOVAL AND TRANSFER TO PLB (00:45)<br>1. GCA SSRMS for access to FRAM handrails<br>2. Attach RET to EuTEF zenith/aft FRAM handrail<br>3. Check tools and tethers<br>4. Verify cooling in good config prior to EuTEF removal<br>5. PGT: **A7/CW2/30.5**<br>(9.2 ft-lb, 30 RPM)<br>6" -Ext-7/16"<br>6. Stow PGT<br>7. Give EV1 GO to release primary FRAM bolt<br><br>8. Lift EuTEF from PFRAM<br><br>9. Reorient EuTEF as required for install<br>10. On EV1 GO, give SSRMS GO for mnvr to LMC (~20 min)<br><br>EUTEF INSTALL ON LMC (00:15) |

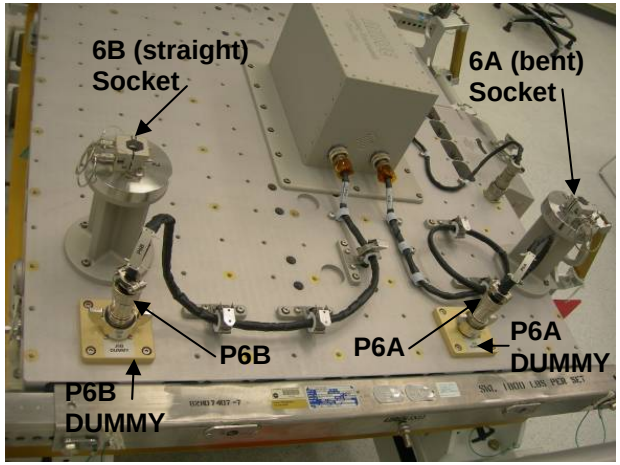
## EUTEF RETRIEVAL AND STOW ON LMC (01:00) (Cont)

<table>
<tr><th>IV</th><th>EV1 (OI)</th><th>EV2 (St)</th></tr>
<tr>
<td>SSRMS: GCA to EuTEF Berth Position<br><br>2. Verify inhibit in place prior to installing EUTEF on LMC:<br>R1 √PL AFT MNC – OFF<br><br>3. Record EuTEF bolt data
<table>
<tr><th>Torque (ft-lb)</th><th>Turns</th></tr>
<tr><td></td><td></td></tr>
</table>
<br>4. On EV2 GO:<br>R1 PL AFT MNC – ON</td>
<td>12. Reposition to stbd side of LMC, set fairlead (P) on forward side of LMC<br>13. Attach long waist tether to aft bulkhead vertical handrail<br>14. GCA SSRMS to EuTEF install on LMC<br><br>15. When aligned and seated on PFRAM, give EV2 GO to drive primary FRAM bolt<br>16. Restrain EuTEF on LMC as required<br><br>17. Inspect gloves</td>
<td>11. On IV and EV1 GO: Position EuTEF on PFRAM using FRAM alignment stripes<br><br>12. On EV1 GO:<br>Engage primary FRAM bolt ~11 turns to hard stop (push ~10 lb to release locking tabs)<br>√Status indicator ‘out’<br>13. Perform pull test on AFRAM<br>14. Remove RET from EuTEF<br>15. Give IV GO to activate heater power<br>16. Inspect gloves</td>
</tr>
</table>

## MISSE 6 RETRIEVAL AND STOW IN PLB (01:30)

| IV/SSRMS | EV1 (OI) | EV2 (St) |
|---|---|---|
| SSRMS: MNVR to Overnight Park Position<br><br>1. On EV1 GO:<br>COL-CC:<br>PDU 1 OUTLET 3:<br>SSPC1,SSPC2,SSPC3,SSPC4 – ON<br><br>PDU 2 OUTLET 3:<br>SSPC1,SSPC2,SSPC3,SSPC4 – ON<br><br>SOLAR FEEDER 1,2 Power – ON | <u>CLOSE STRAIGHT PEC (6B)</u> (00:15)<br>1. Translate to ODS; retrieve fairleads (R) and set fairlead (P) for EV2 spare 85-ft safety tether<br>2. Translate to Columbus nadir EPF<br>3. Complete MISSE photos as reqd<br>4. Release straight PEC PIP pins securing MISSE open (2) and PIP pins for securing MISSE closed (2)<br>5. Close straight PEC; reinsert PIP pins (4) to restrain closed<br><br><u>CLOSE BENT PEC (6A)</u> (00:05)<br>6. Release bent PEC PIP pins securing MISSE open (2) and PIP pins for securing MISSE closed (2)<br>7. Close bent PEC; reinsert PIP pins (4) to restrain closed<br><br><u>DEMATE MISSE 6 CONNECTORS</u> (00:10)<br>8. Remove connector cover from J6A DUMMY<br>9. Remove P6A from bent PEC connector (J6A)<br>10. Mate P6A to J6A DUMMY<br>11. Install connector cover on bent PEC connector (J6A)<br>12. Remove connector cover from J6B DUMMY<br>13. Remove P6B from straight PEC connector (J6B)<br>14. Mate P6B to J6B DUMMY<br>15. Install connector cover on straight PEC connector (J6B)<br>16. Close all TA clamps for P6A (2) and P6B (3) connector cables<br>17. Give COL-CC GO to repower SOLAR<br><br><u>REMOVE BENT PEC FROM LWAPA</u> (00:10)<br>18. Attach RET to bent PEC<br>19. Disengage probe PIP pins (2)<br>20. Remove bent PEC from socket<br>21. Transfer bent PEC to EV2<br>22. Re-engage probe PIP pins (2) on LWAPA stbd socket | <u>SSRMS EGRESS AND RECONFIG</u> (00:25)<br>1. When EV1 clear of worksite, egress APFR<br>2. Tether swap to spare 85-ft safety tether temp stowed on zenith/port side of LMC<br>√Load alleviating bail closed, slider locked<br>√Reel unlocked<br>3. Stow SSRMS 55-ft safety tether load alleviating hook to APFR toe loop<br>√Reel unlocked<br>4. Reconfig APFR to low profile [12,**FF**,**A**,6]<br>5. Give SSRMS operator GO to maneuver SSRMS to overnight park position<br><br><u>WARNING</u><br>Avoid contact with SSPTS cable connectors (2-ft Keep-out Zone)<br><br>6. Translate to MISSE 6 worksite and assist EV1 as required<br><br><u>INSTALL BENT PEC ONTO SIDEWALL CARRIER</u> (00:25)<br><br>7. Receive bent PEC from EV1 and stow on BRT<br>8. Translate to forward side wall carrier |

## MISSE 6 RETRIEVAL AND STOW IN PLB (01:30) (Cont)

| IV/SSRMS | EV1 (OI) | EV2 (St) |
|---|---|---|
| | REMOVE STRAIGHT PEC FROM LWAPA (00:30)<br>23. Attach RET to straight PEC<br>24. Disengage probe PIP pins (2), (see cribsheet for troubleshooting steps)<br>25. Remove straight PEC; stow on BRT<br>26. Re-engage probe PIP pins (2) on LWAPA socket<br><br>INST STRAIGHT PEC ONTO SIDEWALL CARRIER (00:20)<br><br>WARNING<br>Sidewall carrier clamp are a pinch point.<br>Use caution during actuation<br><br>27. If MISSE small ORU bag opened, perform tool inventory<br>28. Retrieve MISSE small ORU bag and temp stow on MWS<br>29. Translate to NOD2 HR 0307 and temp stow MISSE small ORU bag (for eventual return to A/L)<br>30. Translate to aft sidewall carrier<br>31. Disengage clamp PIP pins (2), open clamps (2)<br>32. Remove PEC from BRT; stow on sidewall carrier (probe up, handrails inboard)<br>33. Close sidewall carrier clamps (2)<br>34. Re-engage PIP pins (2) on PEC sidewall carrier clamps<br>35. Inspect gloves | WARNING<br>Sidewall carrier clamp is a pinch point.<br>Use caution during actuation<br><br>9. Disengage clamp PIP pins (2), open clamps (2);<br>10. Remove PEC from BRT; stow on sidewall carrier (probe up, handrails inboard)<br>11. Close sidewall carrier clamps (2)<br>12. Re-engage PIP pins (2) on PEC sidewall carrier clamps<br>13. Inspect gloves<br><br>  <br> |

## EVA CLEANUP/INGRESS (00:40)

| IV | EV1 (OI) | EV2 (St) |
|---|---|---|
| 1. Perform WVS PWRDN (PHOTO/TV, WVS CUE CARD) | CLEANUP (00:20)<br>1. Translate to NOD2 HR 0307<br>2. Tether swap to A/L 85-ft safety tether at NOD2 HR 0307<br>√Load alleviating bail closed, slider locked<br>√Reel unlocked<br>3. Retrieve anchor hook of spare 85-FT safety tether; stow on MWS<br>4. Retrieve MISSE small ORU bag; stow on BRT<br>5. Translate to Stbd Z1 toolbox; open port door<br>6. RET to Rd TM Board in slot #5; remove and stow behind MWS T-bar using MWSEE<br>7. Close port door; ensure all door latches (4) engaged<br>8. Translate to A/L<br><br>INGRESS (00:20)<br>9. Tool inventory<br><br>10. On EV2 GO, release EV2 A/L 85-ft safety tether anchor hook from external D-ring; transfer to EV2<br>11. Transfer MISSE small ORU bag to EV2<br><br>12. Attach waist tether to A/L internal D-ring<br>√Both bails closed, sliders locked<br>13. Release EV1 A/L 85-ft safety tether anchor hook from external A/L D-ring; stow on MWS<br>14. Ingress A/L<br>15. Close hatch thermal cover; attach Velcro strap<br>16. Connect SCU to DCM; √SCU locked<br>17. Expect 1-3 min delay for SCU cooling w/TCV 8-Max C<br>18. WATER – OFF (fwd) expect H2O IS OFF msg<br><br>CAUTION<br>Do not close hatch until EMU water – OFF for 2 min<br><br>19. Verify outer hatch clear of hardware<br>20. EV Hatch – verify handle position per hatch decal; close and lock hatch<br>21. Go to PRE-REPRESS (DEPRESS/REPRESS Cue Card) | CLEANUP (00:20)<br>1. Translate to NOD2 HR 0306<br>2. Tether swap to A/L 85-ft safety tether at NOD2 HR 0306<br>√Load alleviating bail closed, slider locked<br>√Reel unlocked<br>3. Retrieve anchor hook of spare 85-ft safety tether; stow on MWS<br>4. Translate to A/L<br><br>INGRESS (00:20)<br>5. Tool inventory<br>6. Open thermal cover<br>7. Ingress A/L<br>8. Attach right waist tether to fwd UIA D-ring<br>√Both bails closed, sliders locked<br>9. Give EV1 GO to release EV2 A/L 85-ft safety tether anchor hook<br>10. Receive A/L 85-ft safety tether from EV1; stow on MWS<br><br>11. Receive MISSE small ORU bag; stow in A/L using Lg/Sm RET<br><br>12. Connect SCU to DCM; √SCU locked<br>13. Expect 1-3 min delay for SCU cooling w/TCV 8-Max C<br>14. WATER – OFF (fwd) expect H2O IS OFF msg<br><br>15. Go to PRE-REPRESS (DEPRESS/REPRESS Cue Card) |

# POST EVA 1 TOOL CONFIG

## EV1

EMU D-rings

- ❑ Ext on left side
- ❑ Ext on right side
- ❑ Waist Tether (left Ext to MWS, √locked)
- ❑ Waist Tether (right D-ring to MWS, √locked)
- ❑ 85-ft Safety Tether (left D-ring, √locked)
- ❑ Spare 85-ft Safety Tether (left D-ring, √locked)

MWS

- ❑ Small STS Trash Bag
  - ❑ Wire tie (secure trashbag to MWS, tether loop)
- ❑ 1 – Wire tie as tether loop
- ❑ 1 – RET (with PIP pin)
- ❑ 1 – RET
- ❑ 1 – RET
  - ❑ 1 – Rd TM Board
- ❑ Swing Arm (right side)
  - ❑ 1 – RET (Attach to PGT)
    - ❑ 1 – PGT s/n 1002 w/6"-Ext-7/16"
  - ❑ Digital Camera w/bracket
- ❑ BRT (left side)
  - ❑ 1 – RET
  - ❑❑ 2 – short wire ties

EMU Gloves

❑❑ 2 – Adj Equipment Tethers

## EV2

EMU D-rings

- ❑ Ext on left side
- ❑ Ext on right side
- ❑ Waist Tether (right Ext to MWS, √locked)
- ❑ Waist Tether (left D-ring to ERCM, √locked); Dbl Tether
- ❑ 85-ft Safety Tether (left Ext, √locked)
- ❑ Spare 85-ft Safety Tether (left Ext, √locked)

MWS

- ❑ Small Trash Bag
  - ❑ Wire tie (secure bayonet closed; tether loop)
- ❑ 1 – Wire tie as tether loop
- ❑ 1 – RET (with PIP pin)
- ❑❑ 2 – RETs
- ❑ 1 – Adj Equipment Tether
- ❑ Swing Arm (right side)
  - ❑ 1 – RET (Attach to PGT)
    - ❑ 1 – PGT s/n 1006 w/6"-Ext-7/16"
- ❑ BRT (left side)
  - ❑ 1 – RET
  - ❑❑ 2 – short wire ties

EMU Gloves

❑ 1 – Adj Equipment Tether (on left glove)

CREWLOCK

❑ D-ring extender on A/L D-ring

❑ Lg-Sm RET
- ❑ ATA Crewlock Bag
  - ❑ EVA ratchet wrench w/2" -Ext-7/16"
  - ❑ EVA ratchet wrench w/2" -Ext-7/16" (no PW)
  - ❑ Round Torque Multiplier
    - ❑ 5/8" Proud Socket
  - ❑ BRS Pin Tool
  - ❑ 1 – RET (from EV2 ratchet wrench)

❑ Lg-Sm RET
- ❑ Small ORU Bag – MISSE
  - ❑ 1 – Adj Equipment Tether
    - ❑ BMRRM Anti-Rotation Latch Tool
  - ❑ 1 – Adj Equipment Tether
    - ❑ EVA Prybar
  - ❑ 1 – Adj Equipment Tether
    - ❑ EVA Hammer
  - ❑ 1 – Adj Equipment Tether
    - ❑ HST Fastener Retention Tool
  - ❑ 1 – Adj Equipment Tether
    - ❑ CLA Cover MLI Case
  - ❑ 1 – RET
- ❑ 1 – Adj Equipment Tether (stowed on bag outside)

❑ Sm-Sm RET (attached to aft UIA tether point)

❑ Lg-Sm RET
- ❑ PMA3 Crewlock Bag
  - ❑ 1 – Wire tie caddy
    - ❑❑❑❑❑❑❑❑❑❑ – Short wire ties (in caddy)
  - ❑❑❑ 3 – PMA3 HTR Cable Caps
    - (size 15,17,25 integrated together w/long wire tie)
  - ❑ 1 – MMOD Shield Handling Tool

# AMMONIA TANK ASSEMBLY/REMOVE FROM P1 – TASK DATA

**ORU Specs:**

| ORU | Part Number | Serial Number | Dimensions (in) | Mass (lbm) |
|---|---|---|---|---|
| ATA | IF28801-501 | 04 | (L*W*H) 57.3" x 80.1" x 45.4" | Dry – 1289<br>Wet – 1749 |

**Estimated Task Duration:**

| | With SSRMS | Without SSRMS |
|---|---|---|
| **One EV Crew** | **N/A** | **N/A** |
| **Two EV Crew** | **02:10** | **N/A** |

**Foot Restraints:**

| Task | WIF | APFR Setting |
|---|---|---|
| **APFR** | **P1-03** | **[6,WW,K,4]** |
| **APFR** | **P1-04** | **[8,QQ,G,11]** |

**Tools:**

| EV1 | EV2 |
|---|---|
| PGT with 6"–7/16" Wobble Socket<br>Ratchet Wrench with 2"-ext-7/16"<br>Adjustable Fuse Tether<br>Adjustable Tether<br>Torque Multiplier | PGT with 6" Wobble Socket<br>Ratchet Wrench w/2"-Ext-7/16" (for Bolt 1 release with FGB installed) |

**EVA Connectors**

| Harness | To | Clamps (#) | Connector Size | Function |
|---|---|---|---|---|
| P1-P635 | J2 | 1 | 17 | Data |
| P1-P634 | J1 | 1 | 19 | Power |

**EVA Fluid QD's**

| Line Name | From | To | Clamps (#) | QD Size | Function |
|---|---|---|---|---|---|
| F175/M3 * (Nadir) | PM | ATA M3 | 1 | 1/2" | NH3 out |
| F1/M2/M1 (Nadir) | NTA M2 | ATA M1 | none | 1/4" | N2 pressure |
| F174/M4 (Zenith) | Vent | ATA M4 | 1 | 1/2" | NH3 out |
| F2/M3/M2 (Zenith) | NTA M3 | ATA M2 | none | 1/4" | N2 pressure |

***** Spool positioning device installation

**Connector Inhibits/MCC calls**

| Task | Inhibit/Initiate Call |
|---|---|
| P635 to J2 | Verify P1 ATA REMOVAL AND REPLACEMENT PREP Part 4 complete (SODF: ASSY OPS: 17A); EV crew GO to demate electrical connectors P634 and P635 |
| P634 to J1 | Verify P1 ATA REMOVAL AND REPLACEMENT PREP Part 4 complete (SODF: ASSY OPS: 17A); EV crew GO to demate electrical connectors P634 and P635 |
| Close/Demate QDs | Verify P1 ATA REMOVAL AND REPLACEMENT PREP Parts 1 and 2 complete (SODF: ASSY OPS: 17A); EV crew GO to close/demate M1, M2, M3 and M4 |

**Fasteners:**

| Fastener Name | PGT/ratchet | Socket | Qty | Turns | Install Torque (ft-lbf) Ground/On orbit | Recommended Install Torque (ft-lbf) | Recommended Release Torque (ft-lbf) | Failure Torque (ft-lbf) Install/ Remove | Features |
|---|---|---|---|---|---|---|---|---|---|
| Bolt 1 (Clevis) | **[B6 (24.0), CCW2, 30.5]** | 6" wobble-7/16" | 1 | 16.0 - 16.5 | 20.0 - 22.9/7.7 - 28.1 | 9.2 | 24.0 | 35.1/165.8 | √2 white lines visible |
| Bolt 2 (Clevis) | **[B6 (24.0), CCW2, 30.5]** | 6" wobble-7/16" | 1 | 16.0 - 16.5 | 20.0 - 22.9/7.7 - 28.1 | 9.2 | 24.0 | 35.1/165.8 | √2 white lines visible |
| Bolt 3 (Microconical) | **[B4,(19.4) CCW1, 30.5] + TM/ratchet with 2" 7/16" EXT** | 6" wobble-7/16" | 1 | 13.5 - 14.5 | 69.0 - 81.0/37.0 - 81.0 | 12.0 + TM | 19.4 + TM or ratchet wrench w/2" ext | 81.1/146.5 | Bolt pops up |
| Bolt 4 (Clevis) | **[B6(24.0), CCW2, 30.5]** | 6" wobble-7/16" | 1 | 16.0 - 16.5 | 20.0 - 22.9/7.7 - 28.1 | 9.2 | 24.0 | 35.1/165.8 | √2 white lines visible |

**Notes:**

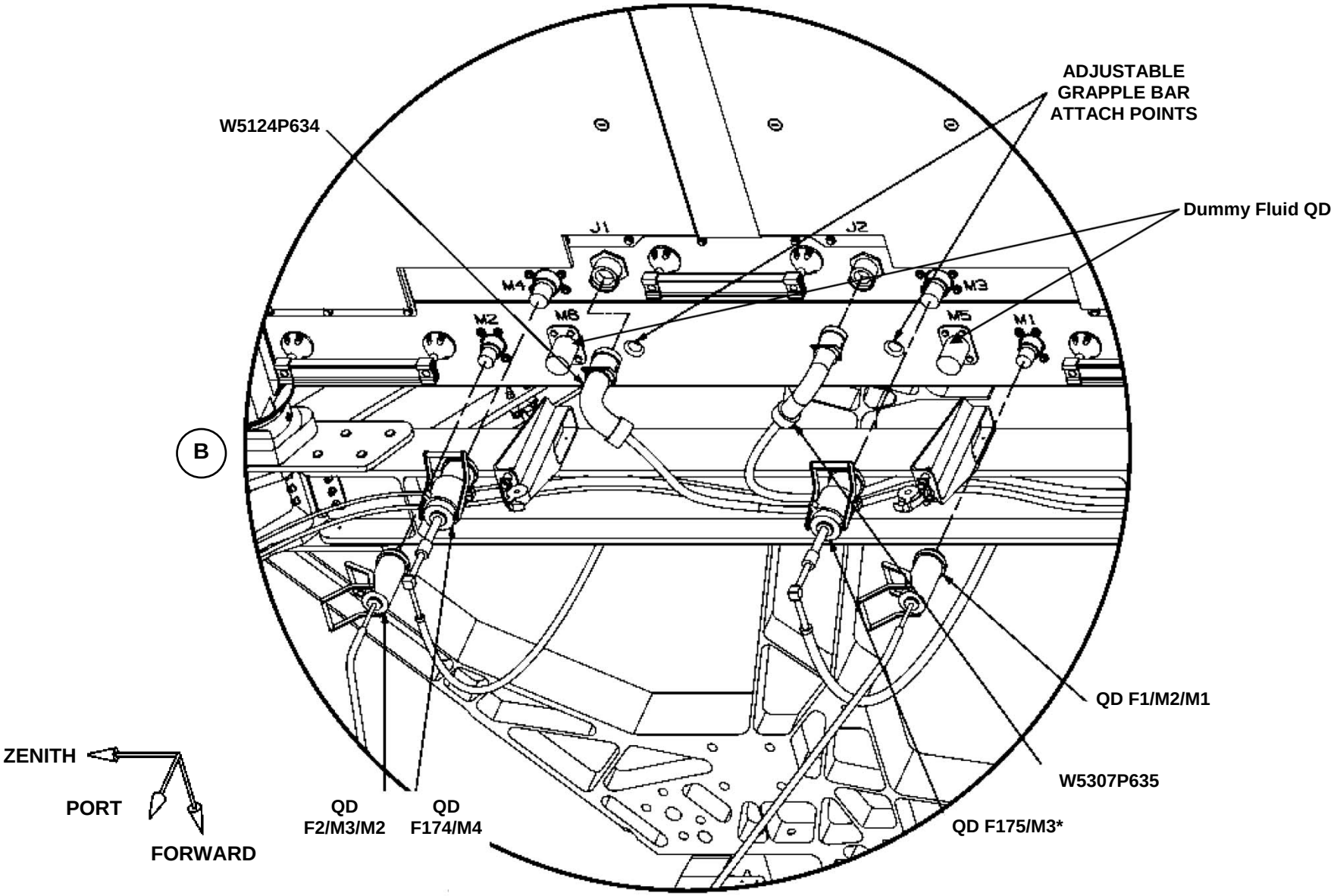
1. Ensure Fluid QD lines are routed under shroud straps

**Cautions:**

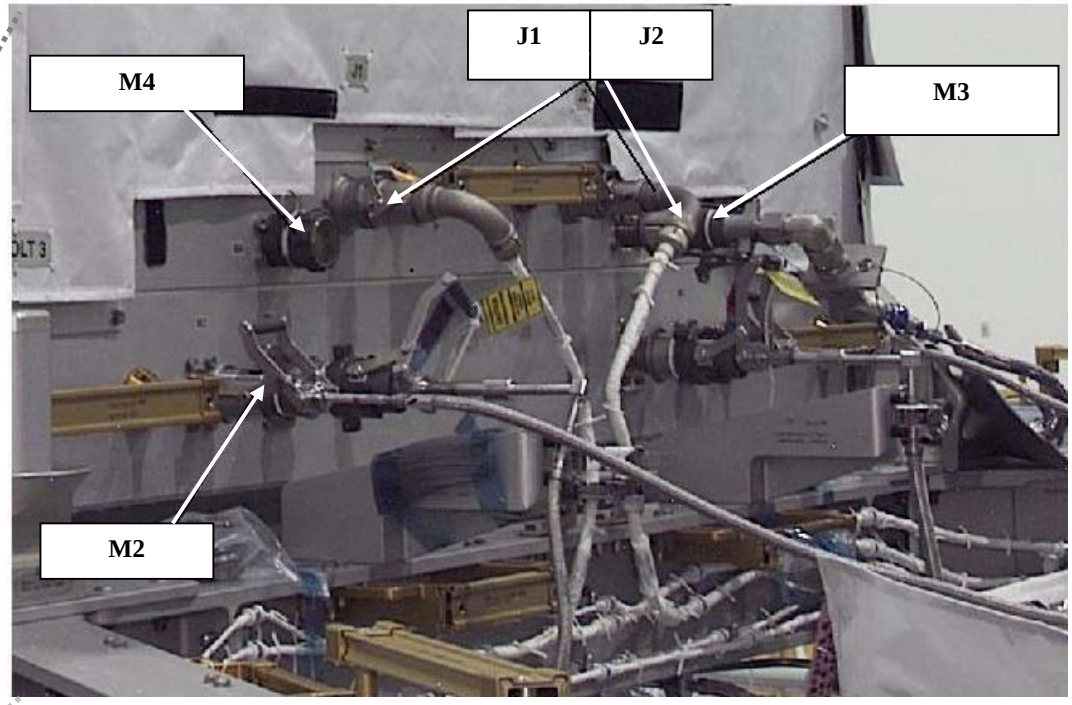
1. ATA fluid QD lines and clamps may be hot if exposed to direct sun
2. Avoid pulling on electrical cables. Avoid bent radii less than 10 times the cable diameter

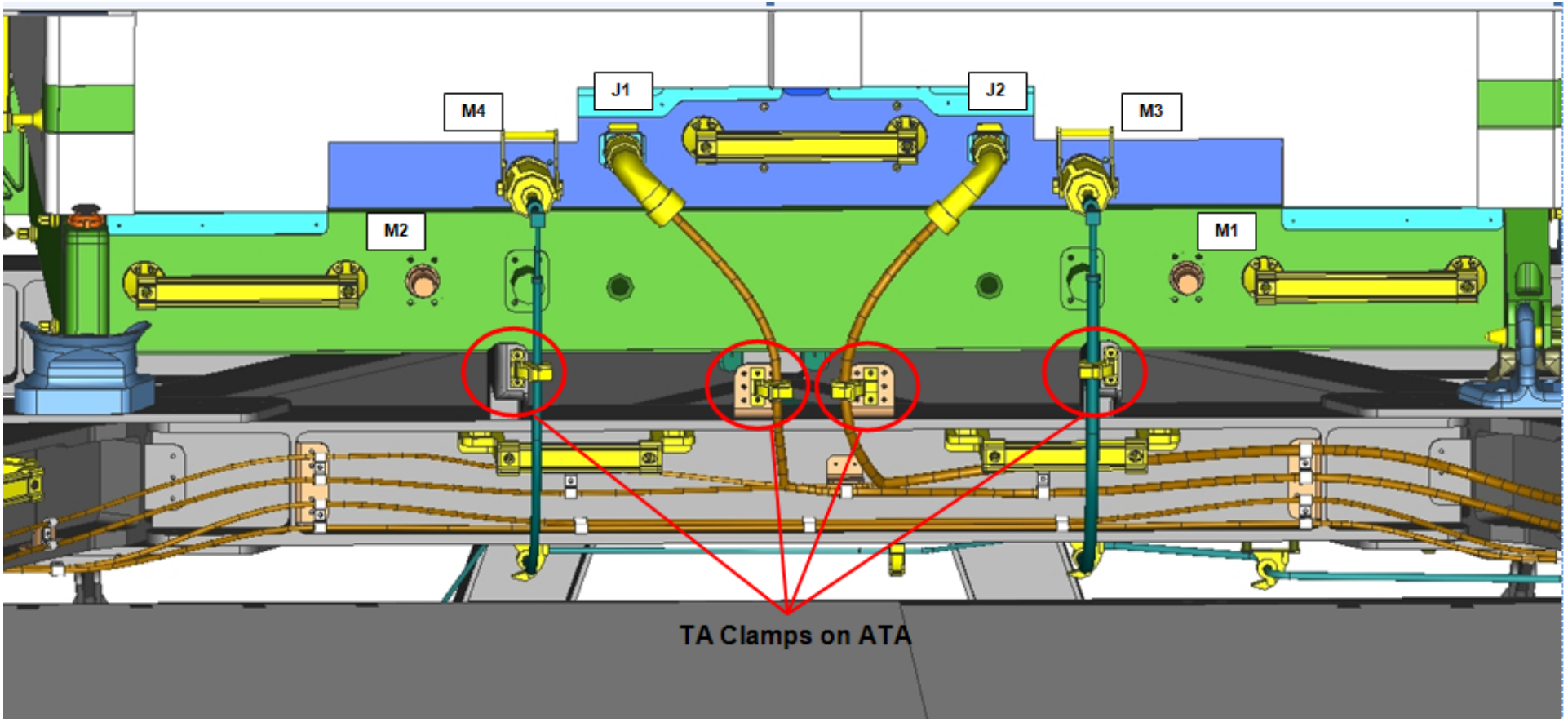
**Warnings:**

1. Verify electrical inhibits in place prior to electrical mate/demate
2. Verify P1 TRRJ rotation inhibits in place


ADJUSTABLE
GRAPPLE BAR
ATTACH POINTS
W5124P634
Dummy Fluid QD
J1
J2
M4
M3
M2
M6
M5
M1
B
QD F1/M2/M1
W5307P635
QD F175/M3*
QD
F2/M3/M2
QD
F174/M4
ZENITH
PORT
FORWARD

## AMMONIA TANK ASSEMBLY – TASK DATA




M4
J1
J2
M3
M2
M1
TA Clamps on ATA

# MISSE 6 REMOVAL/STOW – TASK DATA

**Estimated Task Duration:**

| | With SSRMS | Without SSRMS |
|---|---|---|
| One EV Crew | N/A | 02:00 |
| Two EV Crew | N/A | 01:30 |

**Tools:**

| EV1 (FF) | EV2 |
|---|---|
| 760 digital camera and mount | BRT |
| PGT 6-in ext – 7/16 | |
| Fastener Retention Tool | |
| Prybar | |
| Hammer | |
| BMRRM Anti-Rotation Latch Tool | |

**EVA Fasteners:**

| Fastener Name | Label | Head Size | Qty | Install Torque (ft-lb) | Release Torque (ft-lb) | Failure Torque (ft-lb) | Turns | RPM |
|---|---|---|---|---|---|---|---|---|
| Probe EVA Bolt | N/A | 7/16 | 2/PEC | 10.25 | 12.0 | 21.6 | 11.5 | 30 |

**EVA Connectors:**

| Harness | From | To | Clamps (#) | Conn Size | Function |
|---|---|---|---|---|---|
| P6A | J6A (PEC 6A) | LWAPA | 2 | | PEC power |
| P6B | J6B (PEC 6B) | LWAPA | 3 | | PEC power |

**Foot Restraints:**

| Task | WIF | APFR Setting |
|---|---|---|
| NA | | |

**ORUs/Loose items:**

| ORU/Item | Qty | Part Number, ID | Mass (lb) | Volume ($in^3$) |
|---|---|---|---|---|
| PEC 6A (angled) | 1 | 1247231-1 | 87.0 | 30.91 x 33.38 x 6.80 |
| PEC 6B (bent) | 1 | 1247234-1 | 88.6 | 30.91 x 32.78 x 6.80 |

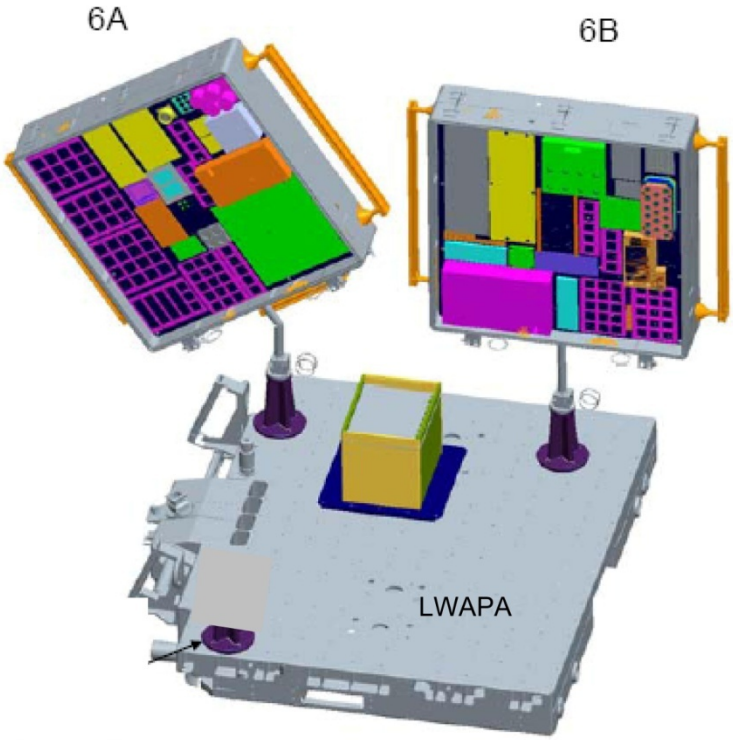
**Notes:**

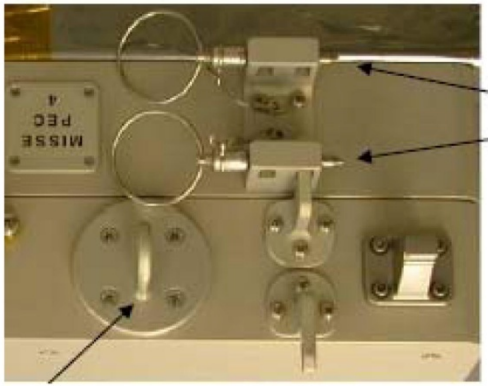
**Cautions:**

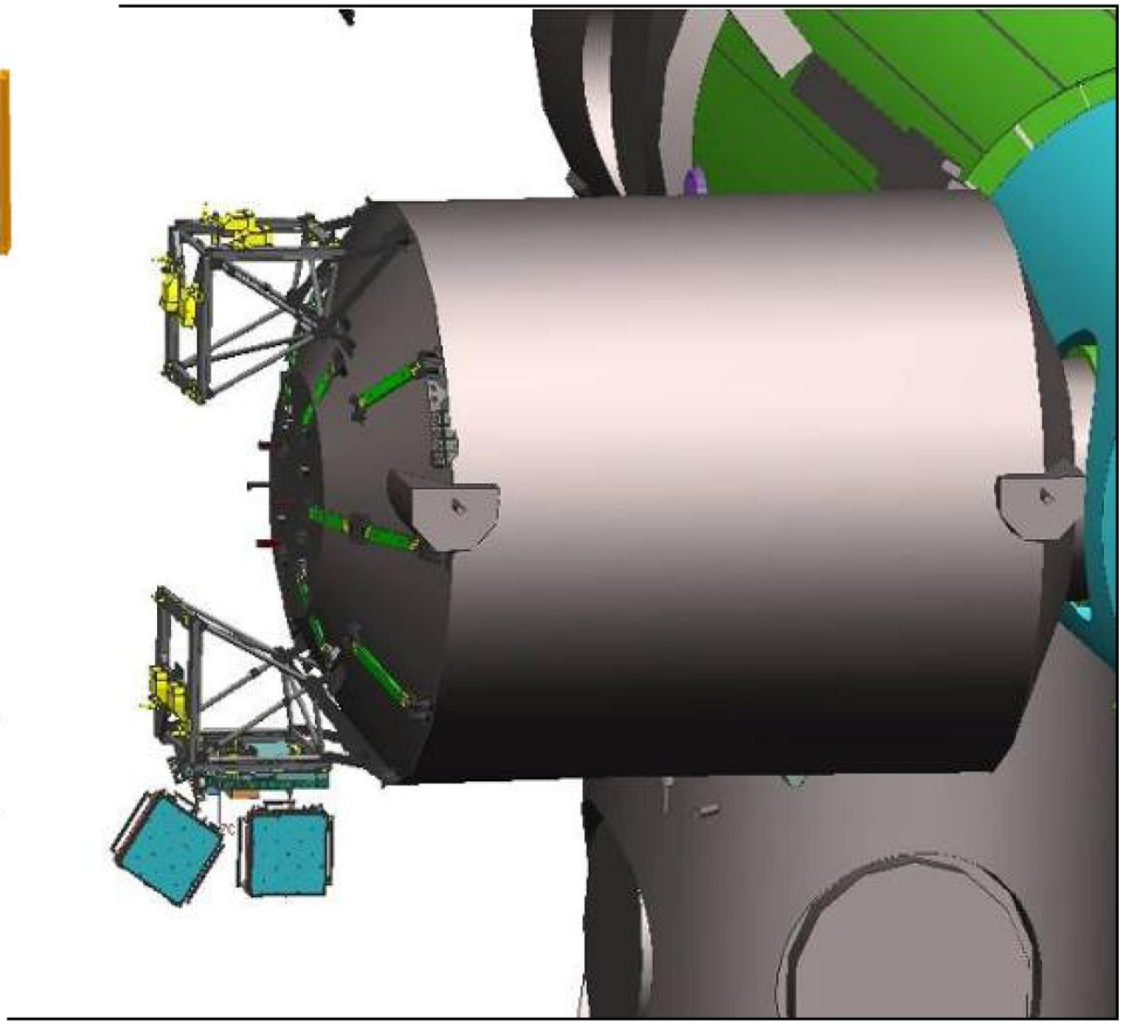
**Warnings:**

1. Sidewall carrier clamp are a pinch point. Use caution during actuation
2. Avoid contact with SSPTS cable connectors (2-ft Keep-out Zone)

**MISSE 6 REMOVAL/STOW – TASK DATA** (Cont)



MISSE 6 install location on Columbus

# EUTEF TRANSFER TO PLB – TASK DATA

**Estimated Task Duration:**

| | With SSRMS | Without SSRMS |
|---|---|---|
| Two EV Crew | 02:05 | N/A |

**Tools:**

| EV1 | EV2 |
|---|---|
| • RET<br>• BRT<br>• Camera<br>• PGT 6-Ext 7/16 | • RET<br>• PGT 6-Ext 7/16 |

**EVA Fasteners:**

| Fastener Name | Head Size | Qty | Install Torque (ft-lb) | Release Torque (ft-lb) | Failure Torque (ft-lb) | Turns |
|---|---|---|---|---|---|---|
| Pri FRAM bolt release (EuTEF) | 7/16 | 1 | 9.2 | 9.2 | 21 | 11 |
| Pri FRAM bolt engage (EuTEF) | 7/16 | 1 | 9.2 | --- | 21 | 11 |

**Foot Restraints:**

| Task | WIF | Setting |
|---|---|---|
| EuTEF Transfer | SSRMS | 12,NN,F,6 |

**Inhibits:**

| Task | Inhibit |
|---|---|
| EuTEF Install on LMC | LMC heater power off:<br>R1 PL AFT MNC – OFF |
| EuTEF Remove from EPF | PDU1 Outlet 3 SSPC 1-4 (4) – OFF<br>PDU2 Outlet 3 SSPC 1-4 (4) – OFF<br>PPSB PLOX1 sw – DISCHARGE<br>PPSB PLOX2 sw – DISCHARGE |

**Notes:**

1. FRAM has a 5.5 lb magnetic soft dock at fwd 2 corners and a 3.5 lb soft dock at aft 2 corners, but they don't work

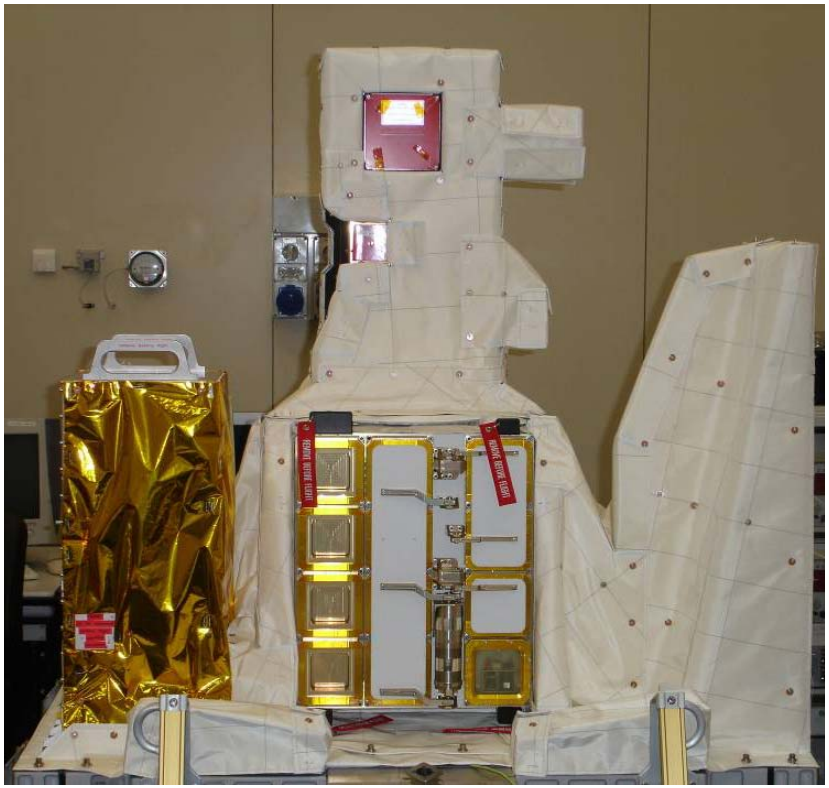
**Cautions:**

1. Avoid contact with PL hardware above the FRAM

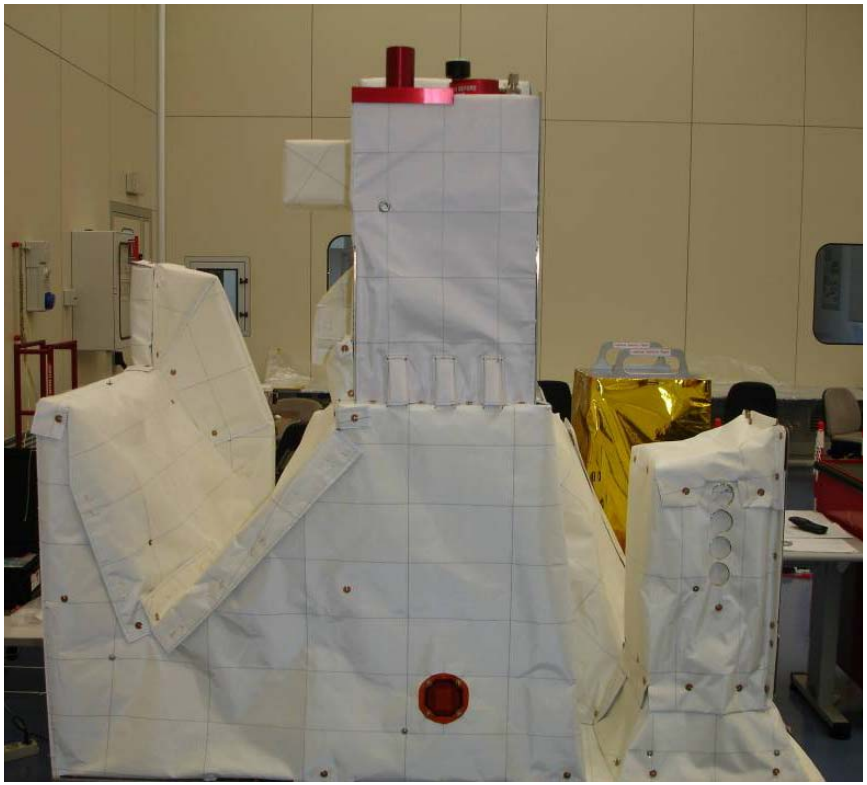
**Warnings:**

1. None

## EUTEF TRANSFER TO PLB – TASK DATA

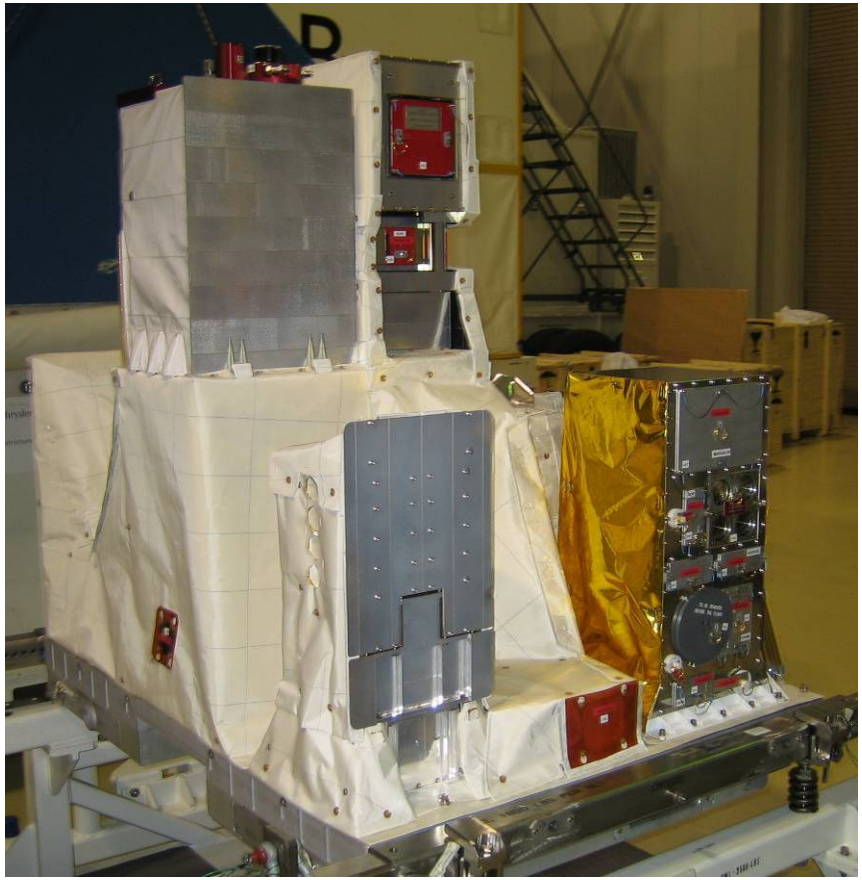


**EuTEF Zenith Face**

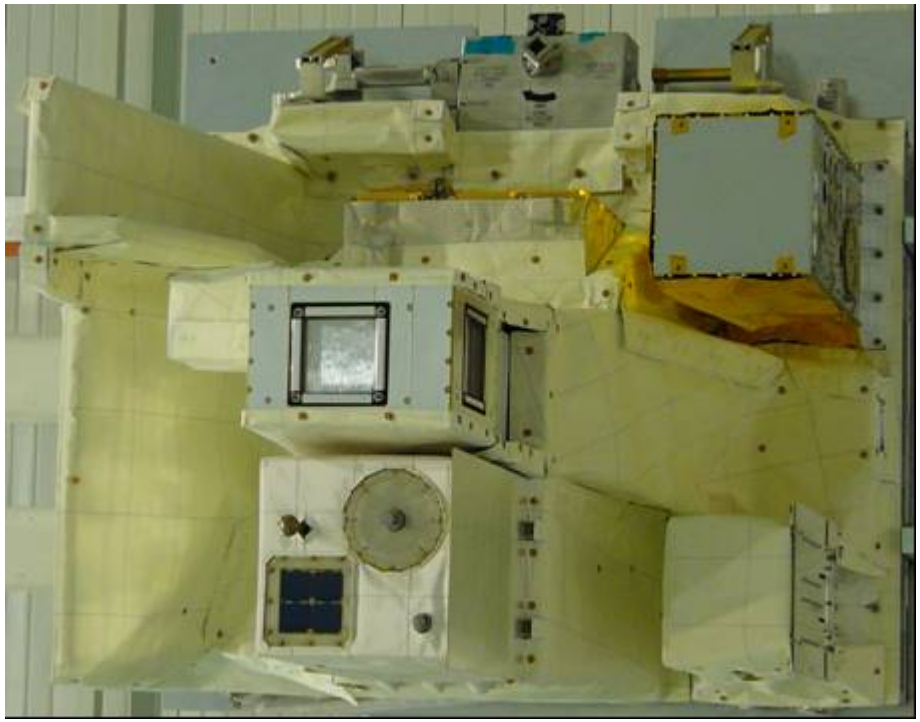


**EuTEF Nadir Face**

## EUTEF TRANSFER TO PLB – TASK DATA



**EuTEF Forward Face**



**EuTEF Starboard Face**

## EVA 2 SUMMARY TIMELINE

| TIME | IV | EV1 (Ol) | EV2 (Fg) |
|---|---|---|---|
| 00:00-00:05 | | POST DEPRESS (00:05) | POST DEPRESS (00:05) |
| 00:05-00:20 | | EGRESS (00:15) | EGRESS (00:15) |
| 00:20-00:55 | | SETUP (00:35) | SSRMS (00:35) |
| 00:55-01:45 | | ATA REMOVAL FROM LMC (00:50)<br>• Remove ATA MLI (00:10)<br>• Remove ATA from LMC (00:40) | ATA REMOVAL FROM LMC (00:50)<br>• SSRMS Setup (00:40)<br>• Remove ATA from LMC (00:10) |
| 01:45-02:15 | | INSTALLATION ON P1 (02:50)<br>• Prep for P1 ATA Install (00:30)<br>• P1 ATA Install Zenith Bolts (2) (00:25)<br>• Connect NH2/N2 Electrical Connectors (00:45)<br>• P1 Cleanup/ATA Handoff (01:10) | INSTALLATION ON P1 (02:50)<br>• MNVR to P1 ATA Install Location (00:30)<br>• P1 ATA Install Nadir Bolts (2) (00:25)<br>• Prep for ATA Handoff (00:25)<br>• ATA Handoff & MNVR to LMC (01:30) |
| 02:15-02:40 | | | |
| 02:40-03:25 | | | |
| 03:25-04:35 | | | |
| 04:35-05:45 | | ATA INSTALL ON LMC (01:10) | ATA INSTALL ON LMC (01:10) |
| 05:45-06:10 | | FGB CLEANUP (00:25) | SSRMS CLEANUP (00:25) |
| 06:10-06:30 | | INGRESS (00:20) | INGRESS (00:20) |
| 06:30 | | | |

# EVA 2 BRIEFING CARD

EV1 _____
EV2 _____
IV _____
R1/M1 _____

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

**Flight Day Prior to EVA – General Briefing (All)**

1. EVA Prep
   - ❑ Get-up Plan – clothing and EMU equipment bag – EV1
   - ❑ Prebreathe protocol review (Notes and Warnings) – IV
   - ❑ Equipment lock activities – IV responsibilities
   - ❑ Suit donning plan – special requests – EV's, IV's
   - ❑ SAFER, MWS, tools, C-Lk positions, bag stowage – EV2
   - ❑ Airlock depress review – IV

2. EV Crew Procedure Review – EV1
   - ❑ Egress Plan
   - ❑ Order of tasks (summary timeline)
   - ❑ Translation plan, fairleads, and tether swaps
   - ❑ Hazards
   - ❑ Ingress Plan

3. Robotics – R1/M1
   - ❑ SRMS/SSRMS initial position, maneuvers, clearances
   - ❑ Coordinate Frames
   - ❑ SRMS/SSRMS comm protocol review – expected calls, use first names
   - ❑ GCA – when, where, handover language
   - ❑ Cameras
   - ❑ Contingencies
     - Suit anomalies while ingressed

**Flight Day Prior to EVA – Additional Briefing (EV, IV)**

4. Communications – CDR, IV
   - ❑ Overall setup: Big loop, A/G2, S/G2, ICOM, Hardline, remind EV crew when mode swapping
   - ❑ EV/IV comm protocol review – Use EV1(2) for DCM sw throws (all time in A/L), use first names otherwise

5. General Procedure Review – EV1
   - ❑ Get-ahead tasks
   - ❑ Constraints – ground and flight – IV
   - ❑ Notes, Cautions, and Warnings review – IV
   - ❑ Contingency procedures – crib sheet

6. Emergencies Review – EV1
   - ❑ Emergency suit doff and power down during EVA prep
   - ❑ Loss of comm
   - ❑ EMU malfunctions
   - ❑ Lost tools
   - ❑ Lost crewmember
   - ❑ DCS
   - ❑ Abort and Terminate scenarios, protocols
   - ❑ Hand signal reviews

7. Post EVA – IV's
   - ❑ Suit doffing responsibilities
   - ❑ Post EVA plan

√Expedited Suit Doffing cue card pre-positioned for EVA day

# EVA 2 BRIEFING CARD (Cont)

**EVA Day, prior to Prebreathe Protocol**

1. Reminders
   - ❑ Translate slow (then space is like water). Relax grip
     - o Be extra careful on non-standard routes or orientations
     - o Don't hop
   - ❑ Tether Discipline
     - o Check all gates closed and hooks locked; check reel locked/unlocked
     - o Local tether when stopped. Check tethers before you leave
     - o When something is attached to a tether, don't grab the tether by the hook
     - o Good pull tests
   - ❑ APFR ops
   - ❑ Be disciplined when tired
   - ❑ Hazards: Payloads, etc
   - ❑ Openness: When you have boot or glove pain let us know
   - ❑ OK for IV and ground to check on us. If you need update, ask
   - ❑ Monitor safety tether. Hold peanut when necessary
   - ❑ Let mistakes pass
   - ❑ If you get a mal, read the caution and warning message so everyone knows what it is
   - ❑ Manage frustration (slow down, if needed)
   - ❑ Cold soak before ingress
   - ❑ Verify PGT settings. PGT collars are easy to bump
   - ❑ Read turns, torque, green light
   - ❑ SSRMS: Coordinate frames and positive GCA handovers
   - ❑ Review first post-egress steps
   - ❑ Review abort/terminate priorities and procedures
   - ❑ Glove Checks
   - ❑ Day/night reconfigurations
   - ❑ Translation Adaptation plan

**IV Checklist Verification Items**

1. Generic
   - ❑ Day/Night Cycles
     - • √Lights, visors, gloves and heaters, tethers, and MWS
   - ❑ √Load Alleviating Strap on Safety Tethers not damaged
     - • Crew report: "**Safety Tether strap looks good**"
   - ❑ √Safety Tether Crew Hook Slidelocks are locked
     - • Crew Report: "**Bails closed, Sliders locked**"
   - ❑ √Both SAFER valves down at egress
     - • Crew Report: "**Both handles down**"
   - ❑ √APFR locking collar Black-on-black and pull test
     - • Crew Report: "**Black-on-black, good pull test**"
   - ❑ √PGT Green light on for bolt engage
     - • May get Lo Torque msg at bolt release
     - • Crew Report: "**XX turns, green light, XX ft-lb"**
   - ❑ √Latches closed on lid, door, etc (i.e., √in landing config)
     - • Crew Report: "**XX Latches done**"
   - ❑ √Connectors for no bent pins, no FOD, inhibits in place
     - • Crew Report: "**Pins good, no FOD, bend radius OK**"
     - • Crew Report: "**Are inhibits in place?**"

2. Task Specific
   - ❑ √Tethers and Tools clear prior to SSRMS ORU movement
     - • Each EV report: "**Tethers and tools clear**"

3. Tool inventory
   - ❑ √Tethers on MWS
   - ❑ Confirm all others as standard unless removed

# EVA 2 TOOL CONFIGURATION

## EV1

EMU D-rings
- ❑ Ext on left side
- ❑ Ext on right side
- ❑ Waist Tethers (right Ext to MWS, √locked)
- ❑ Waist Tethers (left D-ring to MWS, √locked)
- ❑ 85-ft Safety Tether (right Ext, √locked)
- ❑ 85-ft Safety Tether – spare (right Ext, √locked)

MWS
- ❑ Small STS Trash Bag
  - ❑ Wire tie (secure trash bag to MWS, tether loop)
- ❑ 1 – Wire tie as tether loop
- ❑ 1 – RET (with PIP pin)
- ❑❑ 2 – RETs
- ❑ 1 – Adj Equipment Tether (across back of MWS)
- ❑ Swing Arm (right side)
  - ❑ 1 – RET (attach to PGT)
    - ❑ PGT s/n 1002 w/6"-Ext 7/16"
- ❑ BRT (left side)
  - ❑ 1 – RET
  - ❑❑ 2 – short wire ties

EMU Gloves
- ❑❑ 2 – Adj Equipment Tethers on wrists

## EV2

EMU D-rings
- ❑ Ext on left side
- ❑ Ext on right side
- ❑ Waist Tethers (left Ext to MWS, √locked)
- ❑ Waist Tethers (right D-ring to MWS, √locked)
- ❑ 85-ft Safety Tether (right Ext, √locked)
- ❑ 85-ft Safety Tether – spare (right Ext, √locked)

MWS
- ❑ Small Trash Bag
  - ❑ 1 – Adj Equipment Tether
- ❑❑ 2 – Wire ties as tether loops
- ❑ 1 – RET (with PIP pin)
- ❑ 1 – RET
- ❑ 1 – Adj Equipment Tether
- ❑ Swing Arm (right side)
  - ❑ 1 – RET (attach to PGT)
    - ❑ PGT s/n 1006 w/2"-Ext 7/16"
  - ❑ 1 – EVA Camera w/bracket
- ❑ BRT (left side)
  - ❑ 1 – RET
  - ❑❑ 2 – short wire ties

EMU Gloves
- ❑❑ 2 – Adj Equipment Tethers on wrists

**Prior to EVA, perform the following hardware inspections:**
1. RET cords for fraying
2. No red line visible, damage, or discoloration on safety and waist tether load Alleviation straps
3. Inspect ISS/STS trash bags for deformation/damage
4. Inspect EMU gloves for damage
5. Inspect BRT for loose screws

**Use BLUE RETs only**

CREWLOCK
- ❑ D-ring extender on A/L D-ring

- ❑ Lg-Sm RET
  - ❑ ATA Crewlock Bag
    - ❑ 1 – Fish Stringer (Adj Fuse tether)
    - ❑ 1 – Digital Camera w/bracket
    - ❑ 1 – Rd torque multiplier
      - ❑ **7/16" Flush Socket**
    - ❑ 1 – EVA Ratchet Wrench (no palm wheel)
      - ❑ 2" – Ext 7/16" rigid socket
    - ❑ 1 – BRS Pin Tool
    - ❑ CLPA Cover MLI Case (on internal RET)
    - ❑ 1 – RET
      - ❑ 1 – CLPA Cover (in MLI Case)
    - ❑ 1 – Adj Equipment Tether
      - ❑ CLA Cover MLI Case
    - ❑ 1 – RET
      - ❑ 1 – CLA Cover (in MLI Case)

- ❑ Lg-Sm RET
  - ❑ 1/4 Avionics Cable Bag

- ❑ Lg-Sm RET
  - ❑ Lg ORU Bag
    - ❑ Spare RGA
      - ❑❑ 2 – Connector caps (installed on RGA)
      - ❑ 1 – RET
  - ❑❑ 2 – Adj Equipment Tethers (outside of bag, for temp stow)

- ❑ Lg-Sm RET (If PMA3 Heater Cable not done on EVA 1)
  - ❑ PMA3 Crewlock Bag
    - ❑ 1 – Wire tie caddy
      - ❑❑❑❑❑❑❑❑❑❑ – Short wire ties (in caddy)
    - ❑ 1 – MMOD Shield Handling Tool
    - ❑❑❑ 3 – PMA3 HTR Cable Caps
      (size 15,17,25 integrated together w/long wire tie)

## **EVA 2 TOOL CONFIGURATION** (Cont)

Staging Bag

- ❑ Adjustable Fuse Tether #1
  - ❑ Socket Caddy (hook #1)
    - ❑ 6" wobble EXT
    - ❑ RAD
  - ❑ Velcro/Tape Caddy (hook #2)
  - ❑ PGT s/n 1008 (hook #3)
    - ❑ PGT Battery s/n _____
  - ❑ Vise Grips (hook #4)
  - ❑ Ratchet Wrench (hook #5)
  - ❑ Hammer (hook #6)

- ❑ Adjustable Fuse Tether #2
  - ❑ Spare Torque Wrench w/MLI (hook #1)
  - ❑ Connector Cleaner Tool Kit (hook #2)
  - ❑ Pin Straightener Assy (hook #3)
  - ❑ Probe (hook #4)
  - ❑ Prybar (hook #5)
  - ❑ *Empty* (hook #6)
  - ❑ *Empty* (hook #7)
- ❑ MMWS Key Strap Assembly (on wire tie to strap)

IV Bag

- ❑ 2 – Towels w/wire ties
- ❑ Contamination Detection Kit w/watch
- ❑ 2 – GP Caddy
  - ❑ 2 – Adj Thermal Mittens
- ❑ 3 – RET (black, must stay in IV bag)
  - ❑ Socket Caddy (hatch cont)
    - ❑ 1/2 socket 8-in ext (hatch)
    - ❑ 7/16 socket 6-in ext (spare)
  - ❑ DCM plug (2) (SAFER hardmount)

# EVA 2 INHIBIT PAD

Orbiter

TCS *(Prior to Egress)*
IV L12 1. √TCS POWER – OFF

TriDAR *(Prior to Egress)*
IV SSP2 1. √TRIDAR POWER – OFF

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

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

Ground

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

JEM

ICS-EF Antenna *(Prior to Egress)*
**SSIPC**
1. ICS MOD – OFF
2. ICS UPC – OFF
3. ICS HPA – OFF

USOS

PCU *(Prior to Egress)*

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

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

Lab Window *(Prior to Egress)*
IV If EV crew less than 10 feet from window or in window FOV, close window shutter.

S-Band (SASA) Antennas *(Prior to Egress)*
**MCC-H**
1. S1 SASA – Active
2. P1 SASA – Powered down

TRRJ *(Prior to Egress)*
**MCC-H** 1. √P1 TRRJ DLA - LOCKED at -40 degrees

ATA *(See Detailed Procedure for timing of inhibits)*
**MCC-H**/IV 1.106 P1 ATA POST REPLACEMENT ACTIVATION (SODF:ASSY OPS:17A)
**MCC-H**
1. √RPCM P11A_A RPC # 12 Open; Close cmd inh
2. √RPCM P12B_A RPC # 14 Open; Close cmd inh
3. √RPCM P12B_C PRC # 13 Open; Close cmd inh

RSOS

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

IMPULSE *(Prior to Egress)*
MCC-M 1. IMPULSE (ИПИ-100) – Is not activated

## **EVA 2 INHIBIT PAD** (Cont)

USOS (Get-Aheads)

RGA 2 *(On call prior to RGA 2 R&R)*
**MCC-H** 1. √RPCM S02B_E RPC 4 – Open, Close Cmd Inh

PMA3 Heater Cable *(On call prior PMA 3 Heater Cable)*
**MCC-H** 1. √RPCM N1RS2_B RPCs 1-5, 12-15, Open, Close Cmd Inh

## EVA 2 NOTES, CAUTIONS, WARNINGS

NOTES

1. Bolt install: Report torque and turns
2. Bolt release: Report torque and turns if different from published range
3. EVA connectors: After disconnection and prior to connection; verify pin and EMI band integrity; verify connector free of FOD
4. Inspect QDs for damage prior to mating
5. Toolbox doors must be closed with one latch per door when EV crew not in immediate vicinity
6. Avoid contact with OBSS striker bars (Vitrolube coating)
7. 85-ft safety tether retract force may affect body positioning

CAUTION

**ISS Constraints**

A. Avoid inadvertent contact with
   1. Grapple fixture shafts (drylube)
   2. PIP pins
   3. EVA Crane [PMA1]
   4. TCS Reflectors [PMA2,PMA3]
   5. APAS hardware [PMA2,PMA3]
   6. CETA Lights (Z-93 paint) [LAB,S1,Node 1]
   7. Deployed MISSEs [Columbus EPF]
   8. Passive UMAs
   9. MBS/SSRMS/SPDM/JEMRMS taped radiative surfaces: VDU, ACU, JEU, LEU, MCU, CRPCMs, and Cameras
   10. Deployed TUS cable [Nadir CETA rail]
   11. S0 aft face Radiator
   12. GPS Antennas (S13 paint) [S0,JLP]
   13. UHF Antennas [LAB,P1]
   14. ETCS Radiator flexhoses and panels [S1,P1]
   15. EETCS/PV Radiator flexhoses, bellows and panels [P6,P4,S4,S6]
   16. SASA RF Group [S1,P1]
   17. Heat pipe radiators [Z1]
   18. PCU cathode and HCA ports [Z1]
   19. Ku-Band Antenna (SGANT) dish [Z1]
   20. CMG cover/shells [Z1]
   21. SPDM SJEU, EP, OTCM, LEU, and LEE VDU Radiator surfaces
   22. Open CBM petal covers, LAB window shutter, and JPM window shutter
   23. FPMU [S1]
   24. OTSD
   25. JTVE, WVE/EVE, JEF VE Cameras [JEM]
   26. JEM A/L Target and Pins

CAUTION

**ISS Constraints** (Cont)

A. Avoid inadvertent contact with (Cont)
   27. S0/Node 2 Fluid Tray Hardlines at Node 2 end are limited to 25 lb
   28. JEF ORUs and EFUs (paint & lubricant)
   29. MAXI front and top panel (paint)
   30. SEDA-AP sensors (HIT, SDOM, & AOM) and MPAC & SEED
   31. Trunnions and UCMs (paint & lubricant) [JEF Payloads]

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

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

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

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

CAUTION

**ISS Constraints** (Cont)

E. For structural reasons
   1. Avoid vigorous body motions, quick grabs and kickoffs against tether restraints
   2. Avoid performing shaking motions (sinusoidal functions) more than four cycles
   3. Avoid kicking S1/P1 radiator beam. If any of these occur, wait 2 to 5 min to allow structural response to dissipate
   4. Avoid tool impact on ICS-EF sensor
   5. Avoid kicking MMOD shields between JLP and JPM

F. Other
   1. ITT Cannon connector: On demated connectors, do not rotate collar or manipulate cable/connector using collar or connector tool
   2. WIS Antennas: Do not use as handholds [Node 1,Lab,P6,Z1]
   3. Lubricant from Ku-Band SGANT gimbals [Z1], CMGs [Z1], and RTAS Ground Strap fasteners [P6,P4,S4,S6] can contaminate EMU
   4. MLI handholds are not rated for crewmember translation loads
   5. CBM petal covers may not be used as handholds unless both launch restraint pins are engaged
   6. Prevent inadvertent contact of the tether shuttle with ETRS when the P3 Tether Shuttle Stop is raised away from the rail

CAUTION

**Shuttle Constraints**

A. Avoid inadvertent contact with
   1. OBSS and SRMS Composite Sections Joint Torque Arms, Grapple Fixture Shafts, and Cable Harnesses
   2. LCS (silver Teflon) and LDRI (silver Teflon) and ITVC (gold foil) [OBSS]
   3. WVS Antenna [ODS Truss & PLB Sill]
   4. Payload Bay and Camera wire harnesses, cables, cable guides, and connectors

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

CAUTION

**HTV/HTV EP Constraints**

A. Avoid inadvertent contact with
   1. EVA Cover [HTV] (does not meet EVA kick loads)
   2. Wheel guide [HTV] (snag hazard)
   3. HBCS (berthing camera) [HTV EP]
   4. HCSM (solid lubricant) [HTV EP]
   5. HCAM (solid lubricant) [HTV EP]
   6. EP PIU (solid lubricant and Black/White Paint) [HTV EP]

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

WARNING

**ISS Constraints**

A. Avoid inadvertent contact with
   1. Grapple fixture targets and target pins
   2. SSU, ECU, beta gimbal platform, mast canister, SAW blanket boxes unless the beta gimbal is locked and the motor is turned off
   3. Stay inboard of SARJ when active
   4. Stay 2 ft from S1/P1 radiator beam rotational envelope when beam is free to rotate
   5. Stay 5 ft from moving MT on face 1
   6. SOLAR and EuTEF [COL EPF]
   7. ICS-EF sensors

B. Handrails
   1. Handrails previously used for MISSE attachment may not be used as a safety tether point [A/L endcone 564 & 566, A/L Tank 2 nad/fwd & port/fwd, P6 5389]

C. Pinch
   1. NZGL connector linkage. Use caution when mating/locking
   2. ITT Cannon Connector rotating housing
   3. EV side of IV Hatch during Hatch operation (also snag hazard) [A/L]
   4. LAB window shutter and CBM petal cover and JPM window shutter linkages during operation
   5. JEMRMS HRM capture latches
   6. JEM Cameras (JVTEs, EVE, WVE, & JEF VEs)
   7. JEM EFBM capture latches
   8. JEM EFU latching arms
   9. JEF SSE latch
   10. ICS-EF antenna boom
   11. SEDA-AP Mast

WARNING

**ISS Constraints** (Cont)

D. QDs
   1. If QD is in FID when valve is opened (bail fwd), QD will leak and fluid line may whip
   2. Do not rotate if in mated/valve open config

E. RF radiation exposure
   1. Stay 3.6 ft from S-Band (SASA) high gain Antenna when powered [S1,P1]
   2. Stay 1.3 ft from S-Band (SASA) low gain Antenna when powered [S1,P1]
   3. Stay 1 ft from UHF Antenna when powered [LAB,P1]
   4. Stay 0.3 ft from fwd/aft JPM PROX antenna

F. Sharp Edges
   1. Inner edges of WIF sockets
   2. APFR active WIF probes
   3. Mating surfaces of EVA connectors Avoid side loads during connector mating
   4. Back side of MMOD shield fasteners
   5. Spring loaded captive EVA fasteners (e.g., 6B-boxes, BMRRM, RTAS, SARJ Covers); the end of the spring may protrude
   6. PMA umbilical launch restraints-exposed bolt threads
   7. Adjustable Fuse Tether (Fish Stringer) buckles stowed in Node Bag
   8. Nickel coated braided copper Ground Straps may contain frayed wires [P6,P4,S4,S6]
   9. SPDM OTCM gripper jaws

WARNING

**ISS Constraints** (Cont)

F. Sharp Edges (Cont)
   10. Solar Array Blanket Box [P6,S6]
   11. Keep hands away from SSRMS LEE/POA/SPDM LEE/JEMRMS EE opening, snares, and PDGF curvic coupling (teeth)
   12. Fastener threads on back of Z1 U-jumper male FQD panel, if nutplate cap missing
   13. Outboard MT rail attachment lug near P6 handrail 5333 and gap spanner
   14. P2 connector on EWIS box TAA-06 [Zenith/Forward Corner 1 of P5 – SARJ at 0 deg]
   15. Port/Aft portion of A/L circular HR [HR 0506]
   16. Interior of JEMRMS HRMs
   17. JEM A/L hatch corners
   18. ICS-EF AHM gears
   19. MAXI Visual Star Camera

G. Thermal
   1. EVA connectors with booties may become hot if left uncovered. Handling may need to be limited
   2. PMA handrails may be hot. Handling may need to be limited
   3. Turn off glove heaters when comfortable temp reached to prevent bladder damage. Do not pull fingers out of gloves when heaters are on
   4. Uncovered trunnion pins may be hot
   5. SSRMS/MBS/SPDM/JEMRMS/JVTE/JEF VE operating cameras and lights may radiate large amounts of heat

WARNING

**ISS Constraints** (Cont)

G. Thermal (Cont)

6. Stay ≥ 1 ft away from PMAs and MMOD shields > 270 degF if EMU sun visor up; limit time to 15 min or less if > 300 degF
7. Stay at least 0.5 ft away from PMA and MMOD shields > 325 degF
8. Do not touch EMU protective visor if temp has been < -134 degF for > 15 min
9. No EMU TMG contact with PMAs and MMOD shields > 320 degF
10. No EMU boot contact with foot restraint when temp < -120 degF or > 200 degF
11. Columbus end cones may violate touch temperature constraints when $-75 \leq \beta \leq -60$ or $60 \leq \beta \leq 75$V
12. PDGF surfaces may not meet touch temperature requirements for unlimited contact when $\beta \leq -70$ or $\beta \geq 70$
13. JPM port end cones and JLP port nadir may violate touch temperature constraints when $\beta > 60$ deg

H. Electrical Shock

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

WARNING

**ISS Constraints** (Cont)

H. Electrical Shock (Cont)

- MBS Cross-Connect jumpers (translate past these using UMA handrails) include S0 EVA Power Cables (inside S0 Bay 00 Face 4, Bay 01 Face 3) ESP-2 jumper (inside S0 Bay 03 Face 4)

2. Do not touch SPDM CLPA 1 electrical connector prior to camera installation

WARNING

**Shuttle Constraints**

A. Arcing/Molten Debris

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

B. Pinch

1. PRLA operation [PLB]

C. RF radiation exposure

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

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

WARNING

**Shuttle Constraints** (Cont)

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

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

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

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

WARNING

**HTV/HTV EP Constraints**

A. Avoid inadvertent contact with
   1. HTV solar array panels (kick loads can shatter panel and generate sharp edges) [HTV]
   2. HTV fwd RCS thrusters [HTV]

B. Pinch
   1. HSM connector moving parts (pinch hazard and dry film lube) [HTV EP]
   2. EP wheels (pinch point) [HTV EP]

C. RF radiation exposure
   1. Stay 0.7 ft from IOS-N antenna [HTV]
   2. Stay 0.7 ft from IOS-Z antenna [HTV]
   3. Stay 0.3 ft from PLS-Z antenna [HTV]

D. Thermal
   1. EP/HTV handrails may be hot Handling may need to be limited

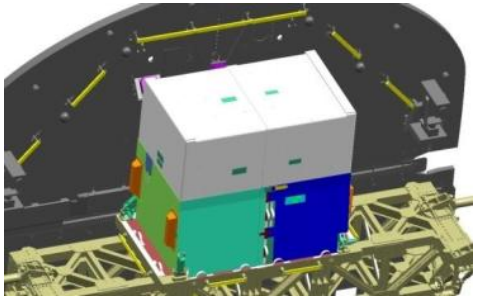
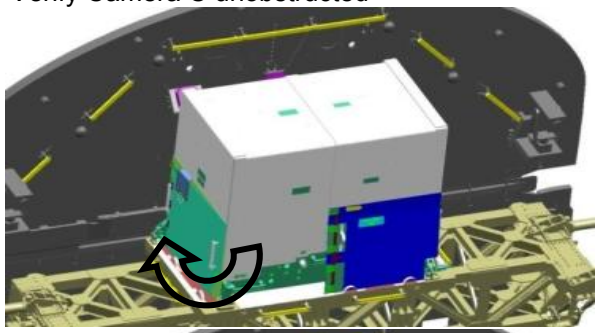
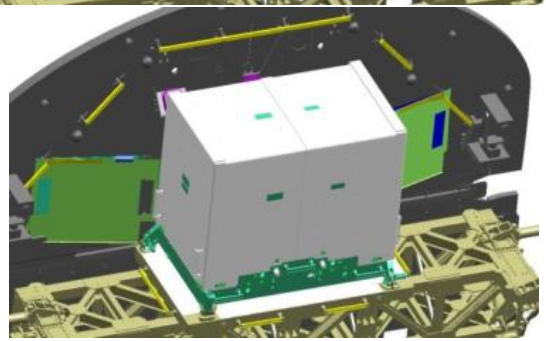
## EGRESS/SETUP (00:55)

| IV (SSRMS) | EV1 (Ol) | EV2 (Fg) |
|---|---|---|
| 1. Start recorders<br>2. √Initial Condition<br><br>3. WVS Software:<br>Select page – RF camera<br>Sel 'Advanced Controls'<br>S-Band Level (two) – Max<br>(required after EV1 and EV2 egress airlock) | **Initial Condition:**<br>Left waist tether to A/L D-ring extender<br>√Bails closed, Sliders locked<br><br><u>EGRESS</u> (00:15)<br>1. Open A/L thermal cover<br>2. Egress A/L<br>3. Connect 85-ft safety tether to A/L fwd anchor point<br>√Both bails closed, slider locked<br>√Reel unlocked<br>4. Release waist tether from A/L D-ring<br><br>5. Receive ATA crewlock bag from EV2; temp stow on A/L HR<br><br>6. Receive NOD3 Ch 1/4 Cable Bag from EV2; stow on BRT<br><br>7. Receive anchor hook of EV1 85-ft safety tether; connect to A/L aft anchor point<br>√Anchor bail closed, slider locked<br>8. Give EV2 GO to release EV2 waist tether<br>9. √SAFER MAN ISOL vlv – OP (dn) and HCM (dn)<br>√ERCA LED – On (if no video signal)<br>10. Inspect gloves | **Initial Condition:**<br>Right waist tether to forward UIA D-ring<br>√Bails closed, Sliders locked<br><br><u>EGRESS</u> (00:15)<br><br>1. Transfer ATA crewlock bag to EV1 (Lg/Sm RET goes with bag)<br>2. Transfer NOD3 Ch 1/4 Cable Bag to EV1 (Lg/Sm RET remains in crewlock)<br><br>3. Transfer anchor hook of EV2 85-ft safety tether to EV1<br>√Load alleviating bail closed, slider locked<br>√Reel unlocked<br><br>4. On EV1 GO, release waist tether from UIA D-ring<br>5. Egress A/L<br>6. Close A/L thermal cover<br>7. √SAFER MAN ISOL vlv – OP (dn) and HCM (dn)<br>√ERCA LED – On (if no video signal)<br>8. Inspect gloves |

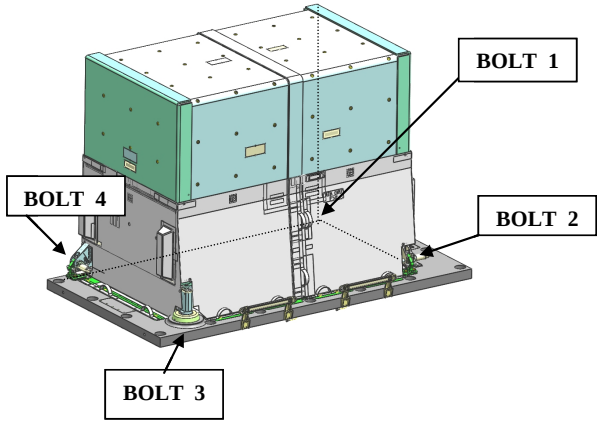
**EGRESS/SETUP (00:55)** (Cont)

| IV (SSRMS) | EV1 (Ol) | EV2 (Fg) |
|---|---|---|
| | SETUP (00:35)<br>11. Translate to Lab HR 0230 (stbd/nadir side of lab Below ESP-2); fairlead on ESP-2 trunnion<br>12. Stow NOD3 Ch 1/4 Cable Bag on Lab HR 0230 with integrated tethers<br>13. Retrieve ATA crewlock bag from A/L HR; stow on BRT<br>14. Translate to ESP-2; set fairlead (P) around aft/port trunnion pin<br>15. Translate to Lab HR 0232; set fairlead (P)<br>16. Translate to JPM HR 1102 (nadir/port translation path on Lab/NOD2 starts with Lab HR 0200)<br>17. Tether swap to spare 85-ft safety tether on JPM HR 1102<br>√Both bails closed, sliders locked<br>√Reel unlocked<br>18. Stow A/L 85-ft safety tether on JPM HR 1102 | SETUP (00:35)<br>9. Translate to Lab HR 0200 via nadir/port route (EV2 leads)' fairlead (R)<br>10. Translate to NOD2 HR 0306; be aware of grapple fixture on PMA2<br>11. Tether swap to spare 85-ft safety tether on NOD2 HR 0306<br>√Both bails closed, sliders locked<br>√Reel unlocked<br>12. Stow A/L 85-ft safety tether on NOD2 HR 0306 |
| | WARNING<br>Crew Shock hazard: 2 ft KOZ of SSPTS connectors port of PMA2<br>Crew Shock hazard: 2 ft KOZ from exposed stbd/fwd MPM contacts (only EV1)<br>Stay above PLB sill when within 1 ft of powered ROEU connector (only EV1) | |
| | 19. Translate to LMC along stbd sill; fairlead (R) on HR on outer standoff of ODS<br>20. Temp stow ATA crewlock bag on LMC clear of EuTEF<br>21. Inspect gloves | 13. Translate to SSRMS GCA position; fairlead (P) tether along port sill<br>14. Inspect gloves |

## ATA REMOVAL FROM LMC (00:50)

| IV (SSRMS) | EV1 (OI) | EV2 (Fg) |
|---|---|---|
| 1. Verify SSRMS at setup EVA 2 Start position<br>  <br>SSRMS: GCA to APFR reconfig position | REMOVE ATA MLI (00:10)<br>1. Release fwd/port MLI flap; restrain with velcro on port panel<br>2. Release port MLI flap; restrain with integral strap on bulkhead handrail<br>3. Verify Camera B unobstructed<br>4. **PGT: B6/CCW2/30.5**<br>(24.0 ft-lb, 30 RPM)<br>6" -Ext-7/16"<br>5. Release ATA Bolt 1 ~16 turns<br>√Two white lines visible<br>Fold floating clevis clear of bolt<br>6. Release fwd/stbd MLI flap; restrain with velcro on stbd panel (note config of fwd flaps)<br>7. Release stbd MLI flap; restrain with integral strap on bulkhead handrail<br>8. Verify Camera C unobstructed<br>  <br>  | NOTE<br>Remain clear of PLB Cameras<br><br>SSRMS SETUP IN PLB (00:40)<br>1. GCA SSRMS for APFR reconfig position<br>2. Tether swap to 55-ft safety tether on SSRMS LEE HR<br>√Both bails closed, sliders locked<br>√Reel unlocked<br>3. Stow spare 85-ft safety tether on port sill HR<br>4. Reconfigure APFR setting **[12,PP,F,8]**<br>5. Attach long waist tether to APFR Ingress Aid attach point<br>6. Fairlead (P) to prevent tether snag on helmet as reqd<br>7. GCA SSRMS for APFR ingress<br>8. Ingress APFR<br>9. Cooling/Visor Check<br>10. Inspect gloves<br>11. GCA for access to Bolt 2<br>12. RET to ATA; lock RET to keep tether from retracting |

## ATA REMOVAL FROM LMC (00:50) (Cont)

| IV (SSRMS) | EV1 (OI) | EV2 (Fg) |
|---|---|---|
| PGT Setting for Bolt 3 if release difficult:<br>**PGT: B4/CCW1/30.5**<br>(19.4 ft-lb, 10 RPM)<br>No Ext +TM (antibacklash – neutral)<br>5 turns (1 turn on bolt) | REMOVE ATA FROM LMC (00:40)<br>  <br><br>9. **PGT: B6/CCW2/30.5**<br>(24.0 ft-lb, 30 RPM)<br>6" -Ext-7/16"<br>10. Once EV2 ingressed into APFR, release Bolt 4, ~16 turns to a hardstop<br>√Two white lines visible<br>11. On EV2 GO, break torque on Bolt 3 with ratchet wrench – 2" -Ext-7/16"<br>12. Stow ratchet wrench in ATA crewlock bag<br>13. **PGT: B6/CCW2/30.5**<br>(24.0 ft-lb, 30 RPM)<br>6" -Ext-7/16"<br>14. Release Bolt 3, 18-19 turns (bolt pops up when fully released) | REMOVE ATA FROM LMC (00:10)<br>13. **PGT: B6/CCW2/30.5**<br>(24.0 ft-lb, 30 RPM)<br>2" -Ext-7/16"<br>14. Release Bolt 2, ~16 turns to a hardstop<br>√Two white lines visible<br>15. When in two-handed positive control of ATA, give EV1 GO to release Bolt 3 |
| SSRMS: GCA EV2 clear of structure | 15. Lift ATA zenith, away from LMC (expect to overcome soft dock force)<br>16. GCA SSRMS clear of structure<br>17. Verify ATA MLI restrained clear for install<br>18. Retrieve ATA crewlock bag from LMC HR; stow on BRT<br>19. Inspect gloves | 16. Lift ATA zenith, away from LMC (expect to overcome soft dock force) |

## ATA INSTALL ON P1 (02:50)

### IV (SSRMS)

SSRMS: GCA to ATA install position

| ATA Bolts | Torque (ft-lb) | Turns |
|---|---|---|
| 1 | N/R | |
| 2 | N/R | |
| 3 | N/R | |
| 4 | N/R | |

| ATA Bolts | Final PGT Torque (ft-lb) | PGT Turns |
|---|---|---|
| 3 | | |

### EV1 (OI)

PREP FOR P1 ATA INSTALL (00:30)

1. Translate to P1 ATA via nadir/port route; fairlead aft of ESP-1 (P), S0 HR 3543 (R), fwd of stanchion (P), and P1 HR 3620 (R)
2. Temp stow ATA crewlock bag on P1 HR 3609
3. Retrieve adj fuse tether from ATA crewlock bag; stow on MWS
4. BRT to P1 HR 3609 for ATA installation

P1 ATA INSTALL ZENITH BOLTS (2) (00:25)

5. GCA ATA into install position
6. **PGT: A7/CW2/30.5**
   (9.2 ft-lb, 30 RPM)
   6" -Ext-7/16"
7. Drive Bolt 3, ~13.5 turns to a hardstop
8. Drive Bolt 4, ~16 turns to a hardstop
   □ Verify no white lines visible
9. Remove 6"-Ext-7/16" wobble socket from PGT; stow in trash bag
10. Retrieve torque multiplier from ATA crewlock bag; install on bolt 3
    □ Verify anti-backlash in neutral
11. **PGT: B1/CW1/30.5**
    (12.0 ft-lb, 10 RPM)
    No Ext
12. Once Bolt 1 installation complete, drive Bolt 3 to a hardstop; report torque and turns
13. Reinstall 6"-Ext-7/16" wobble socket on PGT
14. Remove torque multiplier from Bolt 3; stow in ATA crewlock bag

### EV2 (Fg)

MNVR TO P1 ATA INSTALL LOCATION (00:30)

1. EV2 SSRMS MNVR to ATA install position

P1 ATA INSTALL NADIR BOLTS (2) (00:25)

2. Guide ATA into install location
3. Continue to hold while EV 1 drives bolts
4. Remove RET from ATA
5. **PGT: A7/CW2/30.5**
   (9.2 ft-lb, 30 RPM)
   2" -Ext-7/16"
6. Once Bolt 4 installation complete, drive Bolt 2, ~16 turns to a hardstop
   □ Verify no white lines visible
7. Egress SSRMS as reqd for access to Bolt 1
8. **PGT: A7/CW2/30.5**
   (9.2 ft-lb, 30 RPM)
   2" -Ext-7/16"
9. Drive Bolt 1, ~16 turns to a hardstop
   □ Verify no white lines visible
10. Ingress APFR

## ATA INSTALL ON P1 (02:50) (Cont)

| IV (SSRMS) | EV1 (OI) | EV2 (Fg) |
|---|---|---|
| 1. Verify with MCC-H 1.104 P1 ATA REMOVAL AND REPLACEMENT PREP (SODF: ASSY OPS: 17A) is complete, and EV crew is go for Part 1 of 1.106 P1 ATA POST REPLACEMENT ACTIVATION (SODF: ASSY OPS: 17A)<br><br>SSRMS:<br>GCA EV2 Clear of structure<br><br>2. Verify with MCC 1.106 P1 ATA POST REPLACEMENT ACTIVATION Part 2 (SODF: ASSY OPS: 17A) complete<br><br><u>EVA FLUID QD CUE CARD</u><br>FS CC 7-146<br><br>3. When all QDs mated and open, give MCC GO to perform 1.106 P1 ATA POST REPLACEMENT ACTIVATION Part 4 (SODF: ASSY OPS: 17A) | <u>CONNECT ELECTRICAL & ZENITH FLUID CONNECTORS</u> (00:45)<br>15. Attach adj fuse tether to ATA HR<br>16. On IV/MCC GO: Remove cap from ATA J2; stow cap on adj fuse tether<br>17. Mate connector P635 to ATA J2; close TA clamps as reqd<br>18. Remove cap from ATA J1; stow cap on adj fuse tether<br>19. Mate connector P634 to ATA J1; close TA clamps as reqd<br>20. BRT to P1 HR 3609 for QD operations<br>21. On IV/MCC GO, remove 1/2" QD cap from ATA QD M4: Stow cap on adj fuse tether<br>22. Mate QD F174 to ATA QD M4 (NH3) – **BLOCK D**<br>23. Open valve on QD F174/M4 (NH3) – **BLOCK E**<br>24. Replace thermal bootie on QD F174; close TA clamp as reqd<br><br>25. Remove 1/4" QD cap from ATA QD M2; stow on adj fuse tether<br>26. Mate QD F2/M3/M2 to ATA QD M2 (N2) – **BLOCK D**<br>27. Open valve on QD F2/M3/M2 (N2) – **BLOCK E**<br>28. Replace thermal bootie on QD F2/M3/M2<br><br>29. Remove 1/2" QD cap from ATA QD M3; stow on adj fuse tether<br>30. Mate QD F175 to ATA QD M3 (NH3) – **BLOCK D**<br>31. Open valve on QD F175/M3 (NH3) – **BLOCK E**<br>32. Attach 1/2" SPD to QD F175/M3 – **BLOCK F**<br>33. Replace thermal bootie on QD F175; close TA clamp as reqd<br><br>34. Remove 1/4" QD cap from ATA QD M1; stow on adj fuse tether<br>35. Mate QD F1/M2/M1 to ATA M1 (N2) – **BLOCK D**<br>36. Open valve on QD F1/M2/M1 (N2) – **BLOCK E**<br>37. Replace thermal bootie on QD F1/M2/M1 | <u>PREP FOR ATA HANDOFF</u> (00:25)<br><br>11. Inspect gloves<br>12. GCA SSRMS clear of structure<br><br>13. Give SSRMS GO to MNVR to Old ATA Setup position |

**ATA INSTALL ON P1 (02:50)** (Cont)

| IV (SSRMS) | EV1 (OI) | EV2 (Fg) |
|---|---|---|
| | 38. Retrieve adj fuse tether from the ATA and install on MWS<br>39. WVS Closeout of ATA fluid and electrical connections<br><br>40. Close shroud on port side of ATA<br>41. WVS Close out of ATA MLI<br>42. Inspect gloves<br><br><u>P1 CLEANUP/ATA HANDOFF</u> (00:40)<br>43. Relocate APFR from WIF P1-04 to WIF P1-03 [3,HH,G,6]<br>□ Verify Black on Black<br>□ Perform pull test<br>44. Attach waist tether to APFR | <u>ATA HANDOFF</u> (00:40) |
| SSRMS: GCA to old ATA release position | 45. Ingress APFR<br>46. Check Cooling/Visor<br>47. GCA SSRMS to old ATA release position<br>48. RET to ATA; lock RET to keep tether from retracting | |
| SSRMS: GCA to old ATA handoff position | 49. When in two-handed positive control of ATA, give SSRMS GO to release FGB<br>50. Once grapple release confirmed, give SSRMS GO to MNVR away from old ATA release position<br><br>51. On EV2 GO, release RET from ATA | 14. Check Cooling/Visor<br>15. GCA SSRMS to old ATA handoff position<br>16. RET to ATA; lock RET to keep tether from retracting<br>17. Once in positive control, give EV1 GO to release RET and ATA<br>18. Give SSRMS GO to MNVR to PLB LMC |
| SSRMS: GCA EV2 clear of structure | 52. On EV2 GO, release ATA<br>53. GCA SSRMS clear of structure<br>54. Egress APFR<br>55. Retrieve adj equipment tether and adj fuse tether from NTA; stow both adj fuse tethers (2) and adj equipment tether in ATA crewlock bag<br>56. Retrieve ATA crewlock bag from P1 HR 3609; stow on BRT<br>57. Inspect gloves | |

## ATA INSTALL ON LMC/FGB REMOVAL (01:10)

### IV (SSRMS)

SSRMS: MNVR to PLB LMC

| ATA Bolts | Torque (ft-lb) | Turns |
|---|---|---|
| 1 | N/R | |
| 2 | N/R | |
| 3 | N/R | |
| 4 | N/R | |

| ATA Bolts | Final Torque (ft-lb) | Turns |
|---|---|---|
| 3 | | |

### EV1 (OI)

PREP FOR ATA INSTALL ON LMC (00:30)

1. Translate to PLB via nadir route; retrieve fairleads at P1 HR 3620, S0 HR 3543, and ESP-1
2. Translate to LMC along stbd sill; fairlead (R) on HR on outer standoff of ODS
3. Temp stow ATA crewlock bag on LMC HR near Bolt 3
4. Verify ATA MLI restrained clear for ATA install
5. GCA SSRMS to old ATA berth position

ATA INSTALL ON LMC (00:40)

6. Softdock ATA on LMC
7. **PGT: A7/CW2/30.5**
   (9.2 ft-lb, 30 RPM)
   6" -Ext-7/16"
8. Drive Bolt 3, 18-19 turns to a hardstop
9. Drive Bolt 4, ~16 turns to a hardstop
   □ Verify no white lines visible (Bolt 4 only)
10. Remove 6"-Ext-7/16" wobble socket from PGT; stow in trash bag
11. Retrieve torque multiplier from ATA crewlock bag; install on Bolt 3
    □ Verify antibacklash in neutral
12. **PGT: A7/CW1/30.5**
    (9.2 ft-lb; 10 RPM)
    No Ext
13. Drive Bolt 3 to hardstop; report torque and turns
14. Reinstall 6"-ext-7/16" wobble socket on PGT
15. Remove torque multiplier from Bolt 3; stow in ATA crewlock bag
16. Retrieve ATA crewlock bag from LMC HR; transfer to EV2

### EV2 (Fg)

SSRMS MNVR TO LMC (00:30)

1. Mnvr to PLB LMC

ATA INSTALL ON LMC (00:40)

2. Soft dock ATA on LMC
   Hold ATA in place while EV1 drives Bolt 3
3. **PGT: A7/CW2/30.5**
   (9.2-lb, 30 RPM)
   2" -Ext-7/16"
4. Drive Bolt 2, ~16 turns to a hardstop
   □ Verify no white lines visible
5. Remove RET from ATA
6. Egress SSRMS
7. GCA SSRMS for SSRMS Cleanup
8. Tether swap to spare 85-ft safety tether temp stowed on port sill HR
   √Both bails closed, sliders locked
   √Reel unlocked
9. Receive ATA crewlock bag from EV1; perform ATA crewlock bag inventory
10. Stow ATA crewlock bag on APFR bootplate
11. Stow SSRMS 55-ft safety tether load alleviating hook to outside of ATA crewlock bag

## ATA INSTALL ON LMC/FGB REMOVAL (01:10) (Cont)

| IV (SSRMS) | EV1 (OI) | EV2 (Fg) |
|---|---|---|
| | CAUTION<br>Avoid contact with FGB grapple pin and RMS target<br><br>17. RET to FGB<br>18. **PGT: B7/CCW2/30.5**<br>(25.5 ft-lb, 30 RPM)<br>6" -Ext-7/16"<br>19. Release FGB mounting bolts (4) ~10 turns (any order)<br>□ GP 1 □ GP 2<br>□ GP 3 □ GP 4<br>20. Remove FGB from ATA; stow on BRT<br>21. Inspect gloves<br><br>22. Translate to JPM HR 1102; retrieve ODS fairlead<br>23. Tether swap to A/L 85-ft safety tether at JPM HR 1102<br>√Both bails closed, sliders locked<br>√Reel unlocked<br>24. Retrieve anchor hook of spare 85-ft safety tether; stow on MWS | 12. Retrieve SSRMS 55-ft safety tether anchor hook from SSRMS LEE HR; stow on outside of ATA crewlock bag<br>13. Inspect gloves<br><br>14. Assist EV1 with FGB stow on BRT<br>15. **PGT: A7/CW2/30.5**<br>(9.2 ft-lb, 30 RPM)<br>2" -Ext-7/16"<br>16. Drive Bolt 1, ~16 turns to a hardstop<br>□ Verify no white lines visible<br>17. **PGT: A1/CW2/30.5**<br>(2.5 ft-lb, 30 RPM)<br>2" -Ext-7/16"<br><br>18. Re-torque FGB mounting bolts for landing (4), ~17-20 turns; report torque and turns |

| ATA FGB Mounting Bolts | Re-Torque (ft-lb) | Turns |
|---|---|---|
| GP1 | | |
| GP2 | | |
| GP3 | | |
| GP4 | | |

## EVA CLEANUP (00:25)

### IV

SSRMS: MNVR to PLB clearance position

| PM FGB Mounting Bolts | Torque (ft-lb) | Turns |
|---|---|---|
| GP2 | | |
| GP3 | | |
| GP4 | | |
| GP1 | | |

### EV1 (OI)

WARNING
Stay 3.6 ft from S-Band (SASA) high gain Antenna on S1

FGB CLEANUP (00:25)

1. Translate to S1 ATA, zenith face, for FGB installation
2. **PGT: B6/CCW2/30.5**
   (24.0 ft-lb, 30 RPM)
   6" -Ext-7/16
3. Release S1 ATA Bolt 1 ~16 turns
   √Two white lines visible
   Fold floating clevis clear of bolt
4. **PGT: B7/CCW2/30.5**
   (25.5 ft-lb, 30 RPM)
   6" -Ext-7/16"
5. Release FGB mounting bolts (4), ~20 turns (any order)
   □ GP 1 □ GP 2
   □ GP 3 □ GP 4
6. Orient FGB such that RMS target is facing aft/zenith
7. Soft dock FGB to S1 ATA

CAUTION
GP2 must be the first bolt torqued during installation. Remaining bolts torqued in a star pattern

8. **PGT: A7/CW2/30.5**
   (9.2 ft-lb, 30 RPM)
   6" -Ext-7/16"
9. Drive FGB mounting bolts (4), ~8-11 turns to a hardstop; report torque & turns
10. Close out photos of FGB on S1 ATA
11. Translate to A/L
12. Perform tool inventory

### EV2 (Fg)

SSRMS CLEANUP (00:25)

1. Secure MLI flaps around ATA
2. Remove APFR from SSRMS; stow on BRT
3. Remove WIF adapter from SSRMS; stow on MWS
4. Verify tethers clear of SSRMS; give SSRMS GO to MNVR to PLB clearance position
5. Inspect gloves
6. Translate to NOD2 HR 0306; be aware of grapple fixture on PMA2
7. Tether swap to A/L 85-ft safety tether at NOD2 HR 0306
   √Both bails closed, sliders locked
   √Reel unlocked
8. Retrieve anchor hook of spare 85-ft safety tether; stow on MWS
9. Translate to A/L WIF 10
10. Stow APFR on A/L WIF 10 **[4,PP,F,12]**
    □ Verify Black on Black
    □ Perform pull test
11. Retrieve ATA crewlock bag from APFR
12. Translate to A/L
13. Perform tool inventory

## INGRESS (00:20)

| IV | EV1 (OI) | EV2 (Fg) |
|---|---|---|
| 1. Perform WVS PWRDN (PHOTO/TV, WVS CUE CARD) | INGRESS (00:20)<br><br>1. On EV2 GO, release EV2 A/L 85-ft safety tether anchor hook from external D-ring; transfer to EV2<br><br>2. Attach waist tether to internal A/L D-ring<br>√Both bails closed, sliders locked<br>3. Release EV1 A/L 85-ft safety tether anchor hook from external A/L D-ring; stow on MWS<br>4. Ingress A/L<br>5. Close thermal cover; attach Velcro strap<br>6. Connect SCU to DCM. √SCU locked<br>7. Expect 1-3 minute delay for SCU cooling with TCV 8 – Max C<br>8. WATER – OFF (fwd), expect H2O IS OFF msg | INGRESS (00:20)<br>1. Open thermal cover<br>2. Stow ATA crewlock bag in crewlock using Lg/Sm RET<br>3. Ingress A/L<br>4. Attach right waist tether to fwd UIA D-ring<br>√Both bails closed, sliders locked<br><br>5. Give EV1 GO to release EV2 A/L 85-ft safety tether anchor hook<br>6. Receive A/L 85-ft safety tether from EV1 and stow<br><br>7. Connect SCU to DCM. √SCU locked<br>8. Expect 1-3 minute delay for SCU cooling with TCV 8 – Max C<br>9. WATER – OFF (fwd), expect H2O IS OFF msg |
| | CAUTION<br>Do not close hatch until EMU WATER – OFF for 2 min | |
| | 9. Verify outer hatch clear of hardware<br>10. EV Hatch – verify handle position per hatch decal; close and lock hatch<br>11. Go to PRE-REPRESS (DEPRESS/REPRESS Cue Card) | 10. Go to PRE-REPRESS (DEPRESS/REPRESS Cue Card) |

# POST EVA 2 TOOL CONFIG

## EV1

EMU D-rings
- ❑ Ext on left side
- ❑ Ext on right side
- ❑ Waist Tethers (right Ext to MWS, √locked)
- ❑ Waist Tethers (left D-ring to MWS, √locked)
- ❑ 85-ft Safety Tether (right Ext, √locked)
- ❑ 85-ft Safety Tether – spare (right Ext, √locked)

MWS
- ❑ Small STS Trash Bag
  - ❑ (secure trash bag to MWS, tether loop)
- ❑ 1 – Wire tie as tether loop
- ❑ 1 – RET (with PIP pin)
- ❑❑ 2 – RETs
- ❑ 1 – Adj Equipment Tether
- ❑ Swing Arm (right side)
  - ❑ 1 – RET (attach to PGT)
    - ❑ PGT s/n 1002 w/6"-Ext 7/16"
- ❑ BRT (left side)
  - ❑ 1 – RET
  - ❑❑ 2 – short wire ties

EMU Gloves
- ❑❑ 2 – Adj Equipment Tethers on wrists

## EV2

EMU D-rings
- ❑ Ext on left side
- ❑ Ext on right side
- ❑ Waist Tethers (left Ext to MWS, √locked)
- ❑ Waist Tethers (right D-ring to MWS, √locked)
- ❑ 85-ft Safety Tether (right Ext, √locked)
- ❑ 85-ft Safety Tether – spare (right Ext, √locked)

MWS
- ❑ Small Trash Bag
  - ❑ 1 – Adj Equipment Tether
- ❑❑ 2 – Wire ties as tether loops
- ❑ 1 – RET (with PIP pin)
- ❑ 1 – RET
  - ❑ 1 – WIF Adapter
- ❑ 1 – Adj Equipment Tether
- ❑ Swing Arm (right side)
  - ❑ 1 – RET (attach to PGT)
    - ❑ PGT s/n 1006 w/2"-Ext 7/16"
  - ❑ 1 – EVA Camera w/bracket
- ❑ BRT (left side)
  - ❑ 1 – RET
  - ❑❑ 2 – short wire ties

EMU Gloves
- ❑❑ 2 – Adj Equipment Tethers on wrists

## CREWLOCK

- ❑ D-ring extender on A/L D-ring

- ❑ Large-Sm RET
  - ❑ ATA Crewlock Bag
    - ❑ 1 – Fish Stringer (Adj Fuse Tether-from ATA worksite)
    - ❑ 1 – Digital Camera w/bracket
    - ❑ 1 – Rd torque multiplier
      - ❑ 7/16" Flush Socket
    - ❑ 1 – Fish Stringer (Adj Fuse Tether)
      - ❑❑ 2 – ½" ATA Fluid QD Caps
      - ❑❑ 2 – ¼" ATA Fluid QD Caps
      - ❑❑ 2 – ATA Electrical Caps
    - ❑ 1 – Ratchet Wrench
      - ❑ 2" – Ext 7/16" rigid socket
    - ❑ 1 – Adjustable Tether (from ATA worksite)
    - ❑ 1 – BRS Pin Tool
    - ❑ 1 – Adj Equipment Tether
      - ❑ CLA Cover MLI Case
    - ❑ 1 – RET

    - ❑ 1 – RET
      - ❑ 1 – CLPA Cover MLI Case

- ❑ Large-Sm RET (used for 1/4 Bag)

- ❑ Lg-Sm RET
  - ❑ Lg ORU Bag
    - ❑ Failed RGA
      - ❑❑ 2 – Connector caps (installed on RGA)
      - ❑ 1 – RET
  - ❑❑ 2 – Adj Equipment Tethers (outside of bag)

- ❑ Lg-Sm RET (if PMA3 Heater Cable not done on EVA 1)
  - ❑ PMA3 Crewlock Bag
    - ❑ 1 – Wire tie caddy
      - ❑❑❑❑❑❑❑❑❑❑ – Short wire ties (in caddy)
    - ❑ 1 – MMOD Shield Handling Tool
    - ❑❑❑ 3 – PMA3 HTR Cable Caps
      (size 15,17,25 integrated together w/long wire tie)

# SPARE ATA REMOVAL FROM LMC – TASK DATA

**Estimated Task Duration:**

| | With SSRMS | Without SSRMS |
|---|---|---|
| **One EV Crew** | **N/A** | **N/A** |
| **Two EV Crew** | **~00:50** | **N/A** |

**ORU Specs:**

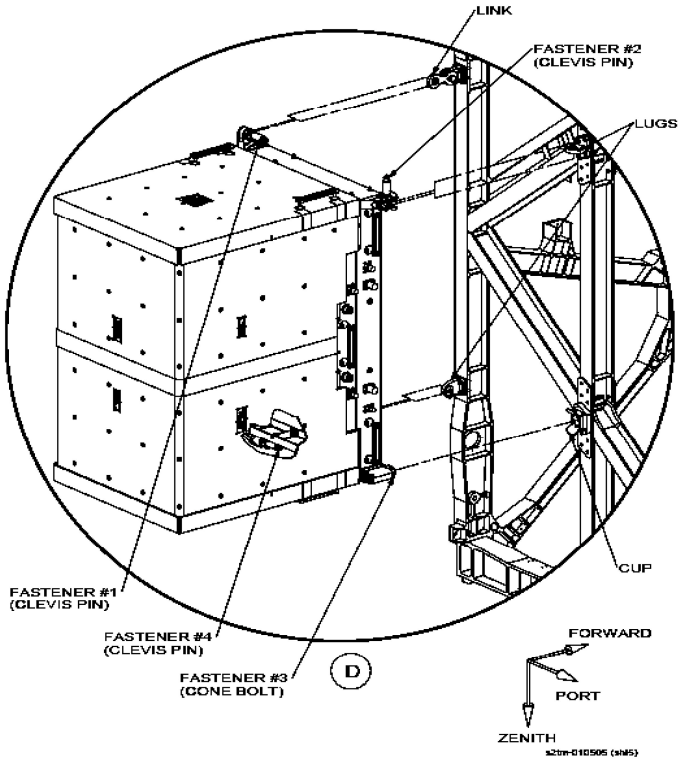
| ORU | Dimensions (inches) | Mass (lbm) |
|---|---|---|
| ATA | (L*W*H) 57.3" x 80.1" x 45.4" | Dry – 1289<br>Wet – 1749.2 |

**Tools:**

| EV1 | EV2 |
|---|---|
| PGT with 6 inch –7/16" Wobble Socket<br>Ratchet Wrench with 2" Rigid Socket<br>BRT | PGT with 6" Wobble or 2" rigid socket |

**Foot Restraints:**

| Task | WIF | APFR Setting |
|---|---|---|
| **APFR** | **SSRMS w/hitch pin** | **[12-PP-F-8]** |




**Fasteners:**

| Fastener Name | PGT/ratchet | Socket | Qty | Turns | Install Torque (ft-lbf) Ground | Recommended Release Torque (ft-lbf) | Failure Torque (ft-lbf) Remove/ Install | Features |
|---|---|---|---|---|---|---|---|---|
| Bolt 1 (Clevis) | **[B6,(24.0) CCW2, 30.5]** | 6" wobble | 1 | 16.0 - 16.5 | 20.0 - 22.9 | 24.0 | 165.8/35.1 | √2 white lines visible |
| Bolt 2 (Clevis) | **[B6,(24.0) CCW2, 30.5]** | 6" wobble | 1 | 16.0 - 16.5 | 20.0 - 22.9 | 24.0 | 165.8/35.1 | √2 white lines visible |
| Bolt 3 (Microconical) | Ratchet wrench to break torque or PGT + TM **[B4,(19.4) CCW2, 30.5]**<br><br>after torque is broken PGT **[B6,(24.0) CCW2, 30.5]** | 2" rigid/6" wobble | 1 | 18 - 19 | 69.0 - 81.0 | 19.4 + TM (or ratchet wrench)<br><br>after torque is broken 24.0 | 146.5/78.3 | Bolt pops up/free spin |
| Bolt 4 (Clevis) | **[B6,(24.0) CCW2, 30.5]** | 6" wobble | 1 | 16.0 - 16.5 | 20.0 - 22.9 | 24.0 | 165.8/35.1 | √2 white lines visible |

**Notes:**

**Cautions:**

**Warnings:**

# SPARE ATA INSTALL ON P1 – TASK DATA

**ORU Specs:**

| ORU | Part Number | Serial Number | Dimensions (in) | Mass (lbm) |
|---|---|---|---|---|
| ATA | IF28801-501 | 04 | (L*W*H) 57.3" x 80.1" x 45.4" | Dry – 1289<br>Wet – 1749.2 |

**Estimated Task Duration:**

| | With SSRMS | Without SSRMS |
|---|---|---|
| **One EV Crew** | **N/A** | **N/A** |
| **Two EV Crew** | **01:10** | **N/A** |

**Foot Restraints:**

| Task | WIF | APFR Setting |
|---|---|---|
| **APFR** | **SSRMS w/hitch pin** | **[12-PP-F-8]** |

**Tools:**

| EV1 | EV2 |
|---|---|
| PGT with 6 inch –7/16" Wobble Socket<br>BRT<br>Torque Multiplier | PGT with 6" Wobble Socket or 2" rigid socket |

**EVA Connectors**

| Harness | To | Clamps (#) | Connector Size | Function |
|---|---|---|---|---|
| P1-P635 | J2 | 1 | 17 | Data |
| P1-P634 | J1 | 1 | 19 | Power |

**Fluid QDs**

| Line Name | From | To | Clamps (#) | QD Size | Function |
|---|---|---|---|---|---|
| F175/M3 * (Nadir) | PM | ATA M3 | 1 | 1/2" | NH3 out |
| F1/M2/M1 (Nadir) | NTA M2 | ATA M1 | None | 1/4" | N2 pressure |
| F174/M4 (Zenith) | Vent | ATA M4 | 1 | 1/2" | NH3 out |
| F2/M3/M2 (Zenith) | NTA M3 | ATA M2 | None | 1/4" | N2 pressure |

***** Spool positioning device installation

**Connector Inhibits/MCC calls**

| Task | Inhibit/Initiate Call |
|---|---|
| P635 to J2 | Verify with MCC-H 1.104 P1 ATA REMOVAL AND REPLACEMENT PREP (SODF: ASSY OPS: 17A) is complete/None |
| P634 to J1 | Verify with MCC-H 1.104 P1 ATA REMOVAL AND REPLACEMENT PREP (SODF: ASSY OPS: 17A) is complete/Post mate give ground GO to power RPCs |
| Mate QDs | Verify with MCC 1.106 P1 ATA POST REPLACEMENT ACTIVATION Part 2 (SODF: ASSY OPS: 17A) complete |
| Open N2 vlvs | None |
| Open NH3 vls | None |

**Fasteners:**

| Fastener Name | PGT/ratchet | Socket | Qty | Turns | Install Torque (ft-lbf) On orbit | Recommended Install Torque (ft-lbf) | Failure Torque (ft-lbf) Install/Remove | Features |
|---|---|---|---|---|---|---|---|---|
| Bolt 1 (Clevis) | **[A7,(9.2) CCW2, 30.5]** | 6" wobble-7/16" | 1 | 16.0 - 16.5 | 7.7 - 28.1 | 9.2 | 35.1/165.8 | √2 white lines not visible |
| Bolt 2 (Clevis) | **[A7,(9.2) CCW2, 30.5]** | 6" wobble-7/16" | 1 | 16.0 - 16.5 | 7.7 - 28.1 | 9.2 | 35.1/165.8 | √2 white lines not visible |
| Bolt 3 (Microconical) | **[B1,(12.0) CCW2, 30.5] + TM for final torque** | 6" wobble-7/16" | 1 | 13.5 - 14.5 | 37.0 - 81.0 | 12.0 + TM | 81.1/146.5 | Hardstop |
| Bolt 4 (Clevis) | **[A7,(9.2) CCW2, 30.5]** | 6" wobble-7/16" | 1 | 16.0 - 16.5 | 7.7 - 28.1 | 9.2 | 35.1/165.8 | √2 white lines not visible |

**Notes:**

1. Once the electrical lines are connected, instruct MCC-H to power RPCs
2. Ensure Fluid QD lines are routed under shroud straps

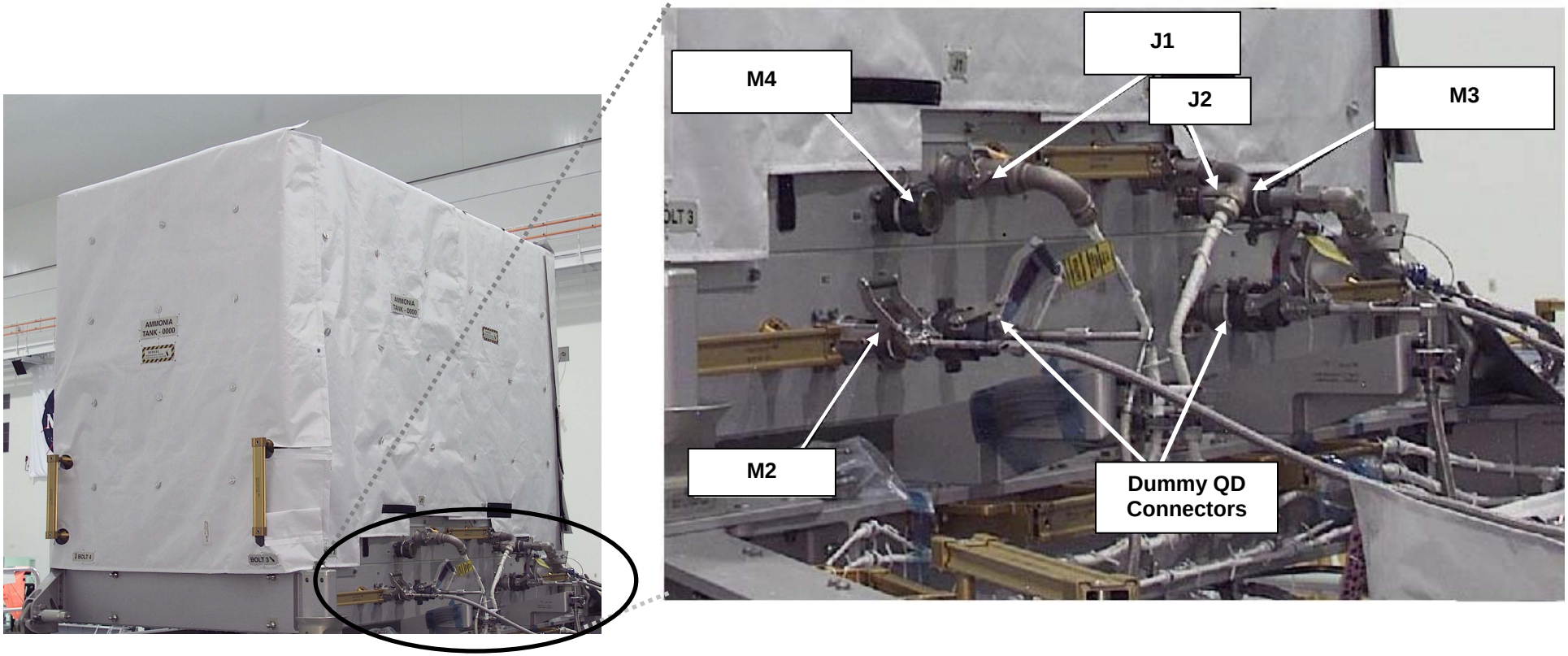
**Cautions:**

1. ATA fluid QD lines and clamps may be hot if exposed to direct sun
2. Avoid pulling on electrical cables. Avoid bent radii less than 10 times the cable diameter

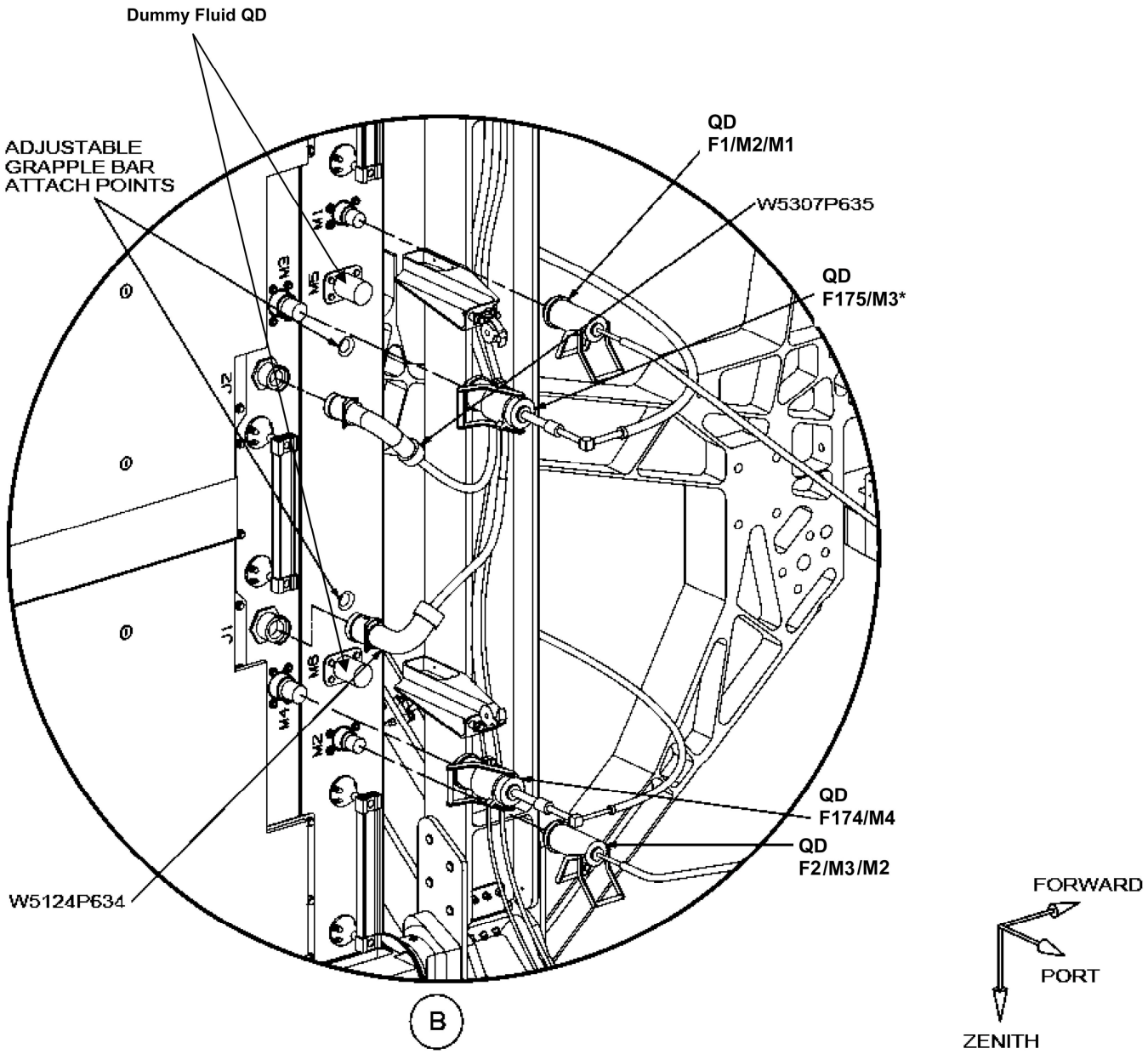
**Warnings:**

1. Verify electrical inhibits in place prior to electrical mate/demate
2. Verify P1 TRRJ rotation inhibits in place
3. Do not open NH3 lines until ISOL vlvs are verified closed by MCC-H

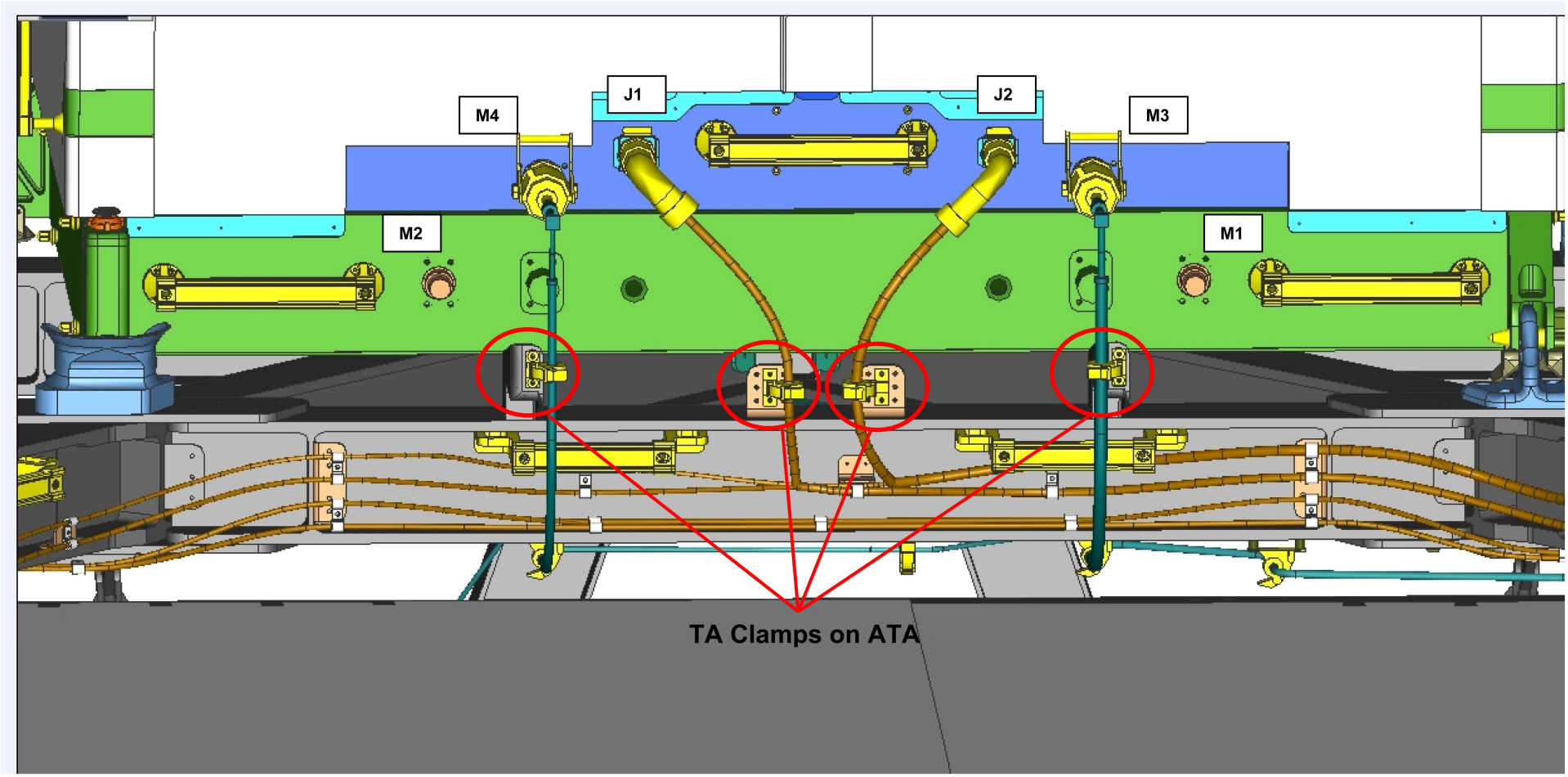
## SPARE ATA INSTALL ON P1 – TASK DATA (Cont)



## SPARE ATA INSTALL ON P1 – TASK DATA (Cont)



## SPARE ATA INSTALL ON P1 – TASK DATA (Cont)



# OLD ATA INSTALL ON LMC – TASK DATA

**Estimated Task Duration:**

| | With SSRMS | Without SSRMS |
|---|---|---|
| **One EV Crew** | **N/A** | **N/A** |
| **Two EV Crew** | **00:30** | **N/A** |

**ORU Specs:**

| ORU | Part Number | Serial Number | Dimensions (in) | Mass (lbm) |
|---|---|---|---|---|
| ATA | IF28801-501 | 02 | (L*W*H) 57.3" x 80.1" x 45.4" | Dry – 1289<br>Wet – 1749.2 |

**Tools:**

| EV1 | EV2 |
|---|---|
| PGT with 6 inch –7/16" Wobble Socket<br>BRT<br>Torque Multiplier | PGT with 6" Wobble or 2" rigid socket |

**Foot Restraints:**

| Task | WIF | APFR Setting |
|---|---|---|
| **APFR** | **SSRMS w/hitch pin** | **[12-PP-F-8]** |

**EVA Fasteners:**

| Fastener Name | PGT/ratchet | Socket | Qty | Turns | Install Torque (ft-lbf) Ground/On orbit | Recommended Install Torque (ft-lbf) | Failure Torque (ft-lbf) Install/ Remove | Features |
|---|---|---|---|---|---|---|---|---|
| Bolt 1 (Clevis) | **[A7,(9.2) CW2, 30.5]** | 6" wobble-7/16" | 1 | 16.0 - 16.5 | 7.7 - 28.1 | 9.2 | 35.1/165.8 | √2 white lines not visible |
| Bolt 2 (Clevis) | **[A7,(9.2) CW2, 30.5]** | 6" wobble-7/16" | 1 | 16.0 - 16.5 | 7.7 - 28.1 | 9.2 | 35.1/165.8 | √2 white lines not visible |
| Bolt 3 (Microconical) | **[A7,(9.2) CW2, 30.5] + TM for final torque** | 6" wobble-7/16" | 1 | 18 - 19 | 37.0 - 81.0 | 9.2 + TM | 81.1/146.5 | Hardstop |
| Bolt 4 (Clevis) | **[A7,(9.2) CW2, 30.5]** | 6" wobble-7/16" | 1 | 16.0 - 16.5 | 7.7 - 28.1 | 9.2 | 35.1/165.8 | √2 white lines not visible |

**Notes:**

1. A softdock is present on Bolts 2 and 4 to help install the ATA on the LMC
2. A softdock is not present on Bolt 3

**Cautions:**

**Warnings:**

# FIXED GRAPPLE BAR – TASK DATA

**Estimated Task Duration:**

| | With SSRMS | Without SSRMS |
|---|---|---|
| One EV Crew | N/A | 00:20 |

**Tools:**

| EV1 | EV2 |
|---|---|
| • Retr tether (FGB)<br>• PGT w/7/16, 6-in extension<br>• Spare safety tether | |

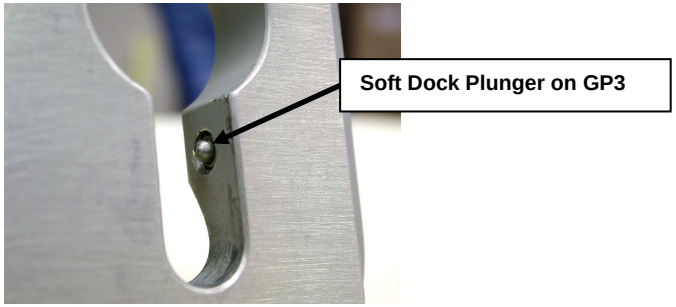
**EVA Fasteners (to/from ATA):**

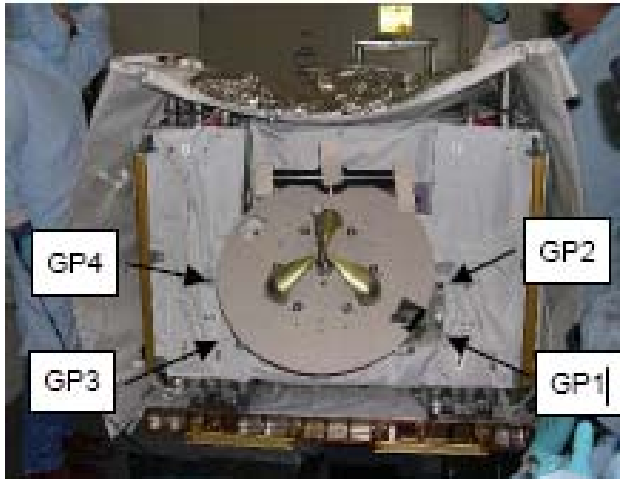
| Fastener Name | PGT Setting | Head Size | Qty | Install Torque (ft-lb) | Release Torque (ft-lb) | Failure Torque (ft-lb) | Turns |
|---|---|---|---|---|---|---|---|
| Grapple Attach Bolt Initial removal for FGB Installation | **[B7,CCW2,30.5]** | 7/16 | 4 | --- | 25.5 | 47.4 | 17-20 |
| Installation of FGB onto ATA | **[A7,CW2,30.5]** | 7/16 | 4 | 9.2 | --- | 16.1 | 8-11 |
| Removal of FGB from ATA after use | **[B7,CCW2,30.5]** | 7/16 | 4 | --- | 25.5 | 47.4 | 17-20 |

**Timeline Considerations:**
** APFR is not required for FGB installation

**Notes:**

1. Do not touch SRMS target or grapple pin shaft on FGB
2. GP2 must be the first bolt torqued. Remaining bolts are torqued in a star pattern (3,4,1)
3. FGB FSE bolts must be backed out at least 20 turns to remove the FGB. Running torque will decrease at ~18 turns when the locking "poly patch" ends. The bolts are fully backed out ~27-33 turns, but torque should not be applied at this point to avoid breaking the castellated nut captive feature



## EVA 3 SUMMARY TIMELINE

| TIME | IV | EV1 (FF) | EV2 (FF) |
|---|---|---|---|
| 00:00-00:05 | | POST DEPRESS (00:05) | POST DEPRESS (00:05) |
| 00:05-00:20 | | EGRESS (00:15) | EGRESS (00:15) |
| 00:20-00:35 | | SETUP (00:15) | SETUP (00:15) |
| 00:35-02:05 | | S3 UPPER OUTBOARD PAS DEPLOY (01:30) | S3 UPPER OUTBOARD PAS DEPLOY (01:30) |
| 02:05-03:05 | | RGA 2 REMOVE AND REPLACE (01:00) | RGA 2 REMOVE AND REPLACE (01:00) |
| 03:05-03:50 | | PMA3 HEATER CABLE CONNECT (00:45) | S0 RPCM R&R (00:45) |
| 03:50-05:35 | | NOD3 AVIONICS CABLE ROUTING (01:45)<br>• CH 2/3 Cable Routing<br>• Connect Ch 2/3 to S0 Panel A145<br>• CH 1/4 Cable Routing<br>• Connect Ch 1/4 to S0 Panel A145 | NOD3 AVIONICS CABLE ROUTING (01:45)<br>• CH 2/3 Cable Routing<br>• CH 1/4 Cable Routing |
| 05:35-05:55 | | NOD1 SLIDEWIRE REMOVAL (00:20) | CLA COVER INSTALLATION (00:20) |
| 05:55-06:30 | | CLEANUP/INGRESS (00:35) | CLEANUP/INGRESS (00:35) |
| 06:30 | | | |

# EVA 3 BRIEFING CARD

EV1 _____
EV2 _____
IV _____
R1/M1 _____

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

**Flight Day Prior to EVA – General Briefing (All)**

1. EVA Prep
   - ❑ Get-up Plan – clothing and EMU equipment bag – EV1
   - ❑ Prebreathe protocol review (Notes and Warnings) – IV
   - ❑ Equipment lock activities – IV responsibilities
   - ❑ Suit donning plan – special requests – EV's, IV's
   - ❑ SAFER, MWS, tools, C-Lk positions, bag stowage – EV2
   - ❑ Airlock depress review – IV

2. EV Crew Procedure Review – EV1
   - ❑ Egress Plan
   - ❑ Order of tasks (summary timeline)
   - ❑ Translation plan, fairleads, and tether swaps
   - ❑ Hazards
   - ❑ Ingress Plan

3. Robotics – R1/M1
   - ❑ SRMS/SSRMS initial position, maneuvers, clearances
   - ❑ Coordinate Frames
   - ❑ SRMS/SSRMS comm protocol review – expected calls, use first names
   - ❑ GCA – when, where, handover language
   - ❑ Cameras
   - ❑ Contingencies
     - Suit anomalies while ingressed

**Flight Day Prior to EVA – Additional Briefing (EV, IV)**

4. Communications – CDR, IV
   - ❑ Overall setup: Big loop, A/G2, S/G2, ICOM, Hardline, remind EV crew when mode swapping
   - ❑ EV/IV comm protocol review – Use EV1(2) for DCM sw throws (all time in A/L), use first names otherwise

5. General Procedure Review – EV1
   - ❑ Get-ahead tasks
   - ❑ Constraints – ground and flight – IV
   - ❑ Notes, Cautions, and Warnings review – IV
   - ❑ Contingency procedures – crib sheet

6. Emergencies Review – EV1
   - ❑ Emergency suit doff and power down during EVA prep
   - ❑ Loss of comm
   - ❑ EMU malfunctions
   - ❑ Lost tools
   - ❑ Lost crewmember
   - ❑ DCS
   - ❑ Abort and Terminate scenarios, protocols
   - ❑ Hand signal reviews

7. Post EVA – IV's
   - ❑ Suit doffing responsibilities
   - ❑ Post EVA plan

√Expedited Suit Doffing cue card pre-positioned for EVA day

# EVA 3 BRIEFING CARD (Cont)

**EVA Day, prior to Prebreathe Protocol**

1. Reminders
   - ❑ Translate slow (then space is like water). Relax grip
     - o Be extra careful on non-standard routes or orientations
     - o Don't hop
   - ❑ Tether Discipline
     - o Check all gates closed and hooks locked; check reel locked/unlocked
     - o Local tether when stopped. Check tethers before you leave
     - o When something is attached to a tether, don't grab the tether by the hook
     - o Good pull tests
   - ❑ APFR ops
   - ❑ Be disciplined when tired
   - ❑ Hazards: Payloads, etc
   - ❑ Openness: When you have boot or glove pain let us know
   - ❑ OK for IV and ground to check on us. If you need update, ask
   - ❑ Monitor safety tether. Hold peanut when necessary
   - ❑ Let mistakes pass
   - ❑ If you get a mal, read the caution and warning message so everyone knows what it is
   - ❑ Manage frustration (slow down, if needed)
   - ❑ Cold soak before ingress
   - ❑ Verify PGT settings. PGT collars are easy to bump
   - ❑ Read turns, torque, green light
   - ❑ SSRMS: Coordinate frames and positive GCA handovers
   - ❑ Review first post-egress steps
   - ❑ Review abort/terminate priorities and procedures
   - ❑ Glove Checks
   - ❑ Day/night reconfigurations
   - ❑ Translation Adaptation plan

**IV Checklist Verification Items**

1. Generic
   - ❑ Day/Night Cycles
     - • √Lights, visors, gloves and heaters, tethers, and MWS
   - ❑ √Load Alleviating Strap on Safety Tethers not damaged
     - • Crew report: "**Safety Tether strap looks good**"
   - ❑ √Safety Tether Crew Hook Slidelocks are locked
     - • Crew Report: "**Bail closed, slider locked**"
   - ❑ √Both SAFER valves down at egress
     - • Crew Report: "**Both handles down**"
   - ❑ √APFR locking collar Black-on-black and pull test
     - • Crew Report: "**Black-on-black, good pull test**"
   - ❑ √PGT Green light on for bolt engage
     - • May get Lo Torque msg at bolt release
     - • Crew Report: "**XX turns, green light, XX ft-lb"**
   - ❑ √Latches closed on lid, door, etc (i.e., √in landing config)
     - • Crew Report: "**XX Latches done**"
   - ❑ √Connectors for no bent pins, no FOD, inhibits in place
     - • Crew Report: "**Pins good, no FOD, bend radius OK**"
     - • Crew Report: "**Are inhibits in place?**"

2. Task Specific
   - ❑ √Tethers and Tools clear prior to SSRMS ORU movement
     - • Each EV report: "**Tethers and tools clear**"

3. Tool inventory
   - ❑ √Tethers on MWS
   - ❑ Confirm all others as standard unless removed

# EVA 3 TOOL CONFIGURATION

## EV1

EMU D-rings

- ❑ Ext on left side
- ❑ Ext on right side
- ❑ Waist Tethers (left Ext to MWS, √locked)
- ❑ Waist Tethers (right Ext to MWS, √locked)
- ❑ 85-ft Safety Tether (left D-ring, √locked)

MWS

- ❑ Small STS Trash Bag
  - ❑ Wire tie (secure trash bag to MWS, tether loop)
- ❑ 1 – Wire tie as tether loop
- ❑ 1 – RET (with PIP pin)
- ❑❑ 2 – RETs
- ❑ 1 – Adj Equipment Tether
- ❑ Swing Arm (right side)
  - ❑ 1 – RET (attach to PGT; block to swingarm)
    - ❑ 1 – PGT s/n 1002 w/6"–Ext–7/16"
- ❑ BRT (left side)
  - ❑ 1 – RET
  - ❑❑❑❑❑❑ 6 – Long wire ties (w/one crimped loop on each)

EMU Gloves

- ❑❑ 2 – Adj Equipment Tethers (on gloves)

**Prior to EVA, perform the following hardware inspections:**

1. RET cords for fraying
2. No red line visible, damage, or discoloration on safety and waist tether load alleviation straps
3. Inspect ISS/STS trash bags for deformation/damage
4. Inspect EMU gloves for damage
5. Inspect BRT for loose screws

**Use BLUE RETs only**

## EV2

EMU D-rings

- ❑ Ext on left side
- ❑ Ext on right side
- ❑ Waist Tethers (left Ext to MWS, √locked)
- ❑ Waist Tethers (right D-ring to MWS, √locked)
- ❑ 85-ft Safety Tether (right Ext, √locked)
- ❑ 55-ft Safety Tether - spare (right Ext, √locked)

MWS

- ❑ Small Trash Bag
  - ❑ 1 – Adj Equipment Tether
- ❑❑ 2 – Wire ties as tether loops
- ❑ 1 – RET (with PIP pin)
- ❑ 1 – RET
- ❑ 1 – Adj Equipment Tether
- ❑ Swing Arm (right side)
  - ❑ 1 – RET
    - ❑ 1 – PGT s/n 1006 w/2"–Ext–7/16"
  - ❑ 1 – Camera w/bracket
- ❑ BRT (left side)
  - ❑ 1 – RET
  - ❑❑ 2 – Short wire ties
  - ❑ 1 – Long wire tie

EMU Gloves

- ❑❑ 2 – Adj Equipment Tethers (on gloves)

## CREWLOCK

- ❑ D-ring extender on A/L D-ring

- ❑ Lg-Sm RET
  - ❑ PMA3 Crewlock Bag
    - ❑ 1 – Wire tie caddy
      - ❑❑❑❑❑❑❑❑❑❑___ – Short wire ties (in caddy)
    - ❑❑❑ 3 – PMA3 HTR Cable Caps (size 15,17,25 integrated together w/long wire tie)
    - ❑ 1 – MMOD Shield Handling Tool

- ❑ Lg-Sm RET
  - ❑ NOD3 Ch 2/3 Avionics Cable Bag

- ❑ Lg-Sm RET
  - ❑ RPCM Crewlock Bag
    - ❑ Spare RPCM s/n C235299 (hook away from RPCM)
    - ❑ 1 – Connector Insulating Sleeve size 33/37
  - ❑ 1 – RET (outside of bag)

- ❑ Lg-Sm RET
  - ❑ PAS Crewlock Bag
    - ❑ 1 – Hammer
    - ❑ 1 – Detent Release Tool
    - ❑ 1 – RET (to an internal D-ring)
      - ❑ 1 – Detent Release Tool
    - ❑ Integral RET to door handle
    - ❑ Integral RET to door handle
    - ❑ Lg/Sm Adj Equipment Tether (outside of bag)

## EVA 3 TOOL CONFIGURATION (Cont)

CREWLOCK (Cont)

- ❑ Lg-Sm RET
  - ❑ Lg ORU Bag
    - ❑ Spare RGA
      - ❑❑ 2 – Connector caps (installed on RGA)
      - ❑ 1 – RET
  - ❑❑ 2 – Adj Equipment Tethers (outside of bag, for temp stow)

- ❑ Adj Fuse Tether
  - ❑ Lg Trash Bag
    - ❑ 1 – RET
  - ❑ 1 – Camera w/bracket
  - ❑ 1 – Wire tie caddy
  - ❑❑❑❑❑❑❑❑❑❑___ – Short wire ties (in caddy)

- ❑ Lg-Sm RET
  - ❑ CLPA Crewlock Bag
    - ❑ 1 – CLA Cover MLI Case (if not completed on EVA 1/2)
      - ❑ 1 – CLA Cover (if not completed on EVA 1/2)
    - ❑ 1 – CLPA Cover MLI Case
      - ❑ 1 – CLPA Cover
    - ❑ 2 – Connector Insulating Sleeve size 21/25 (MBS)
    - ❑ 1 – RET
      - ❑ 1 – Connector Insulating Sleeve size 15/17 (S0 Bay 03)

Staging Bag

- ❑ Adjustable Fuse Tether #1
  - ❑ Socket Caddy (hook #1)
    - ❑ 6" wobble EXT
    - ❑ RAD
  - ❑ Velcro/Tape Caddy (hook #2)
  - ❑ PGT s/n 1008 (hook #3)
    - ❑ PGT Battery s/n _____
  - ❑ Vice Grips (hook #4)
  - ❑ Ratchet Wrench (hook #5)
  - ❑ *Empty* (hook #6)
  - ❑ *Empty* (hook #7)
- ❑ Adjustable Fuse Tether #2
  - ❑ Spare Torque Wrench w/MLI (hook #1)
  - ❑ Connector Cleaner Tool Kit (hook #2)
  - ❑ Pin Straightener Assy (hook #3)
  - ❑ Probe (hook #4)
  - ❑ Prybar (hook #5)
  - ❑ BRS Pin Tool (hook #6)
  - ❑ *Empty* (hook #7)
  - ❑ MMWS Key Strap Assembly (on wire tie to strap)

IV Bag

- ❑ 2 – Towels w/wire ties
- ❑ Contamination Detection Kit w/watch
- ❑ 2 – GP Caddy
  - ❑ 2 – Adj Thermal Mittens
- ❑ 3 – RET (black, must stay in IV bag)
  - ❑ Socket Caddy (hatch cont)
    - ❑ 1/2 socket 8-in ext (hatch)
    - ❑ 7/16 socket 6-in ext (spare)
  - ❑ DCM plug (2) (SAFER hardmount)

# EVA 3 INHIBIT PAD

Orbiter

TCS *(Prior to Egress)*
IV L12 1. √TCS POWER – OFF

TriDAR *(Prior to Egress)*
IV SSP2 1. √TRIDAR POWER – OFF

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

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

Ground

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

JEM

ICS-EF Antenna *(Prior to Egress)*
**SSIPC** 1. ICS MOD – OFF
2. ICS UPC – OFF
3. ICS HPA – OFF

USOS

PCU *(Prior to Egress)*

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

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

Lab Window *(Prior to CLPA cover installation)*
IV If EV crew less than 10 feet from window or in window FOV, close window shutter.

Mobile Transporter *(Prior to Egress)*
**MCC-H** If EV crew <1.5 meters from MT
1. √MT latched

NOD3 CH 2/3 Cables *(Prior to Connector Operations)*
**MCC-H** 1. √MBSU 2 RBI 13 - Open, Close Cmd Inh
2. √MBSU 2 RBI 2 - Open, Close Cmd Inh
3. √RPCM S02B_D RPC 3, Open, Close Cmd Inh
NOD3 CH 1/4 Cables *(Prior to Connector Operations)*
**MCC-H** 4. √MBSU 1 RBI 13 - Open, Close Cmd Inhibit
5. √MBSU 4 RBI 4 - Open, Close Cmd Inhibit
6. √RPCM S01A_D RPC 3, Open, Close Cmd Inhibit

## **EVA 3 INHIBIT PAD** (Cont)

USOS

RGA 2 *(Prior to Egress if not performed on EVA 2)*
**MCC-H** 1. √RPCM S02B_E RPC 4 - Open, Close Cmd Inh

RPCM S01A_D *(Prior to RPCM R&R)*
**MCC-H** 1. √DDCU S01A Converter – Off

PMA3 Heater Cable *(Prior to Egress if not performed on previous EVA)*
**MCC-H** 1. √RPCM N1RS2_B RPCs 1-5, 12-15, Open, Close Cmd Inh

GPS Antenna 2*(Prior to Egress only if task added to EVA)*
**MCC-H** 1. √RPCM S02B_E RPC 6 - Open, Close Cmd Inh
2. √RPCM S01A_E RPC 5 - Open, Close Cmd Inh
GPS Antenna 4 *(Prior to Egress only if task added to EVA)*
**MCC-H** 3. √RPCM S02B_E RPC 8 - Open, Close Cmd Inhibit
4. √RPCM S01A_E RPC 7 - Open, Close Cmd Inhibit

Insulating Booties
W4148 *(Concurrently with S01A_D R&R)*
**MCC-H** 1. √DDCU S01A Converter – Off
MBS Jumper *(On-call immediately prior to task)*
**MCC-H** 2. √RPCM S04B_A RPC 1 - Open, Close Cmd Inh
3. √RPCM S03A_A RPC 1 - Open, Close Cmd Inh
ESP2-57A *(Prior to egress)*
**MCC-H** 4. √RPCM S04B_F RPCs 10-13 - Open, Close Cmd Inh

Starboard SARJ *(Prior to Egress)*
**MCC-H** 1. √DLA (1) – LOCKED
2. All motor setpoints set to zero.
3. All motors deselected.

Starboard TRRJ *(Prior to Egress)*
**MCC-H** 1. √DLA (1) – LOCKED

S3 Zenith Outboard PAS (PAS 1) *(Prior to egress)*
**MCC-H** 1. RPCM S31A A RPC 12 – Open, Close Cmd Inhibit

RSOS

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

IMPULSE *(Prior to Egress)*
MCC-M 1. IMPULSE (ИПИ-100) – Is not activated

## EVA 3 NOTES, CAUTIONS, WARNINGS

NOTES

1. Bolt install: Report torque and turns
2. Bolt release: Report torque and turns if different from published range
3. EVA connectors: After disconnection and prior to connection; verify pin and EMI band integrity; verify connector free of FOD
4. Inspect QDs for damage prior to mating
5. Toolbox doors must be closed with one latch per door when EV crew not in immediate vicinity
6. Avoid contact with OBSS striker bars (Vitrolube coating)
7. 85-ft safety tether retract force may affect body positioning

CAUTION

**ISS Constraints**

A. Avoid inadvertent contact with
   1. Grapple fixture shafts (drylube)
   2. PIP pins
   3. EVA Crane [PMA1]
   4. TCS Reflectors [PMA2,PMA3]
   5. APAS hardware [PMA2,PMA3]
   6. CETA Lights (Z-93 paint) [LAB,S1,Node 1]
   7. Passive UMAs
   8. MBS/SSRMS/SPDM/JEMRMS taped radiative surfaces: VDU, ACU, JEU, LEU, MCU, CRPCMs, and Cameras
   9. Deployed TUS cable [Nadir CETA rail]
   10. S0 aft face Radiator
   11. GPS Antennas (S13 paint) [S0,JLP]
   12. UHF Antennas [LAB,P1]
   13. ETCS Radiator flexhoses and panels [S1,P1]
   14. EETCS/PV Radiator flexhoses, bellows and panels [P6,P4,S4,S6]
   15. SASA RF Group [S1,P1]
   16. Heat pipe radiators [Z1]
   17. PCU cathode and HCA ports [Z1]
   18. Ku-Band Antenna (SGANT) dish [Z1]
   19. CMG cover/shells [Z1]
   20. SPDM SJEU, EP, OTCM, LEU, and LEE VDU Radiator surfaces
   21. Open CBM petal covers, LAB window shutter, and JPM window shutter
   22. FPMU [S1]
   23. OTSD
   24. JTVE, WVE/EVE, JEF VE Cameras [JEM]
   25. JEM A/L Target and Pins

CAUTION (Cont)

**ISS Constraints** (Cont)

A. Avoid inadvertent contact with (Cont)
   26. S0/Node 2 Fluid Tray Hardlines at Node 2 end are limited to 25 lb
   27. JEF ORUs and EFUs (paint & lubricant)
   28. MAXI front and top panel (paint)
   29. SEDA-AP sensors (HIT, SDOM, & AOM) and MPAC & SEED
   30. Trunnions and UCMs (paint & lubricant) [JEF Payloads]

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

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

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

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

CAUTION (Cont)

**ISS Constraints** (Cont)

E. For structural reasons
   1. Avoid vigorous body motions, quick grabs and kickoffs against tether restraints
   2. Avoid performing shaking motions (sinusoidal functions) more than four cycles
   3. Avoid kicking S1/P1 radiator beam
      If any of these occur, wait 2 to 5 min to allow structural response to dissipate
   4. Avoid tool impact on ICS-EF sensor
   5. Avoid kicking MMOD shields between JLP and JPM

F. Other
   1. ITT Cannon connector: On demated connectors, do not rotate collar or manipulate cable/connector using collar or connector tool
   2. WIS Antennas: Do not use as handholds [Node 1,Lab,P6,Z1]
   3. Lubricant from Ku-Band SGANT gimbals [Z1], CMGs [Z1], and RTAS Ground Strap fasteners [P6,P4,S4,S6] can contaminate EMU
   4. MLI handholds are not rated for crewmember translation loads
   5. CBM petal covers may not be used as handholds unless both launch restraint pins are engaged
   6. Prevent inadvertent contact of the tether shuttle with ETRS when the P3 Tether Shuttle Stop is raised away from the rail

CAUTION (Cont)

**Shuttle Constraints**

A. Avoid inadvertent contact with
   1. OBSS and SRMS Composite Sections Joint Torque Arms, Grapple Fixture Shafts, and Cable Harnesses
   2. LCS (silver Teflon) and LDRI (silver Teflon) and ITVC (gold foil) [OBSS]
   3. WVS Antenna [ODS Truss & PLB Sill]
   4. Payload Bay and Camera wire harnesses, cables, cable guides, and connectors

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

CAUTION (Cont)

**HTV/HTV EP Constraints**

A. Avoid inadvertent contact with
   1. EVA Cover [HTV] (does not meet EVA kick loads)
   2. Wheel guide [HTV] (snag hazard)
   3. HBCS (berthing camera) [HTV EP]
   4. HCSM (solid lubricant) [HTV EP]
   5. HCAM (solid lubricant) [HTV EP]
   6. EP PIU (solid lubricant and Black/White Paint) [HTV EP]

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

WARNING

**ISS Constraints**

A. Avoid inadvertent contact with
   1. Grapple fixture targets and target pins
   2. SSU, ECU, beta gimbal platform, mast canister, SAW blanket boxes unless the beta gimbal is locked and the motor is turned off
   3. Stay inboard of SARJ when active
   4. Stay 2 ft from S1/P1 radiator beam rotational envelope when beam is free to rotate
   5. Stay 5 ft from moving MT on face 1
   6. SOLAR and EuTEF [COL EPF]
   7. ICS-EF sensors

B. Handrails
   1. Handrails previously used for MISSE attachment may not be used as a safety tether point [A/L endcone 564 & 566, A/L Tank 2 nad/fwd & port/fwd, P6 5389]

C. Pinch
   1. NZGL connector linkage. Use caution when mating/locking
   2. ITT Cannon Connector rotating housing
   3. EV side of IV Hatch during Hatch operation (also snag hazard) [A/L]
   4. LAB window shutter and CBM petal cover and JPM window shutter linkages during operation
   5. JEMRMS HRM capture latches
   6. JEM Cameras (JVTEs, EVE, WVE, & JEF VEs)
   7. JEM EFBM capture latches
   8. JEM EFU latching arms
   9. JEF SSE latch
   10. ICS-EF antenna boom
   11. SEDA-AP Mast

WARNING (Cont)

**ISS Constraints** (Cont)

D. QDs
   1. If QD is in FID when valve is opened (bail fwd), QD will leak and fluid line may whip
   2. Do not rotate if in mated/valve open config

E. RF radiation exposure
   1. Stay 3.6 ft from S-Band (SASA) high gain Antenna when powered [S1,P1]
   2. Stay 1.3 ft from S-Band (SASA) low gain Antenna when powered [S1,P1]
   3. Stay 1 ft from UHF Antenna when powered [LAB,P1]
   4. Stay 0.3 ft from fwd/aft JPM PROX antenna

F. Sharp Edges
   1. Inner edges of WIF sockets
   2. APFR active WIF probes
   3. Mating surfaces of EVA connectors Avoid side loads during connector mating
   4. Back side of MMOD shield fasteners
   5. Spring loaded captive EVA fasteners (e.g., 6B-boxes, BMRRM, RTAS, SARJ Covers); the end of the spring may protrude
   6. PMA umbilical launch restraints-exposed bolt threads
   7. Adjustable Fuse Tether (Fish Stringer) buckles stowed in Node Bag
   8. Nickel coated braided copper Ground Straps may contain frayed wires [P6,P4,S4,S6]
   9. SPDM OTCM gripper jaws

WARNING (Cont)

**ISS Constraints** (Cont)

F. Sharp Edges (Cont)
   10. Solar Array Blanket Box [P6,S6]
   11. Keep hands away from SSRMS LEE/POA/SPDM LEE/JEMRMS EE opening, snares, and PDGF curvic coupling (teeth)
   12. Fastener threads on back of Z1 U-jumper male FQD panel, if nutplate cap missing
   13. Outboard MT rail attachment lug near P6 handrail 5333 and gap spanner
   14. P2 connector on EWIS box TAA-06 [Zenith/Forward Corner 1 of P5 – SARJ at 0 deg]
   15. Port/Aft portion of A/L circular HR [HR 0506]
   16. Interior of JEMRMS HRMs
   17. JEM A/L hatch corners
   18. ICS-EF AHM gears
   19. MAXI Visual Star Camera

G. Thermal
   1. EVA connectors with booties may become hot if left uncovered. Handling may need to be limited
   2. PMA handrails may be hot. Handling may need to be limited
   3. Turn off glove heaters when comfortable temp reached to prevent bladder damage. Do not pull fingers out of gloves when heaters are on
   4. Uncovered trunnion pins may be hot
   5. SSRMS/MBS/SPDM/JEMRMS/JVTE/ JEF VE operating cameras and lights may radiate large amounts of heat

WARNING (Cont)

**ISS Constraints** (Cont)

G. Thermal (Cont)

6. Stay ≥ 1 ft away from PMAs and MMOD shields > 270 degF if EMU sun visor up; limit time to 15 min or less if > 300 degF
7. Stay at least 0.5 ft away from PMA and MMOD shields > 325 degF
8. Do not touch EMU protective visor if temp has been < -134 degF for > 15 min
9. No EMU TMG contact with PMAs and MMOD shields > 320 degF
10. No EMU boot contact with foot restraint when temp < -120 degF or > 200 degF
11. Columbus end cones may violate touch temperature constraints when $-75 \leq \beta \leq -60$ or $60 \leq \beta \leq 75$V
12. PDGF surfaces may not meet touch temperature requirements for unlimited contact when $\beta \leq -70$ or $\beta \geq 70$
13. JPM port end cones and JLP port nadir may violate touch temperature constraints when $\beta > 60$ deg

H. Electrical Shock

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

WARNING (Cont)

**ISS Constraints** (Cont)

H. Electrical Shock (Cont)

- MBS Cross-Connect jumpers (translate past these using UMA handrails) include S0 EVA Power Cables (inside S0 Bay 00 Face 4, Bay 01 Face 3) ESP-2 jumper (inside S0 Bay 03 Face 4)

2. Do not touch SPDM CLPA 1 electrical connector prior to camera installation

WARNING (Cont)

**Shuttle Constraints**

A. Arcing/Molten Debris

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

B. Pinch

1. PRLA operation [PLB]

C. RF radiation exposure

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

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

WARNING (Cont)

**Shuttle Constraints** (Cont)

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

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

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

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

WARNING (Cont)

**HTV/HTV EP Constraints**

A. Avoid inadvertent contact with
   1. HTV solar array panels (kick loads can shatter panel and generate sharp edges) [HTV]
   2. HTV fwd RCS thrusters [HTV]

B. Pinch
   1. HSM connector moving parts (pinch hazard and dry film lube) [HTV EP]
   2. EP wheels (pinch point) [HTV EP]

C. RF radiation exposure
   1. Stay 0.7 ft from IOS-N antenna [HTV]
   2. Stay 0.7 ft from IOS-Z antenna [HTV]
   3. Stay 0.3 ft from PLS-Z antenna [HTV]

D. Thermal
   1. EP/HTV handrails may be hot Handling may need to be limited

## EGRESS/SETUP (00:30)

| IV (SSRMS) | EV1 (Ol) | EV2 (Fg) |
|---|---|---|
| 1. Start recorders<br>2. √Initial Condition<br><br>3. WVS Software:<br>Select page – RF camera<br>Sel 'Advanced Controls'<br>S-Band Level (two) – Max<br>(required after EV1 and EV2 egress airlock) | **Initial Condition:**<br>A/L D-ring extender with left waist tether<br>√Hooks locked<br><br><u>EGRESS</u> (00:15)<br>1. Open A/L thermal cover<br>2. Egress A/L<br>3. Connect 85-ft safety tether to A/L fwd anchor point<br>√Both bails closed, sliders locked<br>√Reel unlocked<br>4. Release waist tether from A/L D-ring<br><br>5. Receive PMA3 crewlock bag from EV2; stow on equipment lock HR using Lg/Sm RET and integrated tether<br>6. Receive PAS crewlock bag from EV2; stow on BRT<br><br>7. Receive anchor hook of EV2 85-ft safety tether; connect to A/L aft anchor point<br>√Anchor bail closed, slider locked<br>8. Give EV2 GO to release EV2 waist tether<br><br>9. √SAFER MAN ISOL vlv – OP (dn) and HCM (dn)<br>10. √ERCA LED – On (if no video signal) | **Initial Condition:**<br>Fwd UIA D-ring with right waist tether<br>√Hooks locked<br><br><u>EGRESS</u> (00:15)<br><br>1. Transfer PMA3 crewlock bag to EV1 (Lg/Sm RET goes with bag)<br><br>2. Transfer PAS crewlock bag to EV1 (Lg/Sm RET remains in crewlock)<br><br>3. Transfer anchor hook of EV2 85-ft safety tether to EV1<br>√Load alleviating bail closed, slider locked<br>√Reel unlocked<br><br>4. On EV1 GO, release waist tether from UIA D-ring<br>5. Egress A/L<br>6. Close A/L thermal cover<br>7. √SAFER MAN ISOL vlv – OP (dn) and HCM (dn)<br>8. √ERCA LED – On (if no video signal) |

**EGRESS/SETUP (00:30)** (Cont)

| IV (SSRMS) | EV1 (Ol) | EV2 (Fg) |
|---|---|---|
| | SETUP (00:15)<br>11. Translate to S3 Upper Outboard PAS via Face 5/6 translation path; fairlead (P) forward of both nadir light stanchions, remain nadir of Face 4 stanchion<br>12. Temp stow PAS crewlock bag to S3 HR 3043<br>13. Inspect gloves | SETUP (00:15)<br>9. Translate to S3 HR 3008 via Face 5/6 translation path; fairlead (P) at CETA spur, and forward of both nadir light stanchions<br>10. Tether swap to spare 55-ft safety tether on S3 HR 3008<br>√Both bails closed, sliders locked<br>√Reel unlocked<br>11. Stow A/L 85-ft safety tether on S3 HR 3008<br>12. Translate to S3 Upper Outboard PAS, remain zenith of Face 4 stanchion<br>13. Fairlead (R) at S3 HR 3053 and (P) forward of zenith trunnion to keep safety tether clear of PAS worksite<br>14. Inspect gloves |

## S3 UPPER OUTBOARD PAS DEPLOY (01:30)

| IV | EV1 (OI) | EV2 (Fg) |
|---|---|---|
| | CAUTION<br>1. Do not close ADP lock bracket when not inserted in a stowage hole<br>2. Limit 10 lbf when removing or installing Yoke PIP pin and ADP<br>3. To prevent hinge damage, limit diagonal brace to ~7 deg maximum out of plane<br>4. To avoid platform detents, do not exceed 30 inches between yoke ADP and Deploy Clevis Bracket<br>5. EBCS target is susceptible to contact damage. Do not remove MLI until all work inside truss complete | |
| | REMOVE DEPLOY CLEVIS BRACKET<br>1. RET to Deploy Clevis Bracket<br>2. **PGT: B7/CCW2/30.5**<br>(25.5 ft-lb, 30 RPM)<br>6" -Ext-7/16"<br>3. Release Deploy Clevis Bracket bolts (4) 10 turns<br>4. Temp stow Deploy Clevis Bracket with RET<br><br>RELEASE YOKE ADP AND PIP PIN **(Caution #1, #2)**<br>5. Release yoke PIP pin<br>6. Release yoke ADP<br>7. Pre position Lg-Sm adj tether on yoke ADP hole<br>8. Attach small hook of Lg-Sm adj tether to port stanchion of S3 HR 3048<br>9. Tend platform “into” the truss<br><br>REMOVE STOW CLEVIS BRACKET<br>10. RET to Stow Clevis Bracket<br>11. **PGT**: **B7/CCW2/30.5**<br>(25.5 ft-lb, 30 RPM)<br>6" -Ext-7/16"<br>12. Release Stow Clevis Bracket (4) 10 turns<br>Temp stow Clevis Bracket<br><br>13. Receive Diagonal Brace from EV2; temp stow port of PAS worksite using adj equipment tether on S3 HR 3041 | HINGE LINE PREP **(Caution #1)**<br>1. Remove hinge line ADPs (2)<br>2. Insert in stowage hole (toward station forward),<br>❑ √ADP closed: Inboard<br>❑ √ADP closed: Outboard<br><br>REMOVE SARJ BRACES<br>3. Release SARJ Launch Bolt by hand, ~3 turns ccw<br>4. **PGT: B6/CCW3/30.5**<br>(24.0 ft-lb, 60 RPM)<br>2" -Ext-7/16"<br>5. Release SARJ Brace (cup-cone bolt), 35 turns, **Stop on turns; do not exceed 37 turns**<br><br>REMOVE DIAGONAL BRACES<br>6. Attach SARJ Brace to Diagonal Strut, hand tighten SARJ Launch Bolt 1 turn cw<br>7. **PGT: B6/CCW3/30.5**<br>(24.0 ft-lb, 60 RPM)<br>2" -Ext-7/16"<br>8. Release Diagonal Brace (cup-cone bolt)<br>**Stop on turns 35 (do not exceed 37 turns)**<br>9. Stow adj equipment tether on SARJ brace<br><br>**(Caution #3)**<br>10. Guide Diagonal Brace to EV1 |

## S3 UPPER OUTBOARD PAS DEPLOY (01:30) (Cont)

### IV

1. Brace Bolt Installation:

| Bolt | SARJ Brace | Diagonal |
|---|---|---|
| Torque | | |
| Turns | | |

2. Deploy Clevis Bracket Install:

| Bolt # | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Initial Torque | | | | |
| Turns | | | | |
| Final Torque | | | | |

### EV1 (OI)

DEPLOY PLATFORM **(Caution #4)**

14. Deploy platform out until UMA clears longeron
15. On EV2 GO, Rotate yoke from out to in
16. Reposition sm hook of Lg-Sm adj tether to HR

REINSTALL BRACES

17. Release Diagonal Brace from S3 HR 3041 and move into position for re-installation
18. Release Lg-Sm adj tether as needed for brace clearance
19. Reinstall Lg-Sm adj tether once brace is clear

REINSTALL DEPLOY CLEVIS BRACKET

20. Retrieve Deploy Clevis Bracket and finger-start bolts (4), 1-2 turn
21. **PGT: B5/CW2/30.5**
    (22.0 ft-lb, 30 RPM)
    6" -Ext-7/16"
22. Engage Deploy Clevis Bracket bolts (4) to hard stop, expect **10 turns**
23. **PGT: RCW/30.5**
24. 6" -Ext-7/16" Apply final Torque to Deploy Clevis Bracket bolts (4) in Ratchet Mode. Two MTL clicks each bolt

INSTALL YOKE

25. Disconnect Lg-Sm adj equipment tether
26. Install yoke in deploy clevis bracket
    - ❑ Release wire tie securing PIP pin and ADP to yoke (if used)
    - ❑ Install yoke ADP, √lock bracket engaged
    - ❑ Install yoke PIP Pin
27. Retrieve Lg-Sm adj equipment tether from HR; stow in PAS crewlock bag
28. Stow clevis bracket in PAS crewlock bag

### EV2 (Fg)

DEPLOY PLATFORM **(Caution #4)**

11. Monitor UMA to longeron clearance
12. Inform EV1 when UMA just clears longeron
13. Assist EV1 as needed with yoke

REINSTALL DIAGONAL BRACES

14. Assist EV1 with brace installation
15. Retrieve adj equipment tether from SARJ brace
16. **PGT**: **B2/CW2/30.5**
    (16.0 ft-lb, 30 RPM)
    2" -Ext-7/16"
17. Engage Diagonal Brace (cup-cone bolt) to **hard stop**, ~35 turns

REINSTALL SARJ BRACES

18. Release SARJ Brace via SARJ Launch Bolt by hand, ~1 turn ccw
19. **PGT**: **B2/CW2/30.5**
    (16.0 ft-lb, 30 RPM)
    2" -Ext-7/16"
20. Engage SARJ Brace (Cup-Cone bolt) to **hard stop**, ~38 turns
21. Re-engage SARJ Launch Bolt for temp stow; hand tighten cw 2-3 turns

EBCS TARGET PREP **(Caution #5)**

22. When Yoke Install complete, translate to EBCS target and perform:
    - ❑ Verify both EV clear of target area
    - ❑ Remove target cover; stow on backside of target assy

## S3 UPPER OUTBOARD PAS DEPLOY (01:30) (Cont)

| IV | EV1 (OI) | EV2 (Fg) |
|---|---|---|
| 3. IV: Give MCC-H GO to power up IMCA<br>√All tasks inside truss prior to UMA prep complete (including EBCS prep)<br>√Tools cleared from inside truss<br><br>4. IV: Obtain GO from MCC-H for RTL Checkout<br><br>RTL # \| 1 \| 2 \| 3<br>PIP Pin \| \| \| | UMA PREP<br>29. Translate under PAS UMA<br>30. Tether to hitch pin from EVA OVERRIDE anti-rotation cap, remove hitch pin<br>31. Remove anti-rotation cap and stow in PAS crewlock bag<br><br>CLEANUP<br>32. Inspect gloves<br>33. √SAFER MAN ISOL vlv – OP (dn) and HCM (dn)<br>34. Perform PAS crewlock bag tool inventory<br>35. Retrieve PAS crewlock bag; stow on BRT<br>36. Translate to A/L; EV2 leads | RTL CHECKOUT<br>23. Translate to each Guide Vane (3) and perform:<br>❑ Remove launch restraint PIP pin from guide vane; stow in trash bag<br>❑ On **MCC-H** GO, depress and hold RTL lever for 15 sec, then release<br>❑ Verify with **MCC-H** good checkout, move to next guide vane<br><br>CLEANUP<br>24. Inspect gloves<br>25. √SAFER MAN ISOL vlv – OP (dn) and HCM (dn)<br>26. Translate to S3 HR 3008<br>27. Tether swap to A/L 85-ft safety tether<br>√Both bails closed, sliders locked<br>√Reel unlocked<br>28. Translate to A/L |

## RATE GYRO ASSEMBLY (RGA) REMOVE AND REPLACE (01:00)

| IV | EV1 (Ol) | EV2 (Fg) |
|---|---|---|
| | RGA SETUP (00:15)<br><br>1. Transfer PAS crewlock bag to EV2<br><br>2. Receive Lg ORU bag; stow on BRT<br>3. Translate to S0 port wedge face via S0 aft route; fairlead as reqd<br>4. Temp stow spare RGA on S0 Face 3 HAB Cable Tray using integrated lid tethers (2), and to S0 HR 3519 using adj equipment tethers (2)<br>5. Attach RET to S0 HR 3541 for failed RGA 2 temp stow | RGA SETUP (00:15)<br>1. Open thermal cover<br>2. Ingress Crewlock<br>3. Receive PAS crewlock bag; stow on Lg/Sm RET<br>4. Transfer Lg ORU bag to EV1; attach Lg/Sm RET to A/L D-ring extender<br>5. Stow spare 55-ft safety tether in A/L<br>6. Retrieve RPCM crewlock bag<br>7. Egress A/L and close thermal cover<br>8. Stow RPCM crewlock bag on BRT<br>9. √SAFER MAN ISOL vlv – OP (dn) and HCM (dn)<br>10. Set fairlead (P) around Stbd Toolbox WIF (to keep EV1 translation path clear)<br>11. Translate to S0, Face 1, Bay 00 via CETA spur route<br>12. Temp stow RPCM crewlock bag on S0 Face 2 HR3487 or HR3484 (between MBSUs)<br>13. Inspect gloves |
| | CAUTION<br>Avoid inadvertent contact with RGA (Z-93 paint) | |
| | RGA REMOVE AND REPLACE (00:45)<br>6. Open thermal shroud for RGA 2 (stbd shroud)<br>7. BRT to S0 HR 3520 for RGA removal operations<br><br>NOTE<br>If TA clamps must be opened for RGA 2 connector demate, RET to connectors prior to release, to avoid loss inside the truss<br><br>8. Demate connectors from RGA 2 as follows:<br>❑ W4203/P678 from J671<br>❑ W4110/P680 from J673<br><br>9. Restrain connectors clear of worksite | RGA REMOVE AND REPLACE (00:45)<br>14. Ingress S0 truss through Face 1 at Bay 02 to access RGA 2 (stbd RGA) inner bolts<br><br>15. BRT to S0 HR 3507 for RGA bolt operations |

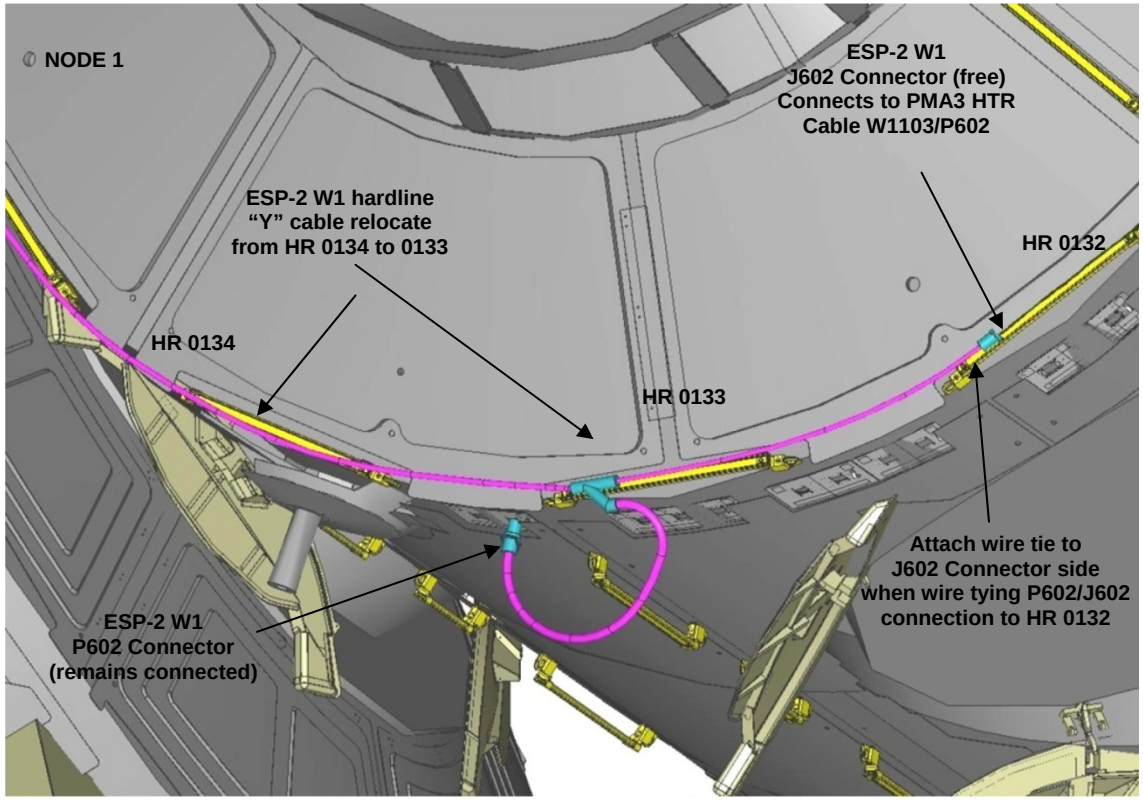
## RATE GYRO ASSEMBLY (RGA) REMOVE AND REPLACE (01:00) (Cont)

| IV | EV1 (Ol) | EV2 (Fg) |
|---|---|---|
| | 10. **PGT: B7/CCW2/30.5**<br>(25.5 ft-lb, 30 RPM)<br>6" -Ext-7/16"<br>11. Release RGA outer bolts (2), 12-14 turns (bolt pops up when fully released)<br>❑ Zenith bolt<br>❑ Nadir bolt<br>12. Attach long waist tether to S0 HR 3520; release BRT<br>13. Attach RET from HR 3541 to RGA 2<br>14. Give EV2 GO to release RGA 2 inner bolts<br>15. Using RGA baseplate handhold, remove failed RGA and temp stow on S0 HR 3541<br>16. Retrieve spare RGA from Lg ORU bag; install on guide rails | 16. **PGT: B7/CCW2/30.5**<br>(25.5 ft-lb, 30 RPM)<br>2" -Ext-7/16"<br>17. On EV1 GO, release RGA 2 inner bolts (2), 12-14 turns (bolt pops up when fully released)<br>❑ Zenith bolt<br>❑ Nadir bolt |
| 1. RGA 2 Installation Bolt Data:<br><table><tr><th>Bolt</th><th>Torque (ft-lb)</th><th>Turns</th></tr><tr><td>Inner Zenith</td><td></td><td></td></tr><tr><td>Inner Nadir</td><td></td><td></td></tr><tr><td>Outer Zenith</td><td></td><td></td></tr><tr><td>Outer Nadir</td><td></td><td></td></tr></table> | 17. **PGT: A2/CW2/30.5**<br>(3.8 ft-lb, 30 RPM)<br>6" -Ext-7/16"<br>18. Give EV2 GO to drive spare RGA 2 inner bolts<br>19. Drive spare RGA 2 outer bolts (2), 12-14 turns to a hardstop<br>❑ Zenith bolt<br>❑ Nadir bolt<br>20. Release RET from spare RGA 2<br>21. Remove connector caps (2) from spare RGA 2 and temp stow on MWS | 18. **PGT: A2/CW2/30.5**<br>(3.8 ft-lb, 30 RPM)<br>2" -Ext-7/16"<br>19. On EV1 GO, drive spare RGA 2 inner bolts (2), 12-14 turns to a hardstop<br>❑ Zenith bolt<br>❑ Nadir bolt<br>20. Release BRT; egress S0 truss through Face 1<br>21. √SAFER MAN ISOL vlv – OP (dn) and HCM (dn)<br>22. Inspect gloves |

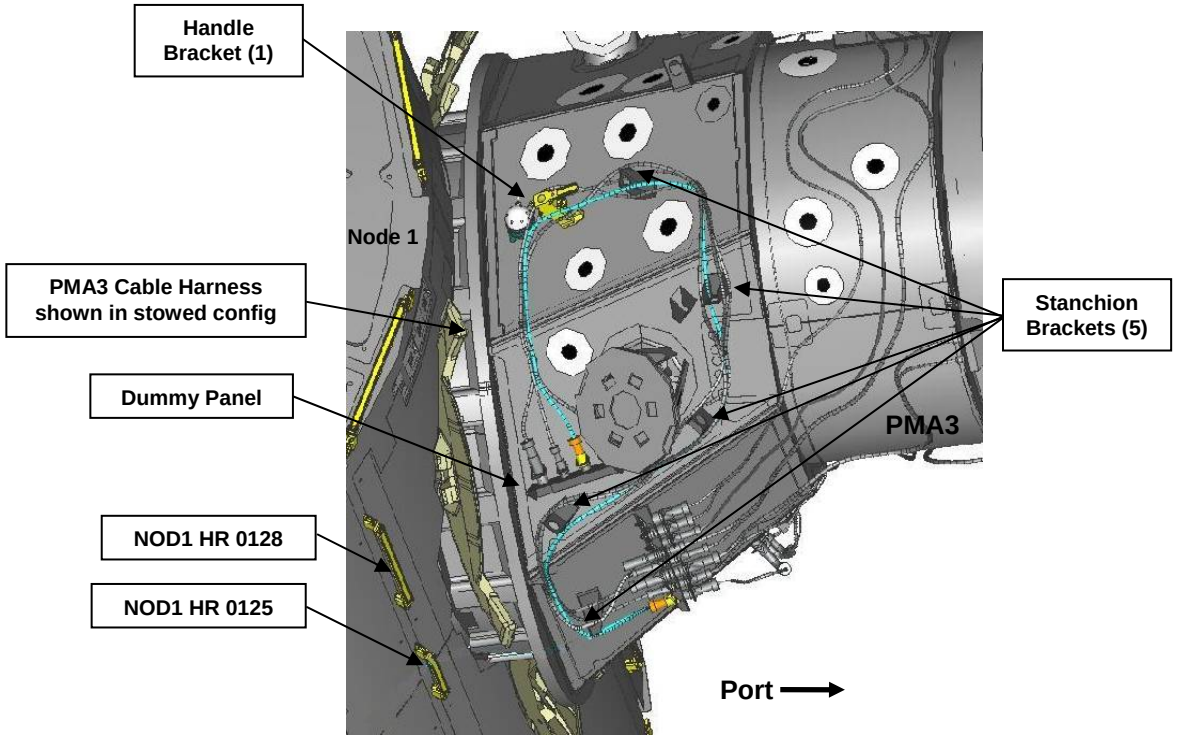
## RATE GYRO ASSEMBLY (RGA) REMOVE AND REPLACE (01:00) (Cont)

| IV | EV1 (Ol) | EV2 (Fg) |
|---|---|---|
| 2. Notify MCC when connectors mated | 22. Mate connectors to spare RGA 2 as follows:<br>❑ W4203/P678 to J671<br>❑ W4110/P680 to J673<br><br>23. Close TA clamps as reqd and remove RET<br>24. Perform WVS survey<br><br>25. Close thermal shroud for RGA 2<br>26. Perform WVS survey<br><br>27. Retrieve failed RGA and RET from S0 HR 3541<br>28. Install connector caps on failed RGA<br>29. Stow failed RGA in Lg ORU bag; stow Lg ORU bag on BRT<br><br>30. Inspect gloves<br><br>31. Translate to A/L; retrieve fairleads as reqd<br>32. Open thermal cover<br>33. Stow Lg ORU bag containing failed RGA in A/L using Lg/Sm RET<br>34. Egress A/L and close thermal cover<br><br>35. √SAFER MAN ISOL vlv – OP (dn) and HCM (dn)<br><br>36. Retrieve PMA3 crewlock bag from equipment lock HR; stow on BRT (leave Lg/Sm RET on equipment lock HR) | |

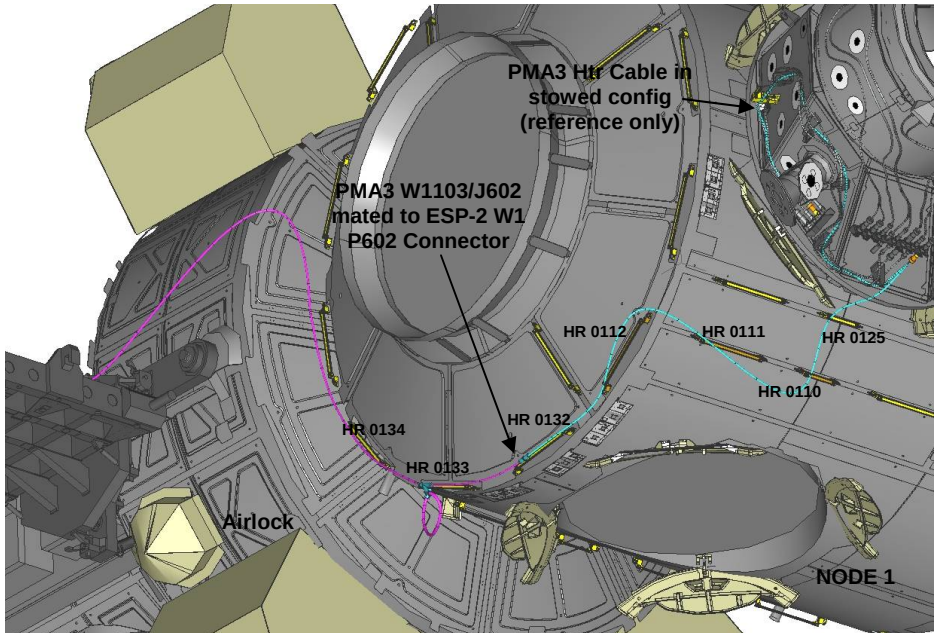
## PMA3 HEATER CABLE CONNECT (00:45)

| IV | EV1 (OI) |
|---|---|
| | NOTE<br>Remain clear of PMA3 FRGF<br><br>ESP 2 CABLE REROUTE (00:10)<br>1. Translate to NOD1 HR 0134 (nadir/stbd side of NOD1; ref. Cable Routing Cue Card as reqd)<br>2. Retrieve wire tie caddy from PMA3 crewlock bag; stow on MWS<br>3. Release ESP-2 W1 hardline "Y" cable from NOD1 HR 0134<br>4. Relocate ESP-2 W1 hardline "Y" cable one handrail port, to NOD1 HR 0133; wire tie in place<br><br>  <br> |

## PMA3 HEATER CABLE CONNECT (00:45) (Cont)

| IV | EV1 (OI) |
|---|---|
| | PMA3 HTR CABLE DISCONNECT FROM PMA3 (00:10)<br>5. Translate to nadir side of PMA3<br>6. Release all TA clamps, beginning with clamp closest to NOD1 HR 0125 (heater cable coils around PMA3 grapple shaft)<br>7. Release PMA3 heater cable connectors (4) from dummy panel (any order)<br>8. Attach MWS EE to handle bracket (bracket closest to dummy panel); release bracket from soft dock<br>  <br> |

## PMA3 HEATER CABLE CONNECT (00:45) (Cont)

| IV | EV1 (OI) |
|---|---|
| | PMA3 HTR CABLE CONNECT TO ESP-2 W1 CABLE (00:25)<br>9. Translate to NOD1 HR 0133, wire tying PMA3 heater cable to:<br>❑ NOD1 HR 0125<br>❑ NOD1 HR 0110<br>❑ NOD1 HR 0111<br>❑ NOD1 HR 0112<br>10. Mate PMA3 heater cable W1103/P602 to ESP-2 W1 J602<br>11. Wire tie connector to NOD1 HR 0132 (attach wire tie between HR and J602 side of connector)<br>12. Retrieve connector caps (3) from PMA3 crewlock bag; install on unmated PMA3 cable connectors<br>13. Bundle unmated PMA3 heater cable connectors (3) together and wire tie to NOD1 HR 0132<br>14. Stow wire tie caddy in PMA3 crewlock bag<br>15. Perform WVS survey<br>16. Inspect gloves<br>  |

## S0 RPCM REMOVE AND REPLACE (00:45)

| IV | EV2 (Fg) |
|---|---|
| 1. Verify S0 RPCM Inhibits in place<br>√DDCU S01A Converter – Off<br>2. Give EV2 GO for RPCM removal<br><br> <br>Equipment hook shown in correct orientation with gate away from RPCM | S0 RPCM R&R (00:30)<br><br>WARNING<br>Edges of RPCM housing may be sharp, use caution while handling<br><br>CAUTION<br>Avoid contact with SPDA radiator (face 3)<br>Failure to align and fully seat socket until lock springs have released can result in damage to RPCM Drive Screw Assembly<br>Combined linear and rotational motion on the socket while inserting, can result in damage to RPCM Drive Screw Assembly<br><br>1. Translate to RPCM crewlock bag<br>2. BRT to S0 HR3484 for RPCM operations<br>3. Slide stbd SPDA door open partially (avoid hitting detents)<br>4. Verify failed RPCM S0_1A_D s/n C024088<br>5. On IV/MCC GO: Tether to failed RPCM using crewlock bag RET (w/hook pointed away from RPCM)<br>6. **PGT: A6/CCW2/30.5**<br>(8.3 ft-lb, 30 RPM)<br>2" -Ext-7/16"<br>7. Release drive screw,~8 turns (push in while turning to release locking tabs)<br>8. √Status Indicator – UNLOCK<br>9. Remove failed RPCM, slide off guide rail<br>10. Inspect guide rail for debris/damage<br>11. Retrieve spare RPCM; stow failed unit in crewlock bag<br>12. Verify spare RPCM s/n C235299<br>13. Inspect spare RPCM connector interface for debris/damage<br>14. Install spare RPCM on guide rail and slide into soft dock<br>15. √Status Indicator – not below UNLOCK |

## S0 RPCM REMOVE AND REPLACE (00:45) (Cont)

<table>
<tr><th>IV</th><th>EV2 (Fg)</th></tr>
<tr><td>3. Record RPCM Installation Bolt Data:<br><br><table><tr><th>Torque (3.8 ft-lb)</th><th>Turns (6.5)</th></tr><tr><td></td><td></td></tr></table><br><br>4. Give MCC-H GO for RPCM power up</td><td>16. PGT: A2/CW2/30.5<br>(3.8 ft-lb, 30 RPM)<br>2" -Ext-7/16"<br>17. Engage drive screw, ~6.5 turns to a hardstop (push in while turning to release locking tabs)<br>18. √Status Indicator – LOCK<br>19. Perform WVS survey<br>20. Slide stbd door to closed position<br>21. √Alignment mark; verify door does not slide freely<br><br><u>CONNECTOR INSULATING SLEEVE INSTALL</u> (00:15)<br>22. Retrieve connector insulating sleeve size 33/37 from RPCM crewlock bag<br>23. Open S0 Ingress Flap (Bay 00, Face 3) and ingress truss<br>24. Install connector insulating sleeve on Channel 1/4 CR 8018 Cable connection S0 P333 (W4145) to S0 Ch 1/4 Jumper J333A (W4148) (note that this cable assembly plugs into S0 at Panel A163)<br>25. Verify all metallic surfaces covered by connector insulating sleeve<br>26. Perform WVS survey<br><br>27. Egress truss and close S0 Ingress Flap<br>28. Perform WVS survey<br>29. √SAFER MAN ISOL vlv – OP (dn) and HCM (dn)<br><br>30. Translate to RPCM crewlock bag; perform tool inventory<br>31. Retrieve RPCM crewlock bag from S0 HR; stow on BRT<br>32. Give GO for RPCM power up<br><br>33. Inspect gloves</td></tr>
</table>

## NOD3 CH 2/3 AND CH 1/4 AVIONICS CABLE INSTALLATION (01:45)

| IV | EV1 (OI) | EV2 (Fg) |
|---|---|---|
| | NOTE<br>Attach wire ties to handrails in a loose config to allow for cable slack adjustment during cleanup.<br><br>Remain clear of PMA3 FRGF | |
| | CH 2/3 AVIONICS CABLE SETUP (00:15)<br>1. Translate to A/L<br>2. Retrieve Lg-Sm RET from equipment lock HR; stow on PMA3 crewlock bag<br>3. Open thermal cover<br>4. Stow PMA3 crewlock bag in A/L using Lg-Sm RET<br>5. Retrieve Lg trash bag; stow on swingarm with RET<br>6. Receive RPCM crewlock bag from EV2; stow in A/L on adj fuse tether<br>7. Receive EV2 PGT, stow in A/L on adj fuse tether<br>8. Transfer wire tie caddy to EV2<br><br>9. Transfer NOD3 Ch 2/3 Cable Bag to EV2 (Lg-Sm RET remains in crewlock)<br><br>10. Egress A/L<br>11. Close thermal cover<br>12. √SAFER MAN ISOL vlv – OP (dn) and HCM (dn)<br>13. Receive NOD3 Ch 2/3 Cable Bag from EV2; stow on BRT<br>14. Translate to S0 via the aft route (over the rat's nest); fairlead on S0 HR 3454 (R) to keep safety tether clear of rat's nest<br>15. Translate to NOD1 fwd endcone HR 0129<br>16. Temp stow Ch 2/3 Cable Bag between NOD1 HRs 0129 and 0126 using integrated adj tethers<br>17. Stow PGT and RET on Ch 2/3 Cable Bag<br>18. If not already completed, relocate APFR/TS from Z1 WIF 08 to Z1 WIF 10 [3,PP,B,6]<br>19. Verify Tool Stanchion pitched zenith | CH 2/3 AVIONICS CABLE SETUP (00:15)<br>1. Translate to A/L<br><br><br><br><br>2. Transfer RPCM crewlock bag to EV1<br><br>3. Transfer EV2 PGT to EV1<br><br>4. Receive wire tie caddy; stow on MWS using an adj equipment tether from glove<br><br>5. Receive NOD3 Ch 2/3 Cable Bag from EV1; hold for EV1<br><br><br><br><br>6. Translate to NOD1 HR 0129 via NOD1 aft/nadir translation path<br>7. Inspect gloves |
| 1. Verify with MCC that Node 3 Channel 1/4 and 2/3 inhibits are in place (see inhibit pad) | | |

## NOD3 CH 2/3 AND CH 1/4 AVIONICS CABLE INSTALLATION (01:45) (Cont)

| IV | EV1 (OI) | EV2 (Fg) |
|---|---|---|
| | ROUTE CH 2/3 AVIONICS CABLE (00:20)<br>20. Receive Ch 2/3 avionics cable fwd end from EV2, attach RET as reqd until 2 wire ties installed<br>21. Attach cable via wire tie to:<br>❑ NOD1 HR 0139 (route cable aft of trun pin)<br><br>22. Translating fwd, unbundle cable and wire tie to:<br>❑ LAB HR 0222<br>❑ S0 Port Strut HR 02 (nadir HR)<br>❑ S0 Port Strut HR 01 (zenith HR)<br>❑ S0 HR 3496<br>❑ S0 HR 3489<br>❑ S0 HR 3485<br>❑ S0 HR 3482<br><br>CONNECT CH 2/3 AVIONICS CABLE (00:20)<br>23. On IV/MCC GO: On S0 Panel A145, RET to/integrate long wire tie; remove connector caps (4) from connectors; stow in Lg trash bag (pip-pinned open):<br>❑ J209<br>❑ J188<br>❑ J192<br>❑ J190<br>24. On Ch 2/3 avionics cable, remove wire tied connector caps (4) from connectors (RET to any one connector cap); stow in Lg trash bag:<br>❑ W9026/P209<br>❑ W9026/P188<br>❑ W9324/P192<br>❑ W9026/P190<br><br>25. Mate Ch 2/3 avionics cable connectors to S0 Panel A145<br>❑ W9026/P209 to J209<br>❑ W9026/P188 to J188<br>❑ W9324/P192 to J192<br>❑ W9026/P190 to J190 | ROUTE CH 2/3 AVIONICS CABLE (00:25)<br>8. Open Ch 2/3 Cable Bag, remove fwd end (P209/P188/P190/P192); transfer to EV1<br>9. Attach denoted “Central” wire tie to:<br>❑ NOD1 HR 0129<br><br>10. Remove aft end (P108/P114/P110/P112) from Ch 2/3 Cable Bag<br>11. Translating aft, unbundle cable and wire tie to:<br>❑ NOD1 HR 0126<br>❑ NOD1 HR 0124<br>❑ NOD1 HR 0121<br>❑ NOD1 HR 0105 (on endcone)<br>❑ NOD1 HR 0106 (nadir on endcone)<br><br>12. Temp stow the remaining coiled cable, using wire ties as reqd, to:<br>❑ NOD1 HR 0118<br>❑ NOD1 HR 0106<br><br>NOD1 CABLE REROUTING (00:05)<br>13. Translate to NOD1/PMA1 cable; evaluate cable configuration and restrain as reqd<br><br>ROUTE CH 1/4 AVIONICS CABLE (00:40)<br>14. Translate to Ch 1/4 cable bag stowed on LAB HR 0230 (stbd/nadir side of LAB, below ESP-2)<br>15. Open Ch 1/4 cable bag, remove fwd end (P208/P181/P183/P185) |

## NOD3 CH 2/3 AND CH 1/4 AVIONICS CABLE INSTALLATION (01:45) (Cont)

| IV | EV1 (OI) | EV2 (Fg) |
|---|---|---|
| 2. Notify MCC when all Ch 2/3 and Ch 1/4 avionics cable connectors are mated | 26. Inspect gloves<br><br>ROUTE CH 1/4 AVIONICS CABLE (00:20)<br>27. Receive fwd end of Ch 1/4 avionics cable from EV2, attach RET as reqd until 2 wire ties installed<br><br>28. Translating zenith, unbundle cable and wire tie to:<br>❑ LAB HR 0229<br>❑ S0 Stbd Strut HR 12 (nadir HR)<br>❑ S0 Stbd Strut HR 11 (zenith HR)<br>29. Perform reach assessment to ensure Ch 1/4 avionics cable connectors reach S0 Panel A145<br>30. Bias loose Ch 1/4 avionics cable toward NOD3 to LAB HR 0229; secure each wire tie (3) along the cable to applicable handrail:<br>❑ S0 Stbd Strut HR 11 (zenith HR)<br>❑ S0 Stbd Strut HR 12 (nadir HR)<br>❑ LAB HR 0229<br><br>CONNECT CH 1/4 AVIONICS CABLE (00:15)<br>31. On S0 Panel A145, RET to/integrate long wire tie; remove connector caps (4) from connectors; stow in Lg trash bag:<br>❑ J185<br>❑ J183<br>❑ J181<br>❑ J208<br>32. On Ch 1/4 avionics cable, remove wire tied connector caps (4) from connectors (RET to any one connector cap); stow in Lg trash bag:<br>❑ W9025/P208<br>❑ W9025/P181<br>❑ W9025/P183<br>❑ W9323/P185<br><br>33. Close Lg trash bag | 16. Attach denoted “Central” wire tie (black sharpie mark on wire tie) to:<br>❑ LAB HR 0230<br>17. Route fwd end of cable between ESP-2 and LAB; transfer to EV1<br><br>NOTE<br>For CH 1/4 Avionics Cable, begin routing cable after EV1 has biased all slack to LAB HR 0229. Attach wire ties to handrails in a final config<br><br>18. Once EV1 has biased loose Ch 1/4 avionics cable beyond LAB HR 0229, secure “Central” wire tie to:<br>❑ LAB HR 0230<br><br>19. Remove aft end (P101/P113/P103/P105) from Ch 1/4 Cable Bag<br><br>20. Translating aft, unbundle cable as required and wire tie to:<br>❑ LAB HR 0217<br>❑ NOD1 HR 0134<br>❑ NOD1 HR 01 (unlabeled)<br>❑ NOD1 HR 02 (unlabeled)<br>❑ NOD1 HR 03 (unlabeled)<br>❑ NOD1 HR 04 (unlabeled)<br>❑ NOD1 HR 0108 |

## NOD3 CH 2/3 AND CH 1/4 AVIONICS CABLE INSTALLATION (01:45) (Cont)

| IV | EV1 (OI) | EV2 (Fg) |
|---|---|---|
| | 34. Mate Ch 1/4 avionics cable connectors to S0 Panel A145<br>❑ W9323/P185 to J185<br>❑ W9025/P183 to J183<br>❑ W9025/P181 to J181<br>❑ W9025/P208 to J208<br><br>35. Notify MCC when all Ch 2/3 and Ch 1/4 avionics cable connectors are mated<br>36. Perform WVS survey<br><br><u>CH 2/3 AVIONICS CABLE CLEANUP</u> (00:15)<br>37. Bias loose Ch 2/3 avionics cable toward NOD3; secure each wire tie (16) along the cable to applicable handrail:<br>❑ S0 HR 3462 (wire tie not yet attached)<br>❑ S0 HR 3482<br>❑ S0 HR 3485<br>❑ S0 HR 3489<br>❑ S0 HR 3496<br>❑ S0 Port Strut HR 01 (zenith HR)<br>❑ S0 Port Strut HR 02 (nadir HR)<br>❑ LAB HR 0222<br>❑ NOD1 HR 0139<br>❑ NOD1 HR 0129<br>❑ NOD1 HR 0126<br>❑ NOD1 HR 0124<br>❑ NOD1 HR 0121<br>❑ NOD1 HR 0105<br>❑ NOD1 HR 0106<br>❑ NOD1 HR 0118<br>38. Perform WVS survey<br>39. Inspect gloves | 21. Temp stow the remaining coiled cable, using wire ties as reqd, to:<br>❑ NOD1 HR 0118<br>❑ NOD1 HR 0107<br><br>22. Perform WVS survey<br>23. Inspect gloves<br><br><u>AVIONICS CABLE CLEANUP</u> (00:20)<br>24. Retrieve Ch 1/4 Cable Bag from LAB HR 0230<br>25. Translate to A/L; open thermal cover<br>26. Stow Ch 1/4 Cable Bag in A/L using Lg/Sm RET<br><br>27. Retrieve CLPA crewlock bag (Lg/Sm RET remains in crewlock)<br><br>28. Retrieve EV2 PGT if reqd; stow on swingarm with RET<br>29. Egress A/L and close thermal cover<br>30. √SAFER MAN ISOL vlv – OP (dn) and HCM (dn) |

## NOD1 SLIDEWIRE REMOVAL/CLA COVER INSTALLATION (01:10)

| IV | EV1 (Ol) | EV2 (Fg) |
|---|---|---|
| | NOD1 SLIDEWIRE REMOVAL (00:20)<br><br>CAUTION<br>Slidewire is damaged and could present a sharp edge. Caution should be taken not to touch nicked areas<br><br>1. Retrieve PGT and RET from Ch 2/3 Cable Bag<br>2. Translate to NOD1 slidewire fwd stanchion; attach RET to fwd stanchion<br>3. **PGT: A5/CCW2/30.5**<br>(7.0 ft-lb, 30 RPM)<br>6" -Ext-7/16"<br>4. Drive stanchion bolt to release slidewire tension<br>5. Depress fwd stanchion plunger and pull stanchion fwd to remove from mount<br><br>6. Translate to the aft stanchion, coiling slidewire; restrain in hand or with a tether as reqd<br>7. Depress aft stanchion plunger and pull stanchion aft to remove from mount<br><br>8. Translate zenith (aft of PMA3) to NOD3 Ch 2/3 Cable Bag<br>9. Stow slidewire inside NOD3 Ch 2/3 Cable Bag, using integrated velcro straps for restraint<br>10. Remove RET from fwd stanchion<br>11. Retrieve PMA3 crewlock bag from NOD1 HR; stow in NOD3 Ch 2/3 Cable Bag and close bag<br><br>12. Retrieve NOD3 Ch 2/3 Cable Bag from NOD1 HR 0129; stow on BRT<br>13. Inspect gloves<br><br>14. Translate to A/L | SSRMS CLA COVER INSTALLATION (00:20)<br>1. If not completed during a previous EVA, perform CLA COVER INSTALLATION in GET-AHEADS (7-XX)<br><br>2. If not completed during a previous EVA, translate to LAB HR 0254 and perform CLPA COVER INSTALLATION in GET AHEADS (7-XX)<br>3. Translate to S0, Bay 04, Face 6 to retrieve externally stowed 55-ft safety tethers (2)<br>4. Retrieve 55-ft safety tether from S0 HR 3539; stow on CLPA crewlock bag exterior<br>5. Retrieve 55-ft safety tether from S0 HR 3544; stow on CLPA crewlock bag exterior<br>6. Inspect gloves<br><br>7. Translate to A/L |

## EVA CLEANUP/INGRESS (00:35)

| IV | EV1 (OI) | EV2 (Fg) |
|---|---|---|
| | CLEANUP (00:15)<br>1. Cleanup as required | CLEANUP (00:15)<br>1. Cleanup as required |
| | INGRESS (00:20)<br>2. Tool inventory | INGRESS (00:20)<br>2. Tool inventory<br>3. Open thermal cover<br>4. Stow CLPA crewlock bag in crewlock using Lg/Sm RET |
| 1. Perform WVS PWRDN (PHOTO/TV, WVS CUE CARD) | | 5. Ingress A/L<br>6. Attach right waist tether to fwd UIA D-ring<br>√Both bails closed, sliders locked |
| | 3. On EV2 GO, release EV2 A/L 85-ft safety tether anchor hook from external D-ring; transfer to EV2 | 7. Give EV1 GO to remove EV2 A/L 85-ft safety tether anchor hook |
| | 4. Transfer Ch 2/3 Cable Bag to EV2 | 8. Receive A/L 85-ft safety tether from EV1; stow on MWS<br>9. Receive Ch 2/3 Cable Bag from EV1 stow in crewlock on Adj fuse tether |
| | 5. Attach waist tether to A/L internal D-ring<br>√Both bails closed, sliders locked<br>6. Release EV1 A/L 85-ft safety tether anchor hook from external A/L D-ring; stow on MWS<br>7. Ingress A/L<br>8. Close hatch thermal cover; attach Velcro strap | |
| | 9. Connect SCU to DCM; √SCU locked<br>10. Expect 1-3 min delay for SCU cooling w/TCV 8-Max C<br>11. WATER – OFF (fwd) expect H2O IS OFF msg | 10. Connect SCU to DCM; √SCU locked<br>11. Expect 1-3 min delay for SCU cooling w/TCV 8-Max C<br>12. WATER – OFF (fwd) expect H2O IS OFF msg |
| | CAUTION<br>Do not close hatch until EMU water – OFF for 2 min | |
| | 12. Verify outer hatch clear of hardware<br>13. EV Hatch – verify handle position per hatch decal; close and lock hatch<br>14. Go to PRE-REPRESS (DEPRESS/REPRESS Cue Card) | 13. Go to PRE-REPRESS (DEPRESS/REPRESS Cue Card) |

# POST EVA 3 TOOL CONFIG

## EV1

EMU D-rings
- ❑ Ext on left side
- ❑ Ext on right side
- ❑ Waist Tethers (left Ext to MWS, √locked)
- ❑ Waist Tethers (right Ext to MWS, √locked)
- ❑ 85-ft Safety Tether (left D-ring, √locked)

MWS
- ❑ Small STS Trash Bag
  - ❑ Wire tie (secure trash bag to MWS, tether loop)
- ❑ 1 – Wire tie as tether loop
- ❑ 1 – RET (with PIP pin)
- ❑❑ 2 – RETs
- ❑ 1 – Adj Equipment Tether
- ❑ Swing Arm (right side)
  - ❑ 1 – RET
    - ❑ 1 – PGT w/6" -Ext-7/16"
  - ❑ 1 – RET
    - ❑ Lg Trash Bag
- ❑ BRT (left side)
  - ❑ 1 – RET
  - ❑❑❑❑❑❑ 6 – Long wire ties

EMU Gloves
- ❑❑ 2 – Adj Equipment Tethers

## EV2

EMU D-rings
- ❑ Ext on left side
- ❑ Ext on right side
- ❑ Waist Tethers (left Ext to MWS, √locked)
- ❑ Waist Tethers (right D-ring to MWS, √locked)
- ❑ 85-ft Safety Tether (right Ext, √locked)

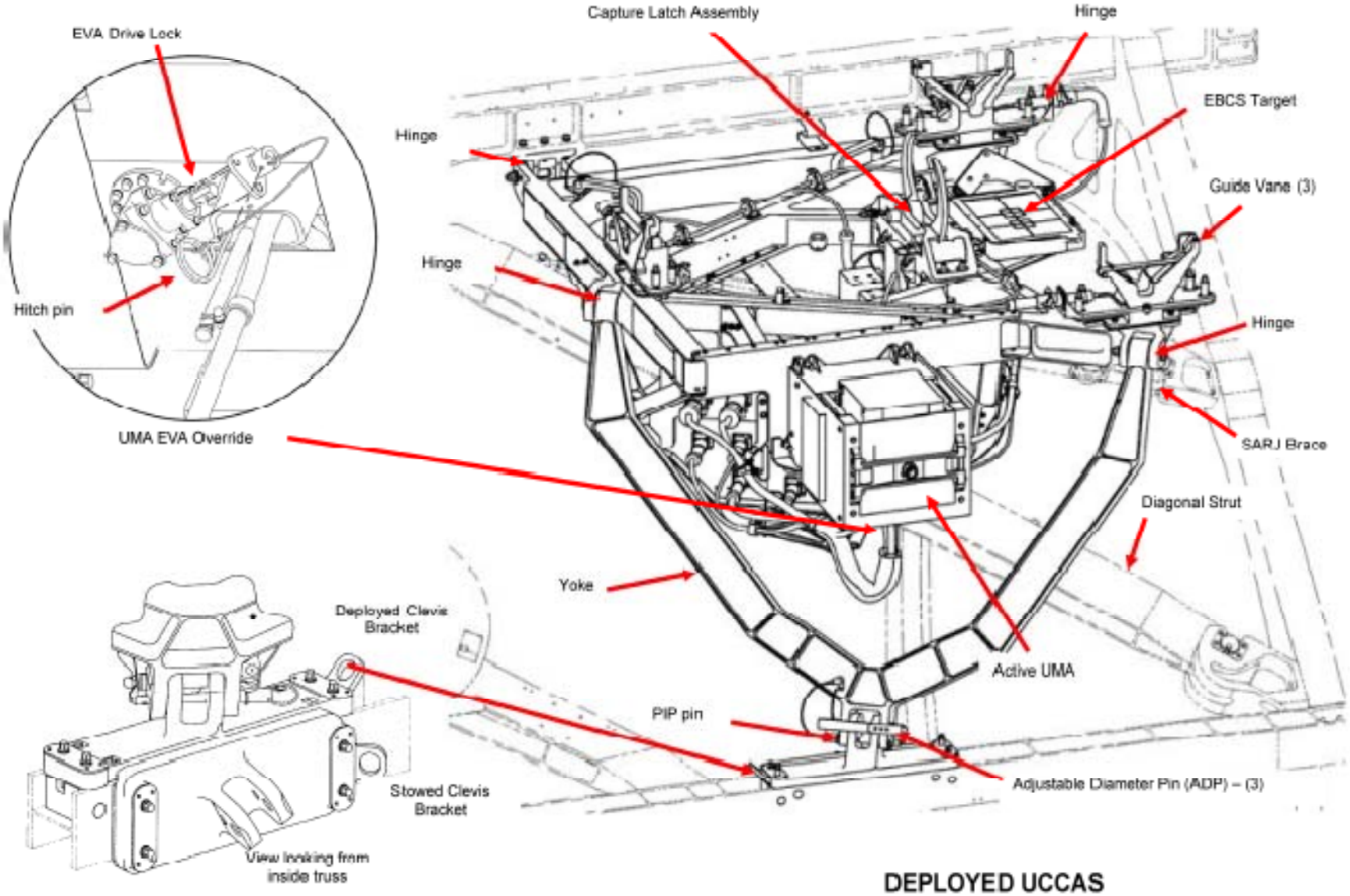
MWS
- ❑ Small Trash Bag
  - ❑ 1 – Adj Equipment Tether
    - ❑❑❑ 3 – PAS RTL PIP pins
- ❑❑ 2 – Wire ties as tether loops
- ❑ 1 – Wire tie caddy
  - ❑❑❑❑❑❑❑❑❑❑___ – Short wire ties (in caddy)
  - ❑ 1 – Adj Equipment Tether (to wire tie caddy)
- ❑ 1 – RET (with PIP pin)
- ❑ 1 – RET
- ❑ 1 – Adj Equipment Tether
- ❑ Swing Arm (right side)
  - ❑ 1 – RET
  - ❑ 1 – Camera w/bracket
- ❑ BRT (left side)
  - ❑ 1 – RET
  - ❑❑ 2 – Short wire ties
  - ❑ 1 – Long wire tie

EMU Gloves
- ❑❑ 1 – Adj Equipment Tether

CREWLOCK
- ❑ D-ring extender on A/L D-ring
- ❑ Lg-Sm RET
  - ❑ NOD3 Ch 1/4 Avionics Cable Bag
- ❑ Lg-Sm RET
  - ❑ NOD3 Ch 2/3 Avionics Cable Bag
    - ❑ NOD1 Slidewire (if removed)

CREWLOCK (cont)
- ❑ Lg-Sm RET
  - ❑ PMA3 Crewlock Bag
    - ❑ 1 – Wire tie caddy
      - ❑❑❑❑❑❑❑❑❑❑___ – Short wire ties
    - ❑ 1 – MMOD Shield Handling Tool
- ❑ Lg-Sm RET
  - ❑ PAS Crewlock Bag
    - ❑ Hammer
    - ❑ Detent Release Tool
    - ❑ 1 – RET
      - ❑ Detent Release Tool
    - ❑ Stow Clevis Bracket
    - ❑ Antirotation cap w/Hitch Pin
    - ❑ Lg/Sm Adj Equipment Tether
- ❑ Lg-Sm RET
  - ❑ Lg ORU Bag
    - ❑ Failed RGA
      - ❑❑ 2 – Connector caps (installed on RGA)
      - ❑ 1 – RET
  - ❑❑ 2 – Adj Equipment Tethers (outside of bag)
- ❑ Adj Fuse Tether
  - ❑ Camera w/bracket
  - ❑ 1 – PGT w/2" -Ext-7/16"
  - ❑ RPCM Crewlock bag
    - ❑ 1 – RPCM (failed)
  - ❑ 1 – RET (outside of bag)
- ❑ Lg-Sm RET
  - ❑ CLPA Crewlock Bag
    - ❑ 1 – CLA Cover MLI Case
    - ❑ 1 – CLPA Cover MLI Case
    - ❑❑ 2 – Connector Insulating Sleeve size 21/25 (MBS)
    - ❑ 1 – RET
      - ❑ 1 – Connector Insulating Sleeve size 15/17
  - ❑❑ 2 – 55-ft safety tethers (stowed on outside of bag)
- ❑ 1 – Spare 55-ft safety tether

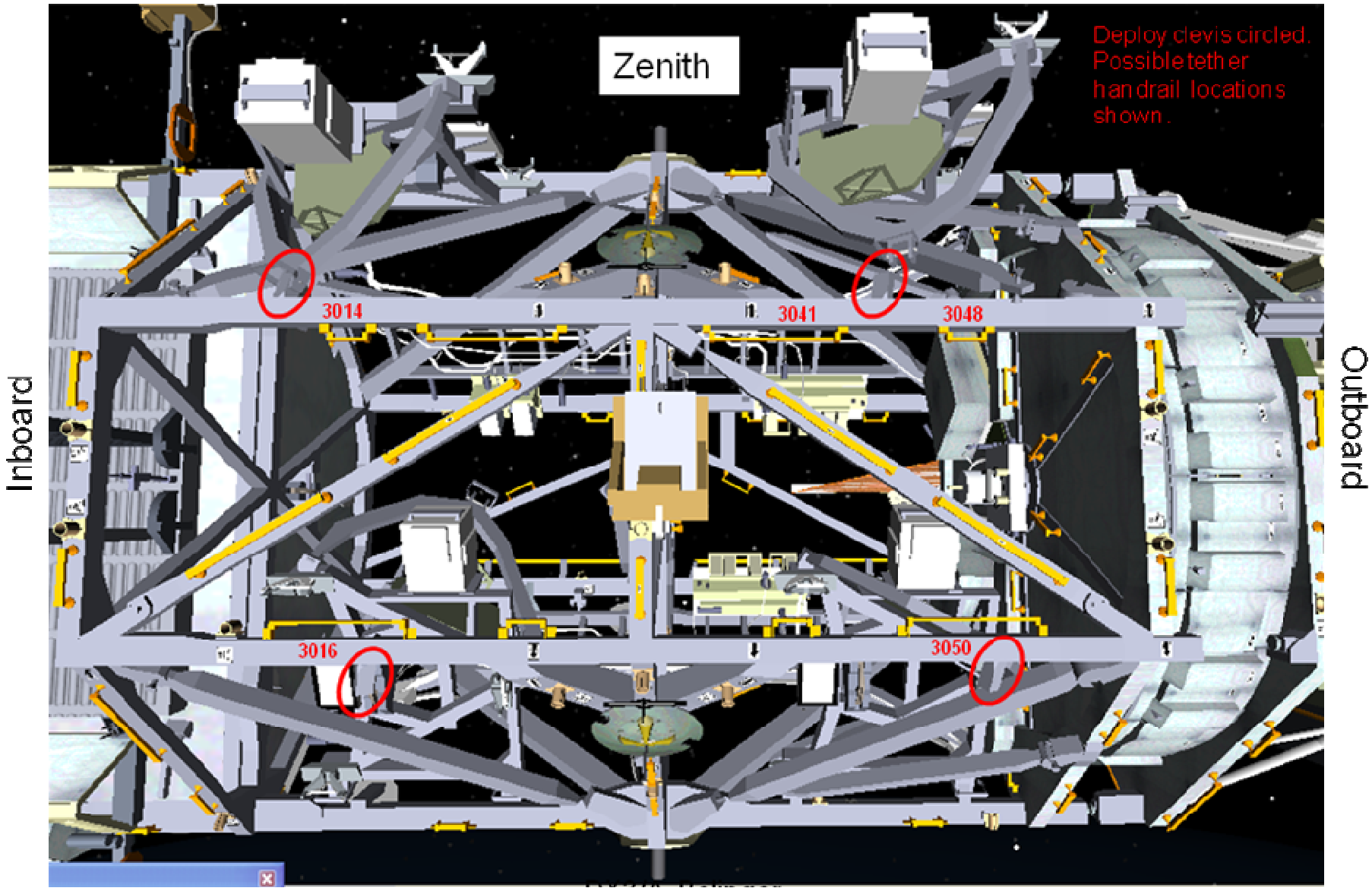
## S3 UPPER OUTBOARD PAS – TASK DATA



**S3 UPPER OUTBOARD PAS – TASK DATA** (Cont)

HINGE LINE ADP ORIENTATION

**S3 UPPER OUTBOARD PAS – TASK DATA** (Cont)



## S3 UPPER OUTBOARD PAS – TASK DATA (Cont)

**Estimated Task Duration:**

| | Without SSRMS |
|---|---|
| One EV Crew | N/A |
| Two EV Crew | 01:30 |

**Tools:**

| EV1 | EV2 |
|---|---|
| PGT | PGT |
| 7/16-6-in socket ext | 7/16-2-in socket ext |
| Crewlock Bag | |
| Lg-sm Adjustable | |

**EVA Fasteners:**

| Fastener Name | Head Size | Qty | Install Torque (ft-lb) | Release Torque (ft-lb) | Failure Torque (ft-lb) | Turns |
|---|---|---|---|---|---|---|
| SARJ Brace Launch Lock Bolt | 7/16 | 1 | 16.0 | 21.5 | 32.3 | 9-13.5 |
| SARJ Brace cup/cone Bolt | 7/16 | 1 | 16.0 | 28.8 | 14.0 and 31.6 | 37-40 |
| Diagonal cup/cone bolt | 7/16 | 1 | 16.0 | 22.7 | 14.0 and 31.6 | 37-40 |
| Stowage Clevis | 7/16 | 4 | 16.0 | 25.5 | 46.7 | 9-16.5 |
| Deploy Clevis | 7/16 | 4 | 30.5 | 25.5 | 106.6 | 7-10.5 |

**Inhibits:**

| Inhibit |
|---|
| Starboard SARJ Locked |
| Starboard TRRJ Locked |
| RPCM S31A A RPC 12 – Open, Close Cmd Inhibit |

**Foot Restraints** (Contingency Yoke Alignment):

| Task | WIF | APFR Setting |
|---|---|---|
| Zenith/Outboard PAS | S3-11 | 5, PP, G, 12 |

**Notes:**

1. UMA EVA Override anti-rotation cap must be removed prior to first use of UMA on PAS
2. EBCS target cover must be removed prior to cargo attachment to PAS. Protects target from MMOD and inadvertent contact. Remove as last activity
3. RAD may be needed for re-install of deployed clevis bracket. It will likely exceed RAD limits and need to be returned for refurb

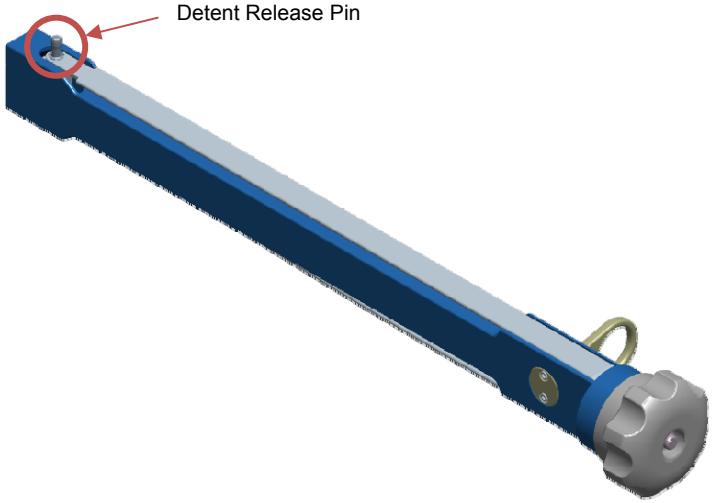
**Cautions**:

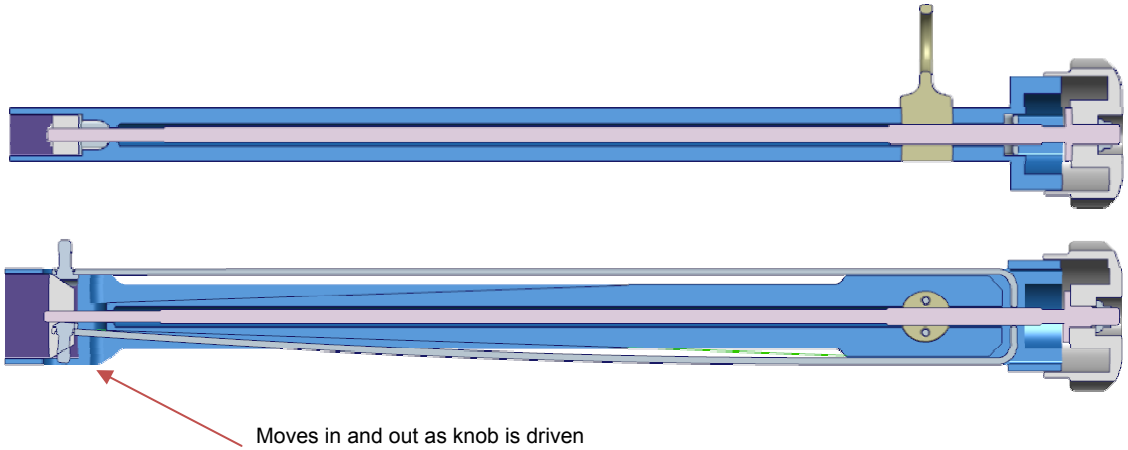
1. Do not lift diagonal brace greater than 7 deg out of rotation plane when rotating to temp stowage location so as to not bend hinge end
2. Do not close ADP lock bracket when ADP is not inserted in a stowage/clevis hole. The pin can fall apart
3. EBCS target has finished surface that is susceptible to damage by contact
4. Do not put platform into detent position

**Warnings**:

## S3 UPPER OUTBOARD PAS – TASK DATA

Detent Release Tool (DRT)





# RATE GYRO ASSEMBLY (RGA) REMOVE AND REPLACE – TASK DATA

**Estimated Task Duration:**

| | With SSRMS | Without SSRMS |
|---|---|---|
| **One EV Crew** | **N/A** | **N/A** |
| **Two EV Crew** | **N/A** | **01:00** |

**ORU Specs:**

| ORU | Part Number | Serial Number | Dimensions (inches) | Mass (lbm) |
|---|---|---|---|---|
| RGA 2 (stbd) | 1F76619-501 | 05 (spare) | 23.5" x 22.1" x 14.3" | 53 lbs |

**Tools:**

| EV1 | EV2 |
|---|---|
| PGT with 6"-Ext-7/16" Wobble Socket<br>BRT<br>Tethers to stow spare and failed RGA<br>Lg ORU bag for RGA transport | PGT with 6" or 2"-Ext-7/16" Socket<br>BRT |

**Foot Restraints:**

| Task | WIF | APFR Setting |
|---|---|---|
| **APFR** | **N/A** | **N/A** |

**Fasteners:**

| Fastener Name | Label | Head Size | Qty | Install Torque (ft-lb) | Release Torque (ft-lb) | Failure Torque (ft-lb) | Turns |
|---|---|---|---|---|---|---|---|
| RGA Bolt | | 7/16" | 4 | 3.8 | 25.5 | 30.7 | 11.8-13.8 |

**EVA Connectors:**

| RGA2 | Harness | Connector | Connector Size | To | Function |
|---|---|---|---|---|---|
| | W4203 | P678 | 11 | J671 | Data |
| | W4110 | P680 | 15 | J673 | Power |

**Notes:**

1. If TA clamps must be opened for RGA 2 connector demate, RET to connectors prior to release, to avoid loss inside the truss

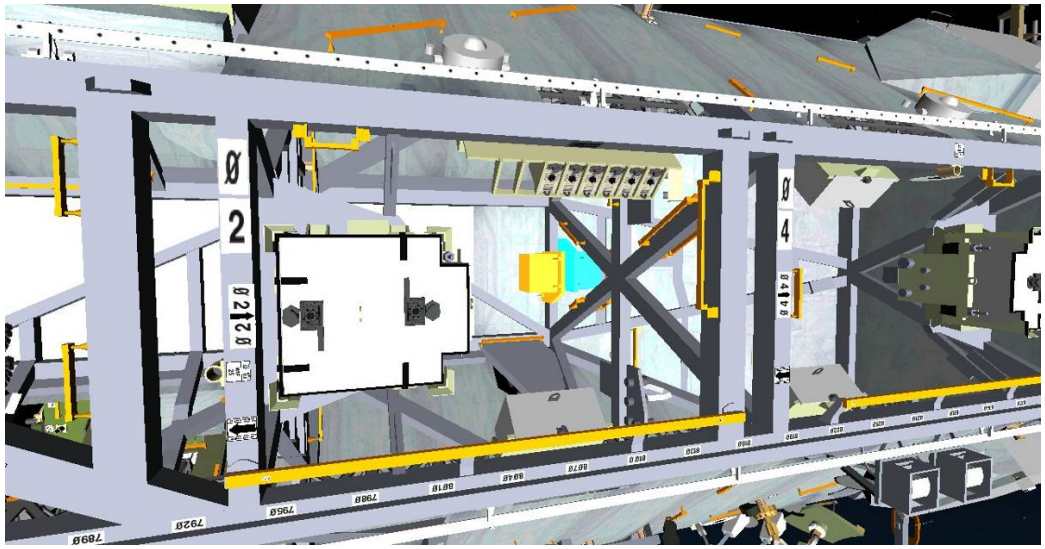
**Cautions:**

1. Avoid inadvertent contact with RGA (Z-93 paint)

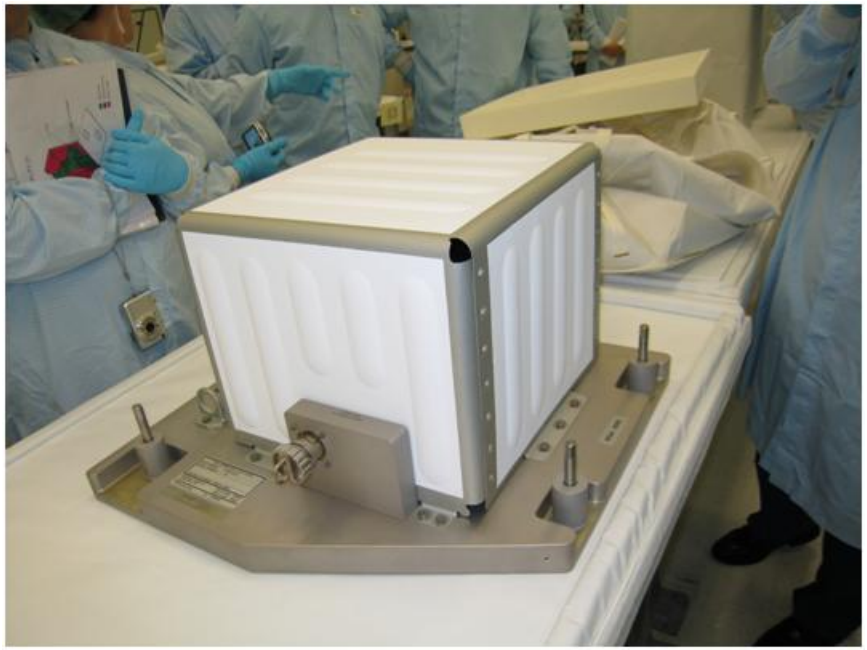
**Warnings:**

1.

## RATE GYRO ASSEMBLY (RGA) REMOVE AND REPLACE – TASK DATA (Cont)



**RGA2 Worksite**



**Spare RGA 2**

# PMA3 HEATER CABLE CONNECT – TASK DATA

**Estimated Task Duration:**

| | With SSRMS | Without SSRMS |
|---|---|---|
| **One EV Crew** | **N/A** | **N/A** |
| **Two EV Crew** | **N/A** | **00:30** |

**ORU Specs:**

| ORU | Dimensions (inches) | Mass (lbm) |
|---|---|---|
| PMA3 Htr Cable | Length ~196" | N/A |

**Tools:**

| EV |
|---|
| Long Wire Ties<br>Short Wire Ties<br>PGT w/6"-Ext-7/16" socket (only required if any of the stanchion brackets or handle bracket is not released) |

**Foot Restraints:**

| Task | WIF | APFR Setting |
|---|---|---|
| **APFR** | **N/A** | **N/A** |

**EVA Connectors**

| Cable | Harness | Connector | Connector Size | To | Function |
|---|---|---|---|---|---|
| PMA3 Htr | W1103 | P602 | 21 | ESP-2 W1 J602 | Shell heaters |
| | W1101 | P608 | 25 | Size 15 Cap | Sec Pwr APCU-2/ N1-RPDA-4B |
| | W1201 | P603 | 15 | Size 17 Cap | 1553 Data-CB-A Video |
| | W1301 | P601 | 17 | Size 25 Cap | Inst-RTDs, GNC Moding |

**Notes:**

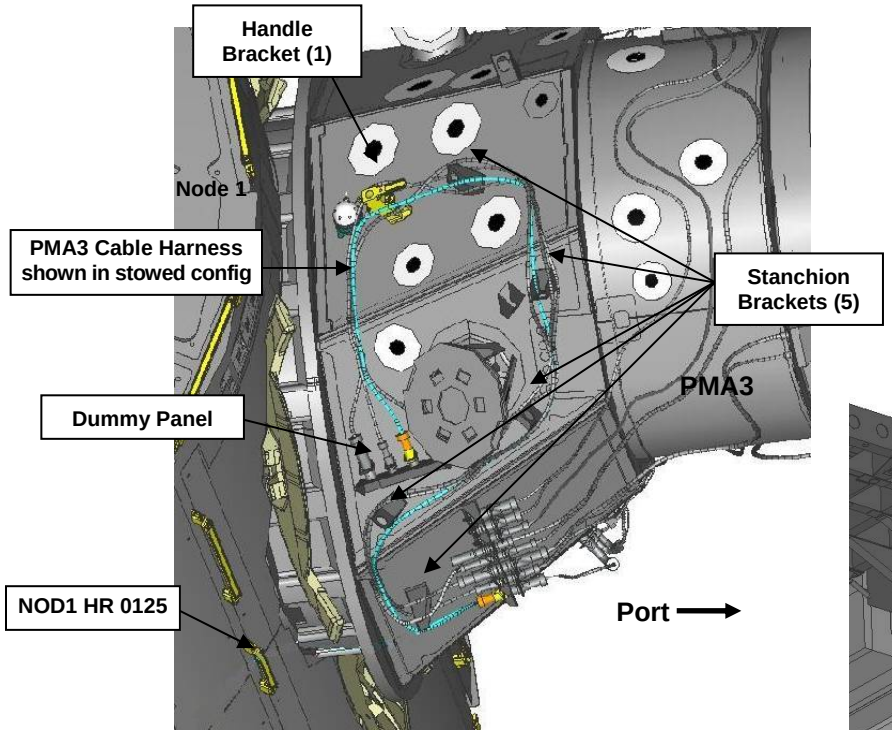
1.

**Cautions:**

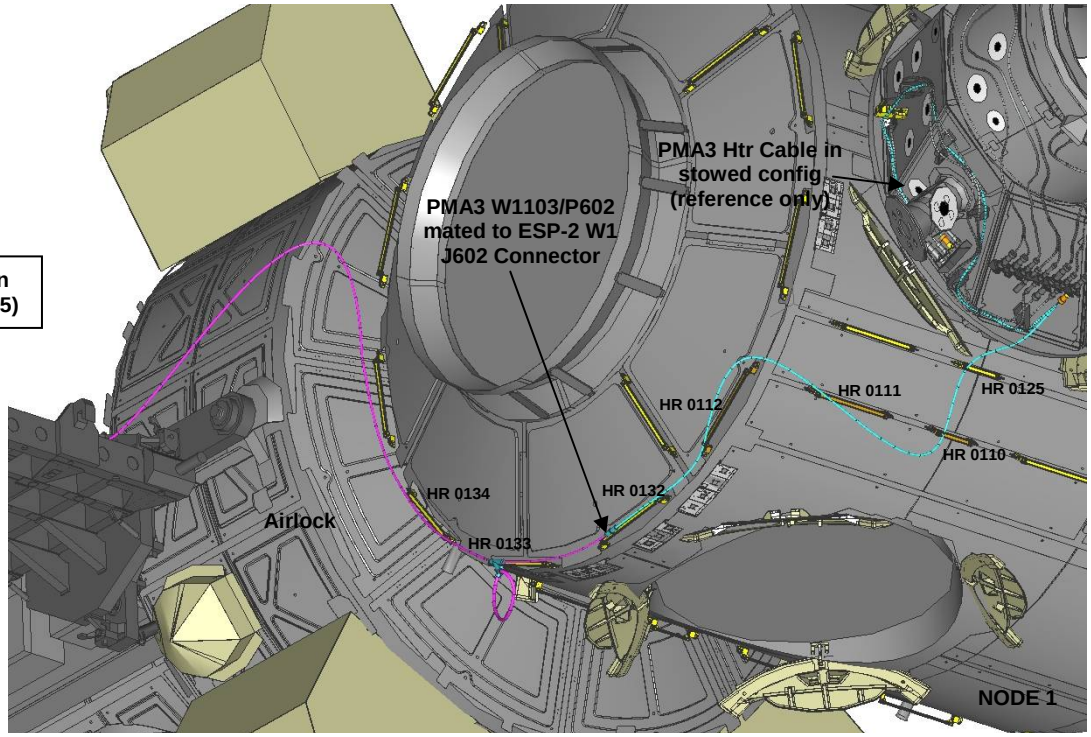
1.

**Warnings:**

## PMA3 HEATER CABLE CONNECT – TASK DATA (Cont)

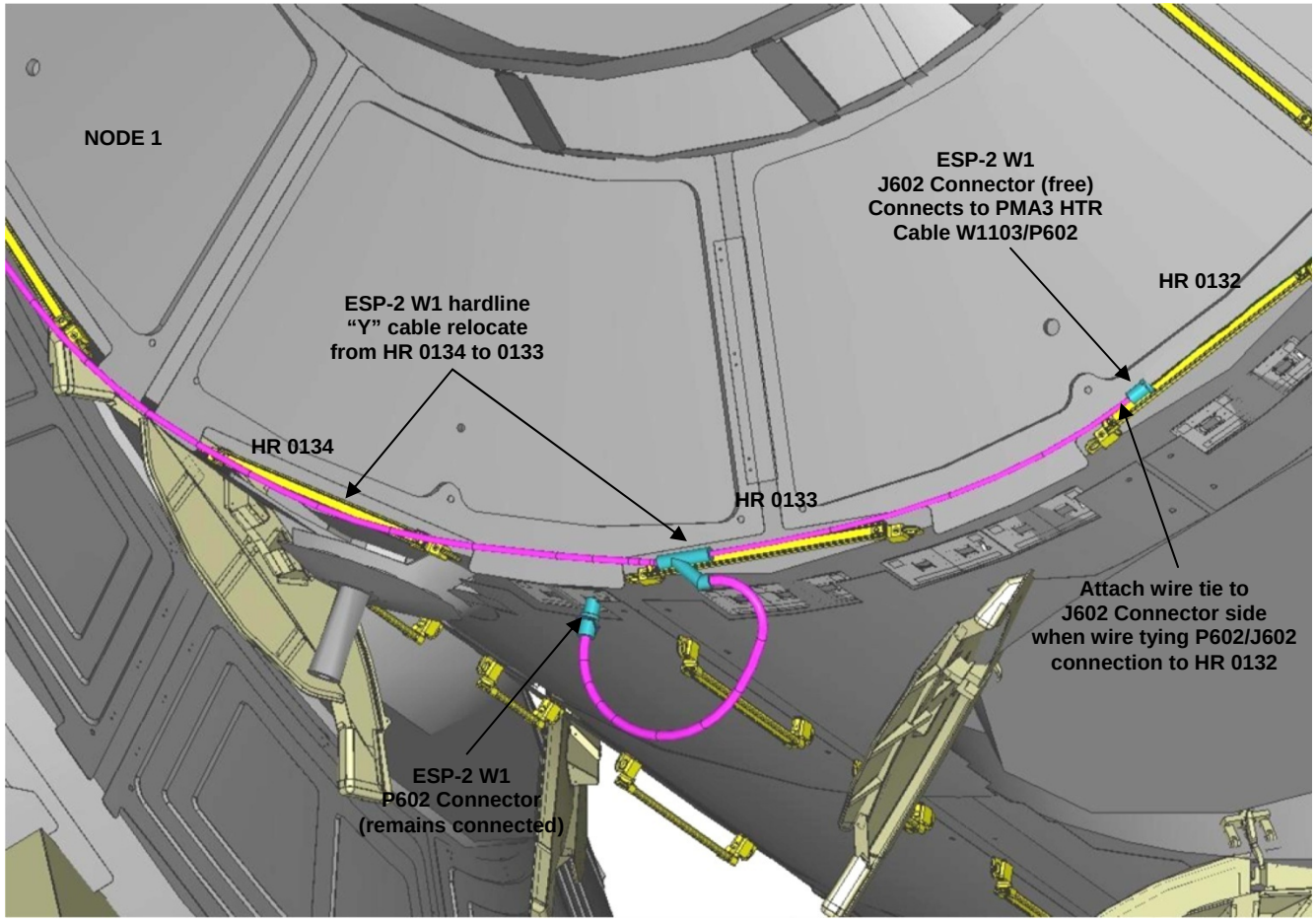



PMA3 HTR Cable in Stowed Config




PMA3 HTR Cable in Routed Config, Mated to ESP-2 W1 J602

## PMA3 HEATER CABLE CONNECT – TASK DATA (Cont)




**ESP-2 W1 Cable in position for mate to PMA3 HTR Cable at NOD1 HR 0132**

# S0_1A_D RPCM REMOVE AND REPLACE – TASK DATA

**Estimated Task Duration:**

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

**ORU Specs:**

| ORU | Part Number | Serial Number | Dimensions (inches) | Mass (lbm) |
|---|---|---|---|---|
| RPCM | R077419-51 (Spare)<br>R077419-61 (Failed) | C235299 (Spare)<br>C024088 (Failed) | 3.5" x 9.1" x 6.9" | 8.95 lbs |

**Tools:**

| EV |
|---|
| PGT w/2" or 6"-Ext-7/16" socket<br>Small ORU bag (or crewlock bag) |

**Foot Restraints:**

| Task | WIF | APFR Setting |
|---|---|---|
| **APFR** | **N/A** | **N/A** |

**Fasteners:**

| Fastener Name | Label | Head Size | Qty | Install Torque (ft-lb) | Release Torque (ft-lb) | Failure Torque (ft-lb) | Turns |
|---|---|---|---|---|---|---|---|
| RPCM Drive Screw | | 7/16" | 1 | 3.8 | 4.5 | 18.6 (Removal)<br>8.5 (Install) | 8 (Removal)<br>6-7 (Install) |

**Notes:**

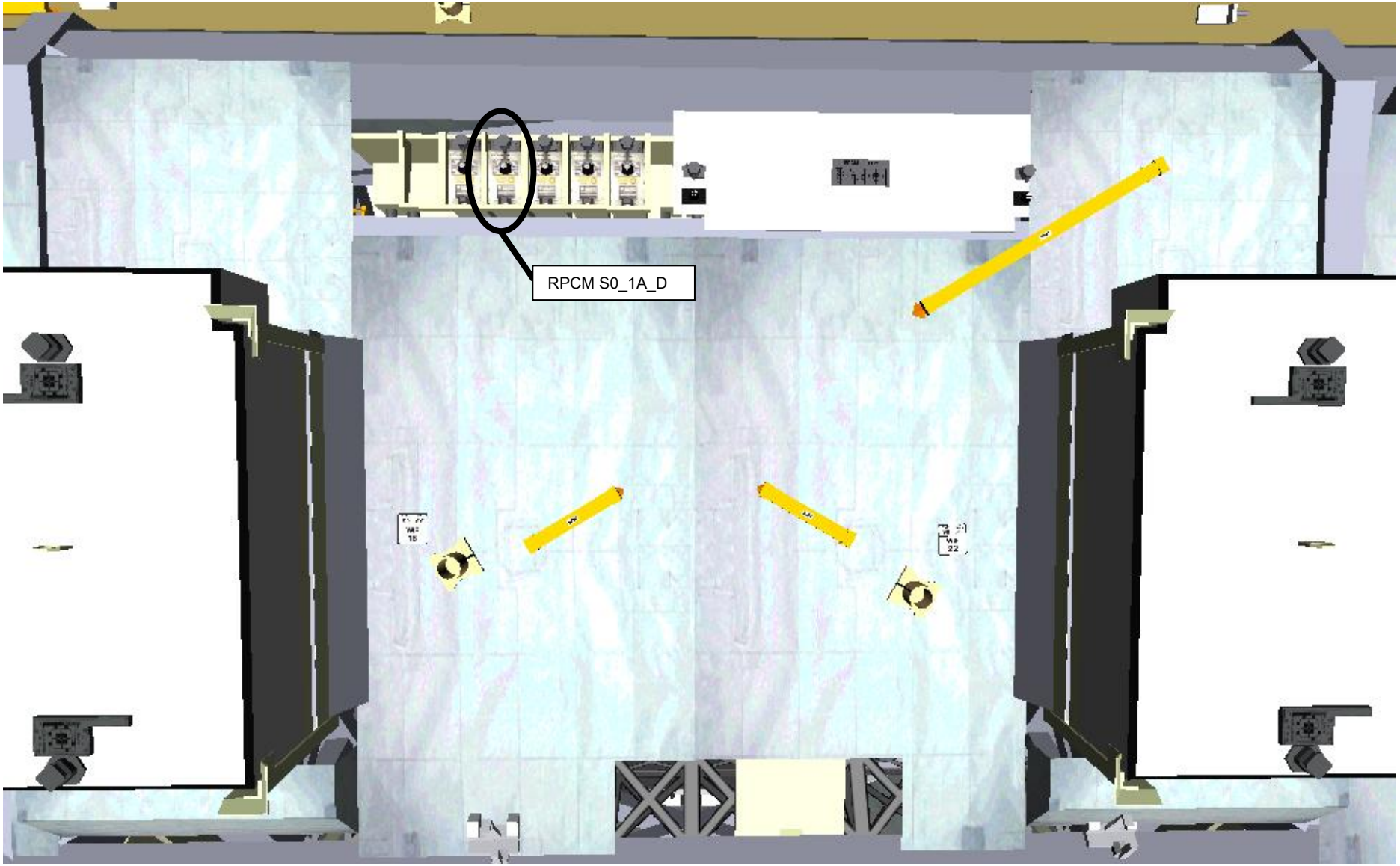
1. The round scoop is removed for bolt driving operations to allow for visual verification of socket engagement on the drive screw
2. Installation of tether on RPCM tether point must be oriented such that the hook is facing the body of the RPCM. Otherwise interference between the SPDA frame and the RPCM will not allow hook removal

**Cautions:**

1. Failure to use wobble socket, or socket with equivalent outer diameter, to release lock springs can result in damage to the RPCM Drive Screw Assembly
2. Do not operate drive screw with scoop attached to microconical. The wobble socket feature will not extend thru the round scoop
3. Failure to align and fully seat socket until lock springs have released can result in damage to RPCM Drive Screw Assembly
4. Combined linear and rotational motion on the socket while inserting, can result in damage to RPCM Drive Screw Assembly
5. If worksite is left unattended at any time with just Bolt 7 and the tether tie down, the tether must be cinched snug

**Warnings:**

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




**RPCM S0_1A_D Location (S0 Face 2)**

**Proper Tether Hook Installation Orientation**

**Incorrect Tether Hook Installation Orientation**

# NOD3 CH 1/4 AND 2/3 AVIONICS CABLE – TASK DATA (Cont)

**Estimated Task Duration:**

| | With SSRMS | Without SSRMS |
|---|---|---|
| **One EV Crew** | **N/A** | **N/A** |
| **Two EV Crew** | **N/A** | **01:00 per cable** |

**ORU Specs:**

| ORU | Part Number | Dimensions (inches) | Mass (lbm) |
|---|---|---|---|
| Ch 1/4 Cable | 684-014123-0001 | ~675" (29" x 17" x 15.8" bagged) | 60.5 lbs |
| Ch 2/3 Cable | 684-014125-0001 | ~710" (29" x 17" x15.8" bagged) | 60.5 lbs |

**Tools:**

| EV1 | EV2 |
|---|---|
| Long Wire Ties<br>Short Wire Ties<br>Lg Trash Bag (to stow S0 Panel A145 caps) | Long Wire Ties<br>Short Wire Ties |

**Foot Restraints:**

| Task | WIF | APFR Setting |
|---|---|---|
| **APFR** | **N/A** | **N/A** |

**EVA Connectors**

| S0-NOD3 Av Cable | Harness | Connector | Connector Size | S0 Panel A145 Connector | Function |
|---|---|---|---|---|---|
| Ch 2/3 | W9026 | P209 | 25L | J209 | Pri 2B Power |
| Ch 2/3 | W9026 | P188 | 25L | J188 | Pri 2A Power |
| Ch 2/3 | W9026 | P190 | 17 | J190 | Sec 2B Power |
| Ch 2/3 | W9324 | P192 | 13 | J192 | LT-B HX Instr |
| Ch 1/4 | W9025 | P208 | 25L | J208 | Pri 1B Power |
| Ch 1/4 | W9025 | P181 | 25L | J181 | Pri 4A Power |
| Ch 1/4 | W9025 | P183 | 17 | J183 | Sec 1B Power |
| Ch 1/4 | W9323 | P185 | 13 | J185 | MT-A HX Instr |

**Notes:**

1. Initially attach wire ties to handrails in a loose config to allow for NOD3 Ch 2/3 Avionics Cable slack adjustment during cleanup
2. Remain clear of PMA3 FRGF (PMA3 mated to NOD1 Port CBM)
3. For NOD3 Ch 1/4 Avionics Cable, begin routing cable after EV1 has biased all slack to LAB HR 0229. Attach wire ties to handrails in a final config

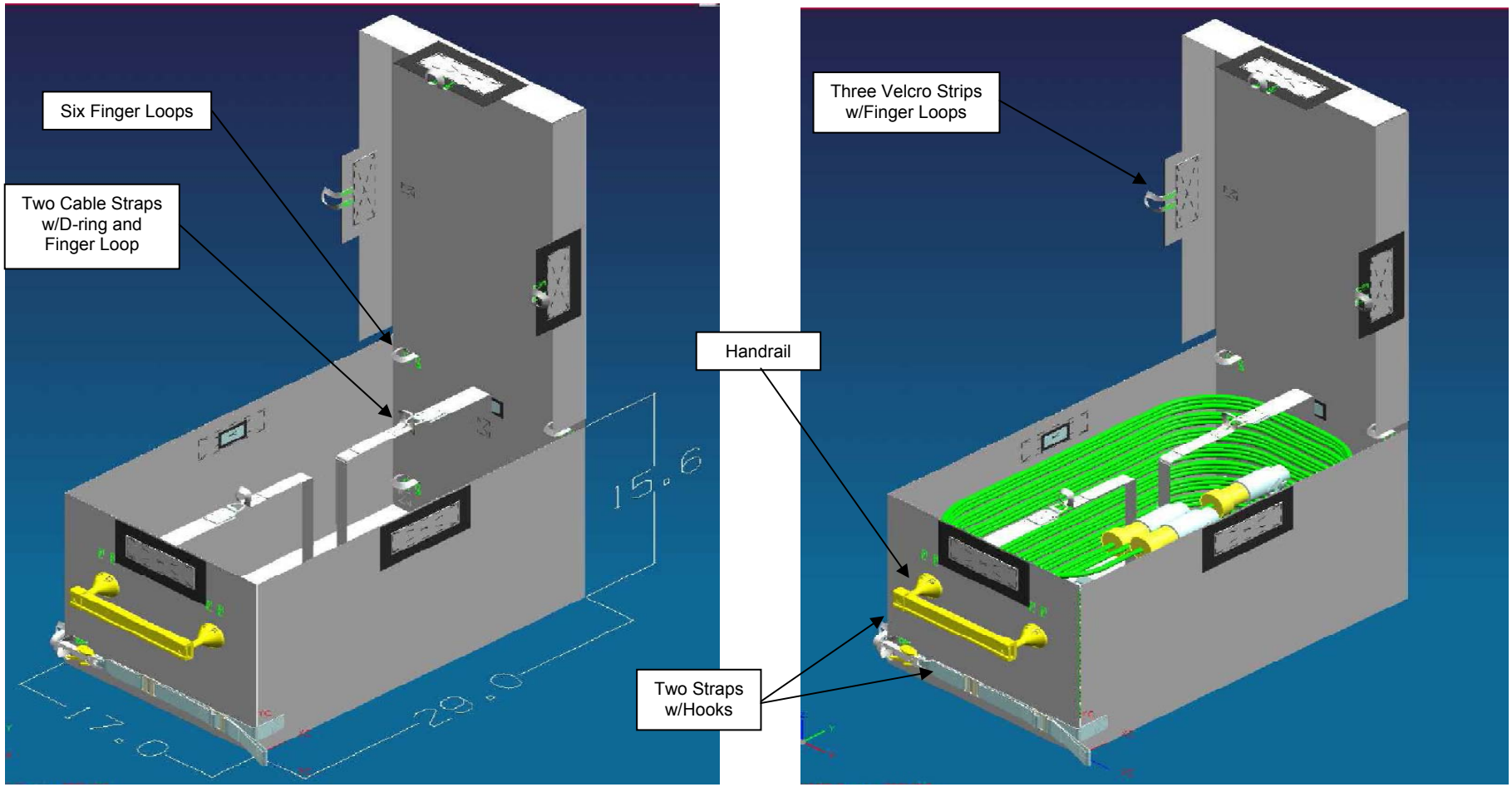
**Cautions:**

1. Avoid pulling on electrical cables. Avoid bent radii less than 10 times the cable diameter

**Warnings:**

1. Verify electrical inhibits for S0 Panel A145 in place prior to electrical mate/demate

## NOD3 CH 1/4 AND 2/3 AVIONICS CABLE – TASK DATA (Cont)




**NOD3 Avionics Cable Bag**

# NOD1 SLIDEWIRE REMOVAL – TASK DATA (Cont)

Estimated Task Duration:

| | With SSRMS | Without SSRMS |
|---|---|---|
| **One EV Crew** | **N/A** | **00:25** |
| **Two EV Crew** | **N/A** | **N/A** |

**ORU Specs:**

| ORU | Part Number | Serial Number | Dimensions (in) | Mass (lbm) |
|---|---|---|---|---|
| NOD1 Slidewire | SEG33106344-301 | N/A | 156" x 3.2" x 6.3" | 6.1 lbs |

**Tools:**

| EV |
|---|
| PGT w/2" or 6"-Ext-7/16" socket<br>ORU bag (or crewlock bag) |

**EVA Fasteners:**

| Fastener Name | Head Size | Qty | Install Torque (ft-lb) | Release Torque (ft-lb) | Failure Torque (ft-lb) | Turns |
|---|---|---|---|---|---|---|
| Slidewire Stanchion Bolt | 7/16 | 2 | N/A | 6.3 | N/A | NR |

**EVA Connectors**:
None

**Foot Restraints:**

| Task | WIF | APFR Setting |
|---|---|---|
| **APFR** | **N/A** | **N/A** |

**ORU Mass:**

**Cautions:**

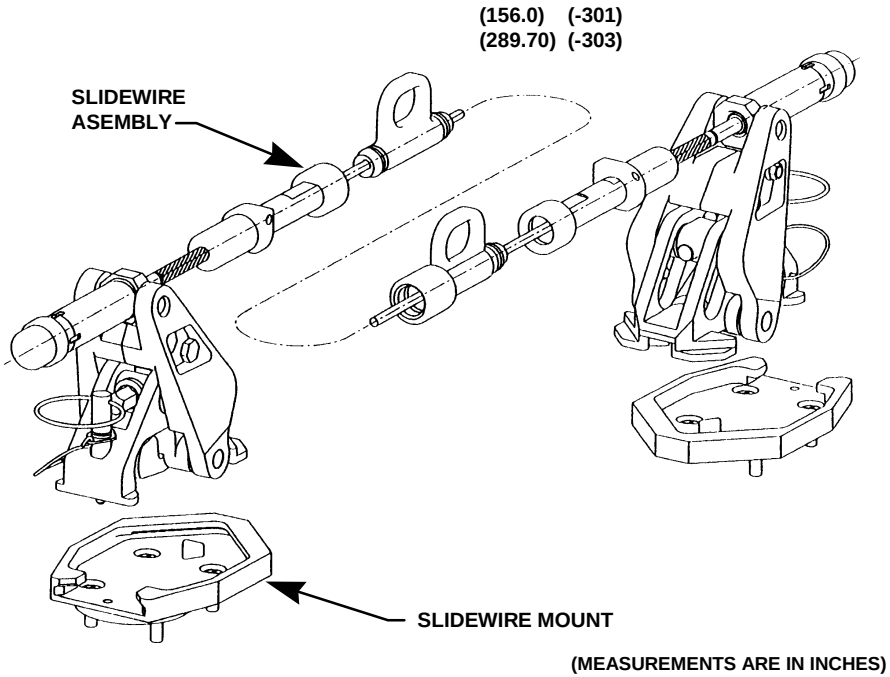
1. Slidewire is damaged and could present a sharp edge. Caution should be taken to not touch nicked areas

**Warnings:**

**Notes:**

## NOD1 SLIDEWIRE REMOVAL – TASK DATA (Cont)

**Slidewire with mounting brackets shown**
**(NOTE: Mounting brackets remain attached to NOD1)**




**Slidewire Schematic (NOD1 is -301 model)**

## TIMELINE GET-AHEADS – STS-128

| EVA Get-ahead Task (Order indicates priority) | Duration | EVA to Perform Task |
|---|---|---|
| RGA Remove and Replace (FS 7-117) | 01:00 | EVA 2 |
| PMA3 Heater Cable (FS 7-122) | 00:45 | EVA 1, 2 |
| APFR 4/TS Relocation (FS 7-126) | 00:15 | EVA 1, 2 |
| CLA Cover Installation, SSRMS LEE (FS 7-127) | 00:15 | EVA 1, 2, 3 |
| CLPA Cover Installation, SSRMS Elbow (FS 7-127) | 00:20 | EVA 2, 3 |
| APFR 2 Relocation for ULF-3 (FS 7-129) | 00:15 | EVA 2, 3 |
| FGB NOD-LAN Cable (FS 7-130) | 00:45 | EVA 1, 2, 3 |
| GPS Antenna Installation (FS 7-136) | 00:45 for 1 antenna<br>01:00 for both | EVA 3 |
| A/L Handrail Wire Tie Installation (FS 7-140) | 00:10 | EVA 1, 2, 3 |
| PMA2 Stbd SSPTS Connector Insulating Sleeve Install (FS 7-140) | 00:20 | EVA 2 |
| MT/MBS Connector Insulating Sleeve Install (FS 7-144) | 00:15 | EVA 3 |

## RGA 2 REMOVE AND REPLACE (01:00)

| IV | EV1 (Ol) | EV2 (Fg) |
|---|---|---|
| **MCC-H**<br>1. √RPCM S02B_E RPC 4 – Open, Close Cmd Inh | RGA SETUP (00:15)<br>1. Translate to A/L<br>2. Perform cleanup as reqd before beginning RGA R&R<br>3. Receive Lg ORU bag; stow on BRT<br>4. Translate to S0 port wedge face via S0 aft route; fairlead as reqd<br>5. Temp stow spare RGA on S0 Face 3 HAB Cable Tray using integrated lid tethers (2), and to S0 HR 3519 using adj equipment tethers (2)<br>6. Attach RET to S0 HR 3541 for failed RGA 2 temp stow | RGA SETUP (00:15)<br>1. Translate to A/L<br>2. Open thermal cover<br>3. Ingress Crewlock<br>4. Perform cleanup as reqd before beginning RGA R&R<br>5. Transfer Lg ORU bag to EV1; attach Lg/Sm RET to A/L D-ring extender<br>6. Egress A/L and close thermal cover<br>7. √SAFER MAN ISOL vlv – OP (dn) and HCM (dn)<br>8. Set fairlead (P) around Stbd Toolbox WIF (to keep EV1 translation path clear)<br>9. Translate to S0, Face 1, Bay 00 via CETA spur route<br>10. Inspect gloves |
| | CAUTION<br>Avoid inadvertent contact with RGA (Z-93 paint) | |
| | RGA REMOVE AND REPLACE (00:45)<br>7. Open thermal shroud for RGA 2 (stbd shroud)<br>8. BRT to S0 HR 3520 for RGA removal operations<br><br>NOTE<br>If TA clamps must be opened for RGA 2 connector demate, RET to connectors prior to release, to avoid loss inside the truss<br><br>9. Demate connectors from RGA 2 as follows:<br>☐ W4203/P678 from J671<br>☐ W4110/P680 from J673<br><br>10. Restrain connectors clear of worksite | RGA REMOVE AND REPLACE (00:45)<br>11. Ingress S0 truss through Face 1 at Bay 02 to access RGA 2 (stbd RGA) inner bolts<br><br>12. BRT to S0 HR 3507 for RGA bolt operations |

## RGA 2 REMOVE AND REPLACE (01:00) (Cont)

| IV | EV1 (Ol) | EV2 (Fg) |
|---|---|---|
| | 11. **PGT: B7/CCW2/30.5**<br>(25.5 ft-lb, 30 RPM)<br>6" -Ext-7/16" | 13. **PGT: B7/CCW2/30.5**<br>(25.5 ft-lb, 30 RPM)<br>2" -Ext-7/16" |
| | 12. Release RGA outer bolts (2), 12-14 turns (bolt pops up when fully released)<br>☐ Zenith bolt<br>☐ Nadir bolt | |
| | 13. Attach long waist tether to S0 HR 3520; release BRT<br>14. Attach RET from HR 3541 to RGA 2<br>15. Give EV2 GO to release RGA 2 inner bolts | |
| | | 14. On EV1 GO, release RGA 2 inner bolts (2), 12-14 turns (bolt pops up when fully released)<br>☐ Zenith bolt<br>☐ Nadir bolt |
| | 16. Using RGA baseplate handhold, remove failed RGA and temp stow on S0 HR 3541<br>17. Retrieve spare RGA from Lg ORU bag; install on guide rails | |
| | 18. **PGT: A2/CW2/30.5**<br>(3.8 ft-lb, 30 RPM)<br>6" -Ext-7/16" | 15. **PGT: A2/CW2/30.5**<br>(3.8 ft-lb, 30 RPM)<br>2" -Ext-7/16" |
| 2. RGA 2 Installation Bolt Data: | 19. Give EV2 GO to drive spare RGA 2 inner bolts | |
| | | 16. On EV1 GO, drive spare RGA 2 inner bolts (2), 12-14 turns to a hardstop<br>☐ Zenith bolt<br>☐ Nadir bolt |
| | 20. Drive spare RGA 2 outer bolts (2), 12-14 turns to a hardstop<br>☐ Zenith bolt<br>☐ Nadir bolt | 17. Release BRT; egress S0 truss through Face 1<br>18. √SAFER MAN ISOL vlv – OP (dn) and HCM (dn) |
| | 21. Release RET from spare RGA 2<br>22. Remove connector caps (2) from spare RGA 2 and temp stow on MWS | 19. Inspect gloves<br>20. Translate to A/L |

| Bolt | Torque (ft-lb) | Turns |
|---|---|---|
| Inner Zenith | | |
| Inner Nadir | | |
| Outer Zenith | | |
| Outer Nadir | | |

## RGA 2 REMOVE AND REPLACE (01:00) (Cont)

| IV | EV1 (Ol) | EV2 (Fg) |
|---|---|---|
| 3. Notify MCC when connectors mated | 23. Mate connectors to spare RGA 2 as follows:<br>☐ W4203/P678 to J671<br>☐ W4110/P680 to J673<br><br>24. Close TA clamps as reqd and remove RET<br>25. ☞ Perform WVS survey<br><br>26. Close thermal shroud for RGA 2<br>27. ☞ Perform WVS survey<br><br>28. Retrieve failed RGA and RET from S0 HR 3541<br>29. Install connector caps on failed RGA<br>30. Stow failed RGA in Lg ORU bag; stow Lg ORU bag on BRT<br><br>31. Inspect gloves<br><br>32. Translate to A/L; retrieve fairleads as reqd<br>33. Open thermal cover<br>34. Stow Lg ORU bag containing failed RGA in A/L using Lg/Sm RET | |

# RGA REMOVE AND REPLACE – TASK DATA

**Estimated Task Duration:**

| | With SSRMS | Without SSRMS |
|---|---|---|
| **One EV Crew** | **N/A** | **N/A** |
| **Two EV Crew** | **N/A** | **01:00** |

**ORU Specs:**

| ORU | Part Number | Serial Number | Dimensions (inches) | Mass (lbm) |
|---|---|---|---|---|
| RGA 2 (stbd) | 1F76619-501 | 05 (spare) | 23.5" x 22.1" x 14.3" | 53 lbs |

**Tools:**

| EV1 | EV2 |
|---|---|
| PGT with 6"-Ext-7/16" Wobble Socket<br>BRT<br>Tethers to stow spare and failed RGA<br>Lg ORU bag for RGA transport | PGT with 6" or 2"-Ext-7/16" Socket<br>BRT |

**Foot Restraints:**

| Task | WIF | APFR Setting |
|---|---|---|
| **APFR** | **N/A** | **N/A** |

**Fasteners:**

| Fastener Name | Label | Head Size | Qty | Install Torque (ft-lb) | Release Torque (ft-lb) | Failure Torque (ft-lb) | Turns |
|---|---|---|---|---|---|---|---|
| RGA Bolt | | 7/16" | 4 | 3.8 | 25.5 | 30.7 | 11.8-13.8 |

**EVA Connectors:**

| RGA2 | Harness | Connector | Connector Size | To | Function |
|---|---|---|---|---|---|
| | W4203 | P678 | 11 | J671 | Data |
| | W4110 | P680 | 15 | J673 | Power |

**Notes:**

1. If TA clamps must be opened for RGA 2 connector demate, RET to connectors prior to release, to avoid loss inside the truss

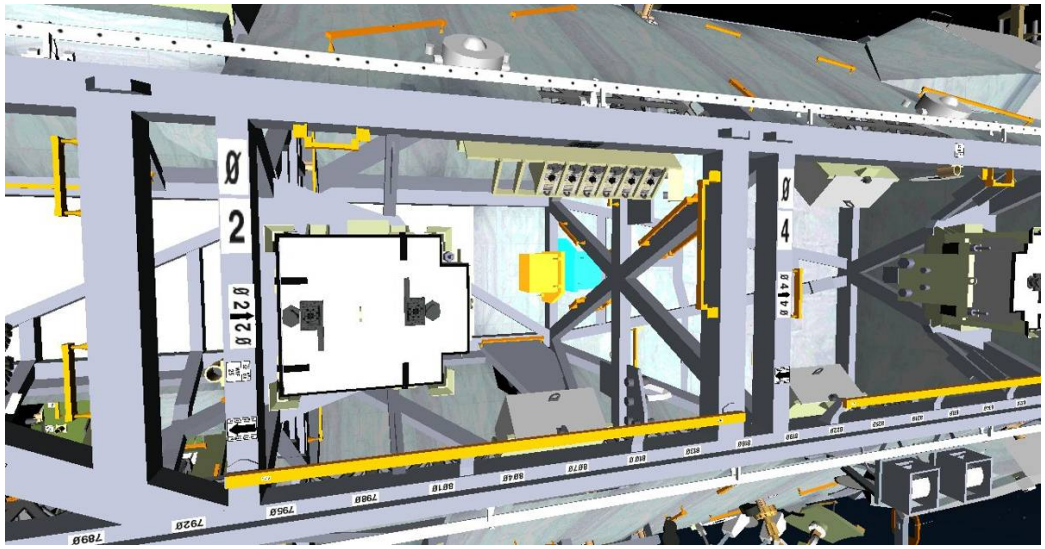
**Cautions:**

1. Avoid inadvertent contact with RGA (Z-93 paint)

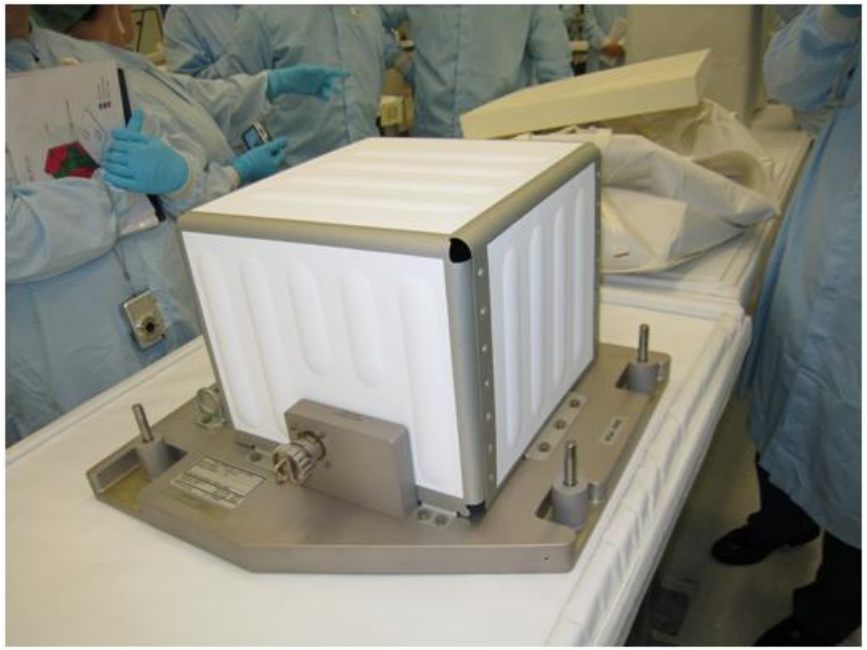
**Warnings:**

1.

## RGA REMOVE AND REPLACE – TASK DATA (Cont)

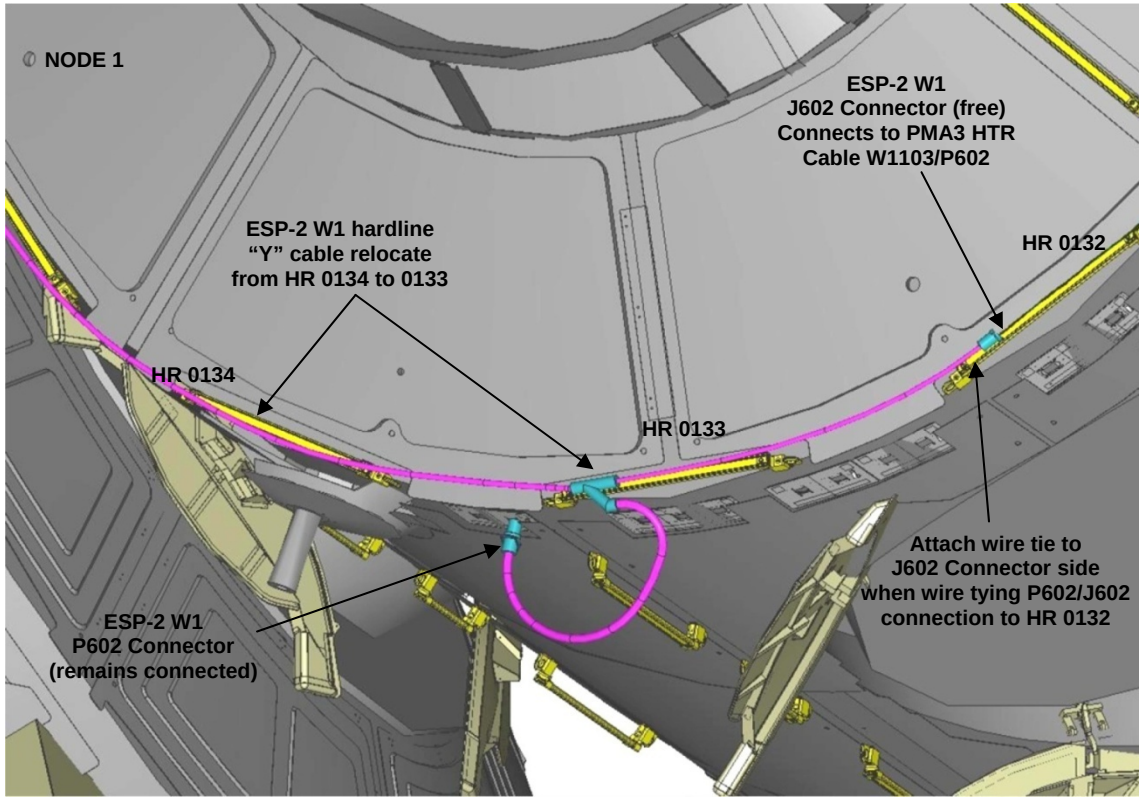


**RGA 2 Worksite**

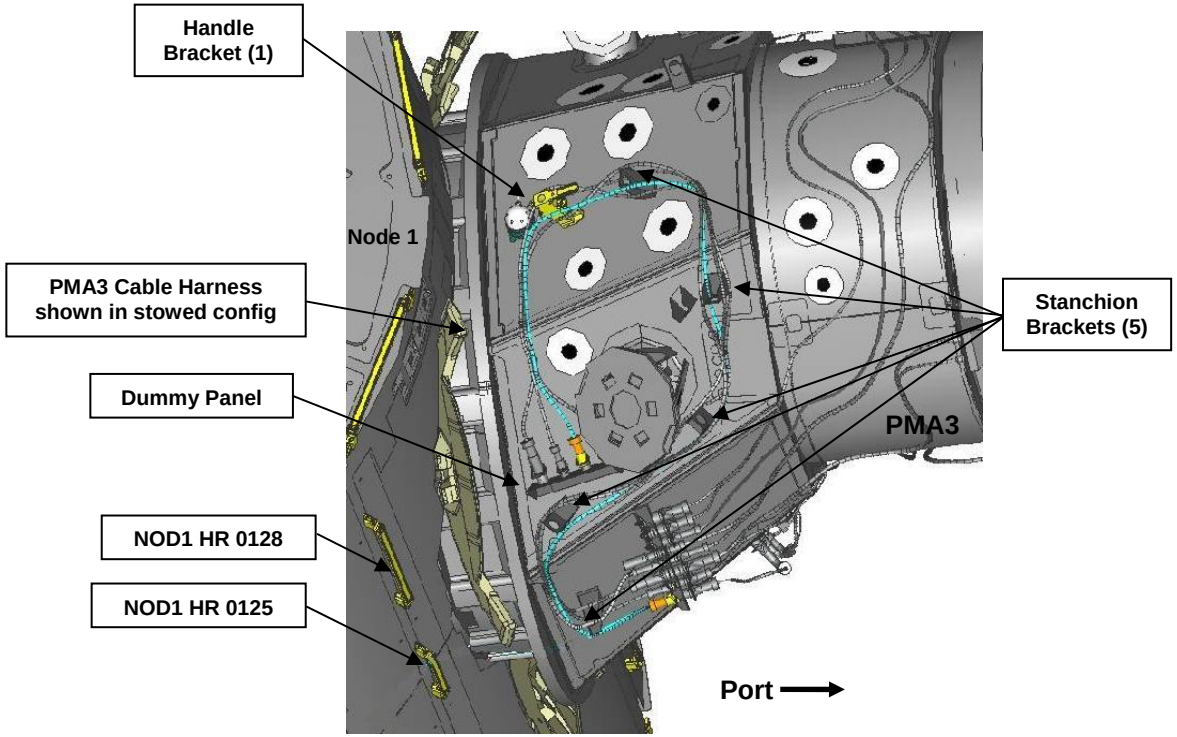


**Spare RGA 2**

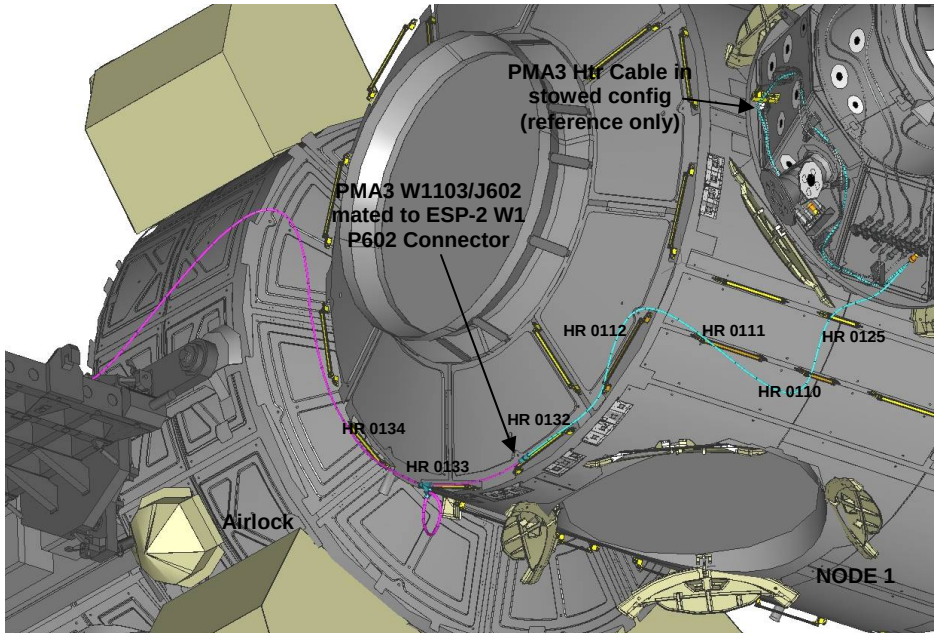
## PMA3 HEATER CABLE CONNECT (00:45)

| IV | EV1 (OI) |
|---|---|
| **MCC-H**<br>1. √RPCM N1RS2_B RPCs 1-5, 12-15, Open, Close Cmd Inh | <u>NOTE</u><br>Remain clear of PMA3 FRGF<br><br><u>ESP-2 CABLE REROUTE</u> (00:10)<br>1. Translate to A/L; retrieve PMA3 crewlock bag and stow on BRT<br>2. Translate to NOD1 HR 0134 (nadir/stbd side of NOD1)<br>3. Retrieve wire tie caddy from PMA3 crewlock bag; stow on MWS<br>4. Release ESP-2 W1 hardline "Y" cable from NOD1 HR 0134<br>5. Relocate ESP-2 W1 hardline "Y" cable one handrail port, to NOD1 HR 0133; wire tie in place<br><br>  <br> |

## PMA3 HEATER CABLE CONNECT (00:45) (Cont)

| IV | EV1 (OI) |
|---|---|
| | PMA3 HTR CABLE DISCONNECT FROM PMA3 (00:10)<br>6. Translate to nadir side of PMA3<br>7. Release all TA clamps, beginning with clamp closest to NOD1 HR 0125 (heater cable coils around PMA3 grapple shaft)<br>8. Release PMA3 heater cable connectors (4) from dummy panel (any order)<br>9. Attach MWS EE to handle bracket (bracket closest to dummy panel); release bracket from soft dock<br>  |

## PMA3 HEATER CABLE CONNECT (00:45) (Cont)

| IV | EV1 (OI) |
|---|---|
| | PMA3 HTR CABLE CONNECT TO ESP-2 W1 CABLE (00:25)<br>10. Translate to NOD1 HR 0133, wire tying PMA3 heater cable to:<br>☐ NOD1 HR 0125<br>☐ NOD1 HR 0110<br>☐ NOD1 HR 0111<br>☐ NOD1 HR 0112<br>11. Mate PMA3 heater cable W1103/P602 to ESP-2 W1 J602<br>12. Wire tie connector to NOD1 HR 0132 (attach wire tie between HR and J602 side of connector)<br>13. Retrieve connector caps (3) from PMA3 crewlock bag; install on unmated PMA3 cable connectors<br>14. Bundle unmated PMA3 heater cable connectors (3) together and wire tie to NOD1 HR 0132<br>15. Stow wire tie caddy in PMA3 crewlock bag<br>16. Perform WVS survey<br>17. Inspect gloves<br>  |

# PMA3 HEATER CABLE CONNECT – TASK DATA

**Estimated Task Duration:**

| | With SSRMS | Without SSRMS |
|---|---|---|
| **One EV Crew** | **N/A** | **N/A** |
| **Two EV Crew** | **N/A** | **00:30** |

**ORU Specs:**

| ORU | Dimensions (inches) | Mass (lbm) |
|---|---|---|
| PMA3 Htr Cable | Length ~196" | N/A |

**Tools:**

| EV |
|---|
| Long Wire Ties<br>Short Wire Ties<br>PGT w/6"-Ext-7/16" socket (only required if any of the stanchion brackets or handle bracket is not released) |

**Foot Restraints:**

| Task | WIF | APFR Setting |
|---|---|---|
| **APFR** | **N/A** | **N/A** |

**EVA Connectors**

| Cable | Harness | Connector | Connector Size | To | Function |
|---|---|---|---|---|---|
| PMA3 Htr | W1103 | P602 | 21 | ESP-2 W1 J602 | Shell heaters |
| | W1101 | P608 | 25 | Size 15 Cap | Sec Pwr APCU-2/ N1-RPDA-4B |
| | W1201 | P603 | 15 | Size 17 Cap | 1553 Data-CB-A Video |
| | W1301 | P601 | 17 | Size 25 Cap | Inst-RTDs, GNC Moding |

**Notes:**

1.

**Cautions:**

1.

**Warnings:**

## APFR 4/TS RELOCATION (00:15)

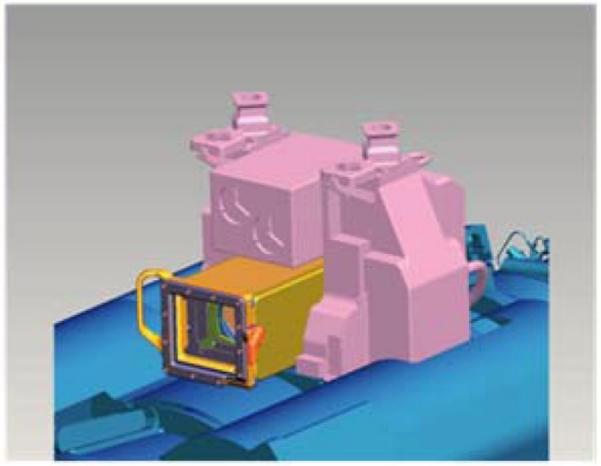
| IV (SSRMS) | EV1 (OI) |
|---|---|
| | <u>APFR 4/TS RELOCATION FOR NOD3 AVIONICS CABLE INSTALL</u> (00:15)<br>1. Translate to APFR in Z1 WIF 08 (near fwd/port corner of Z1)<br>2. RET to APFR and remove from Z1 WIF 08<br><br>3. Relocate APFR to Z1 WIF 10 (just zenith/port of Z1 WIF 08)<br>4. Install APFR in Z1 WIF 10 [3,PP,B,6 ] – Tool stanchion should point zenith<br>☐ Verify Black on Black<br>☐ Perform pull test |

## CLA AND CLPA COVER INSTALL

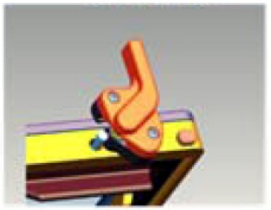
| IV (SSRMS) | EV ( ) |
|---|---|
| IV:<br>1. If EV crew less than 10 ft from LAB window or in window FOV, close window shutter | CLA COVER INSTALLATION, SSRMS LEE (00:15)<br><br>CAUTION<br>Avoid contact with CLA cover lens<br><br>1. Translate to NOD2 PDGF (along port/nadir translation path); fairlead as reqd<br>2. Retrieve CLA cover from crewlock bag; MLI case remains in crewlock bag<br>3. Rotate locking lever to the open/unlocked position (lever perpendicular to plane of lens)<br>4. Install CLA cover on SSRMS CLA by inserting spring loaded flange to depress spring<br>5. Rotate cover to seat against camera bracket for full installation<br>6. Rotate locking lever to the closed/locked position (lever parallel to plane of lens)<br>7. Perform pull test<br>8. Remove RET<br>9. Perform WVS survey<br><br>CLPA COVER INSTALLATION, SSRMS ELBOW (00:20)<br><br>CAUTION<br>Avoid contact with CLPA cover lens<br><br>1. Translate to LAB HR 0254 (along port/nadir translation path); fairlead as reqd<br>2. Retrieve CLPA cover from crewlock bag; MLI case remains in crewlock bag<br>3. Rotate locking lever to the open/unlocked position (lever perpendicular to plane of lens)<br>4. Install CLPA cover on SSRMS CLPA by inserting spring loaded flange to depress spring<br>5. Rotate cover to seat against camera bracket for full installation<br>6. Rotate locking lever to the closed/locked position (lever parallel to plane of lens)<br>7. Perform pull test<br>8. Remove RET<br>9. Perform WVS survey |

## CLA AND CLPA COVER INSTALL – TASK DATA

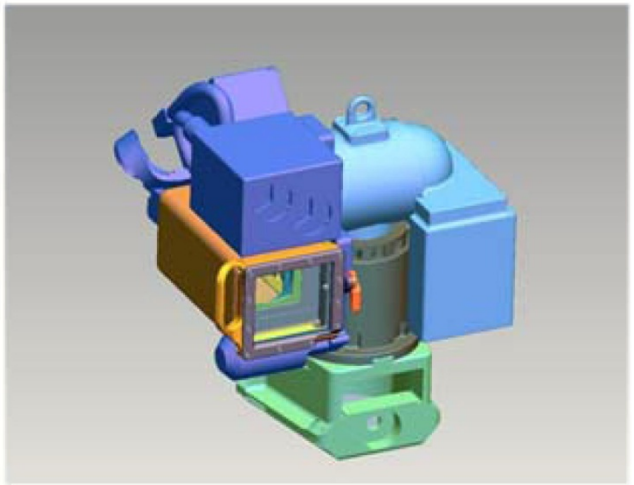
CLA Cover
(Shown in Unlocked Position)



Cover on CLA



Latch Pin



Cover on CLPA

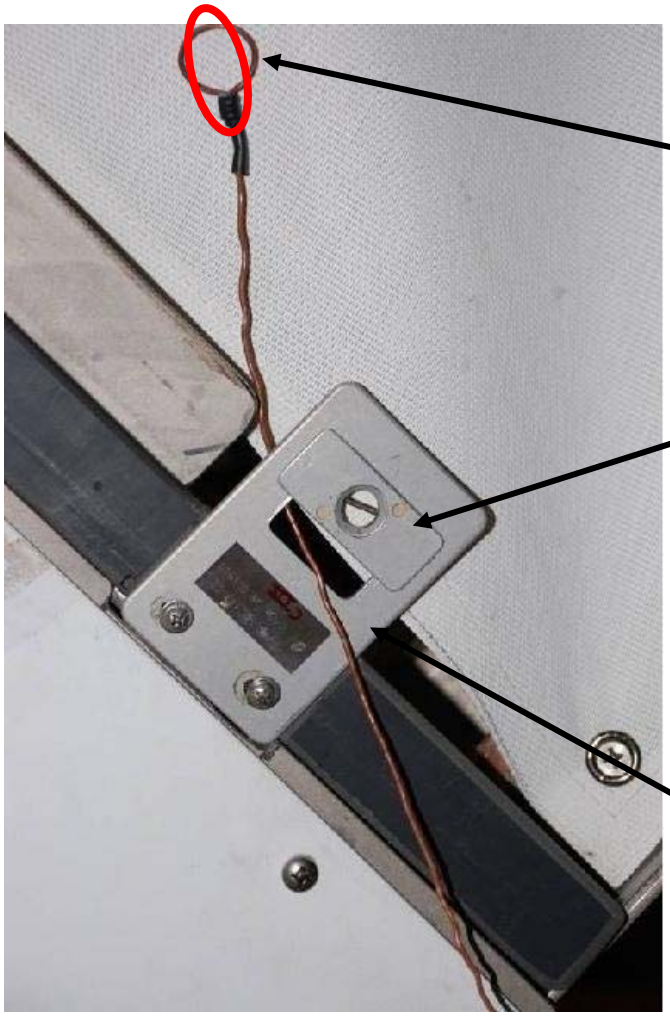
## APFR 2 RELOCATION (00:15)

| IV (SSRMS) | EV1 (OI) |
|---|---|
| | APFR 2 RELOCATION FOR ULF-3 (00:15)<br><br>WARNING<br>Remain starboard of P1 FRGF to avoid TRRJ rotation envelope<br><br>1. Translate to APFR in P1 WIF 03 (near nadir/port corner of P1 ATA)<br>2. Retrieve APFR; stow on BRT<br><br>CAUTION<br>Keep APFR clear of S0 radiator during translation<br><br>3. Translate to Z1 WIF 11 (fwd/stbd corner of Z1)<br>4. Install APFR in Z1 WIF 11 [12,UU,H,12]<br>☐ Verify Black on Black<br>☐ Perform pull test |

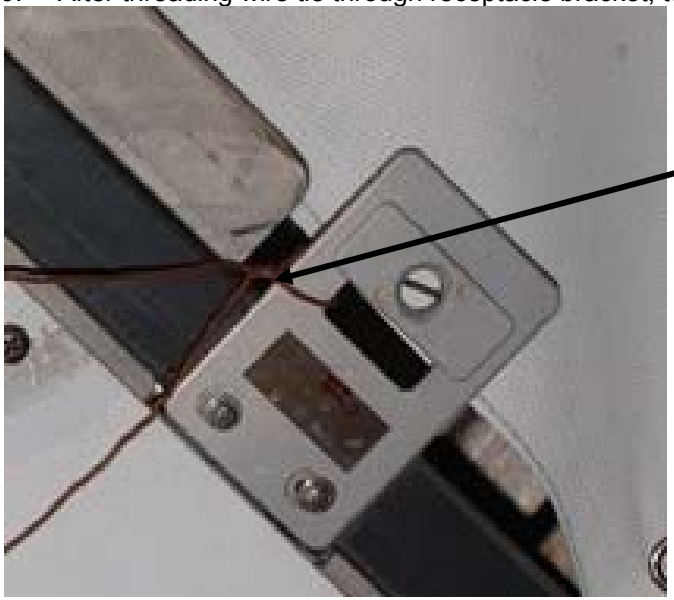
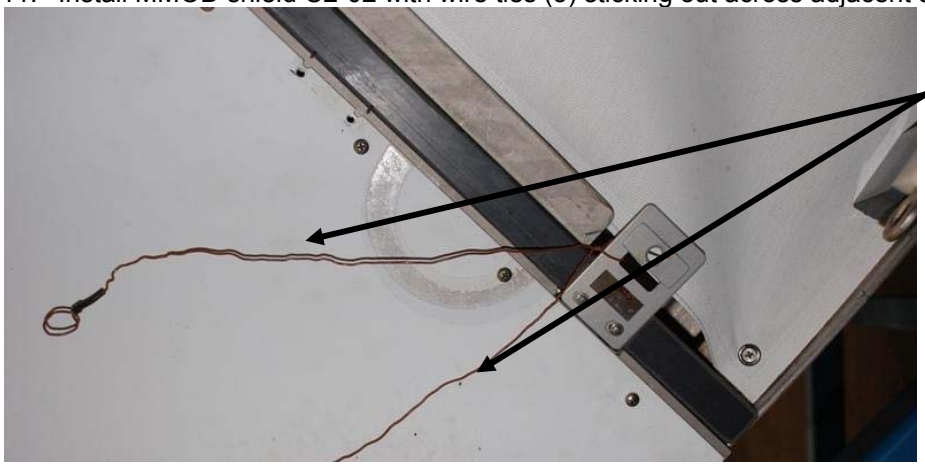
## NOD FGB LAN CABLE REPOSITION/MMOD SHIELD INSTALL (00:45)

| IV (SSRMS) | EV1 (OI) |
|---|---|
| | NOD-FGB LAN CABLE REPOSITION (00:15)<br>1. Translate to A/L; retrieve PMA3 crewlock bag and stow on BRT<br>2. Translate to Node 1 MMOD shield C2-02 (Node 1 fwd port endcone)<br>3. Temp stow PMA3 crewlock bag on LAB HR 0210<br>4. BRT to LAB HR 0209<br>5. Assess alignment; may need to loosen adj equipment tethers<br>6. Reposition FGB LAN cable connector cable, wire tie to NOD1 HR 0141 (and HR 0145 as reqd)<br>7. Perform WVS survey<br><br>WIRE TIE SHIELD (00:20)<br><br>NOTE<br>Wire tie must positively capture the Dzus fastener (either 2 wraps around or 1 wrap and a double twist) and positively capture structure on the Node.<br><br>Wire tie must pull shield flat against structure and in toward centerline of module.<br><br>Verify both ends of wire tie attached securely so that if wire tie breaks, each end will still be attached |

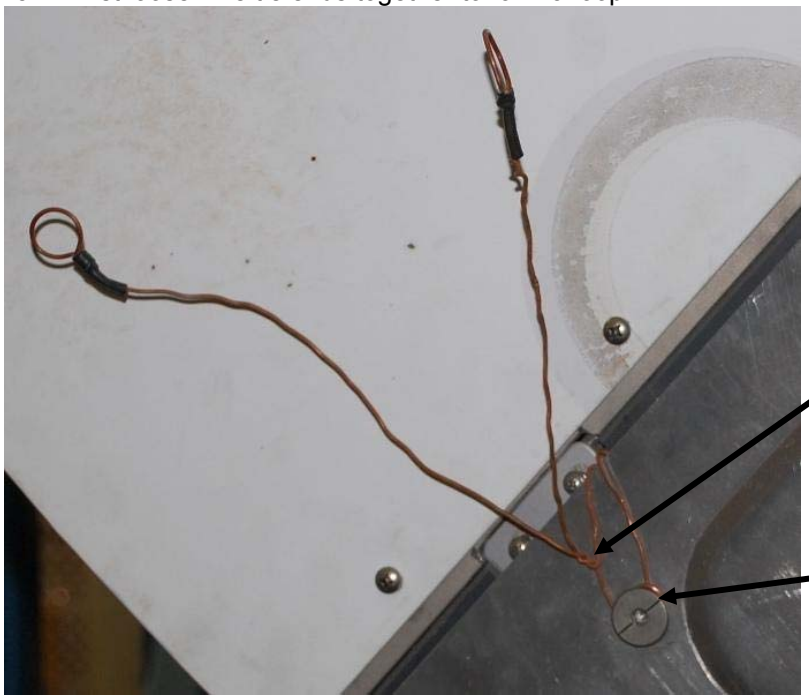
## NOD FGB LAN CABLE REPOSITION/MMOD SHIELD INSTALL (00:45) (Cont)

| IV (SSRMS) | EV1 (OI) |
|---|---|
| | 8. Shift floating receptacle toward center of shield and insert long wire tie through 'window' in receptacle bracket<br>  <br>Use crimped-loop end of long wire tie for easier access through nutplate<br>Floating receptacle shifted toward the center of the shield<br>Long wire tie inserted thru 'window' in receptacle bracket |

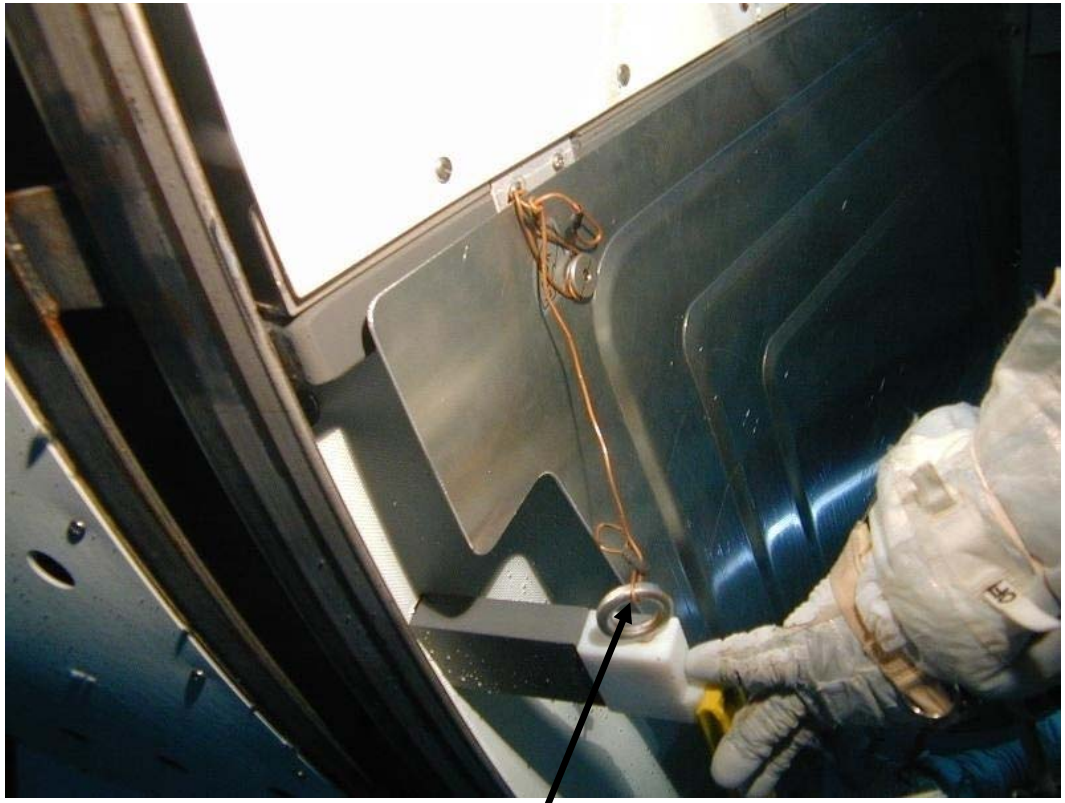
## NOD FGB LAN CABLE REPOSITION/MMOD SHIELD INSTALL (00:45) (Cont)

| IV (SSRMS) | EV1 (OI) |
|---|---|
| | 9. After threading wire tie through receptacle bracket, twist 3 times<br>  <br><br>10. Install long wire tie on two remaining receptacle brackets<br>11. Install MMOD shield C2-02 with wire ties (3) sticking out across adjacent shield<br>  <br> |

## NOD FGB LAN CABLE REPOSITION/MMOD SHIELD INSTALL (00:45) (Cont)

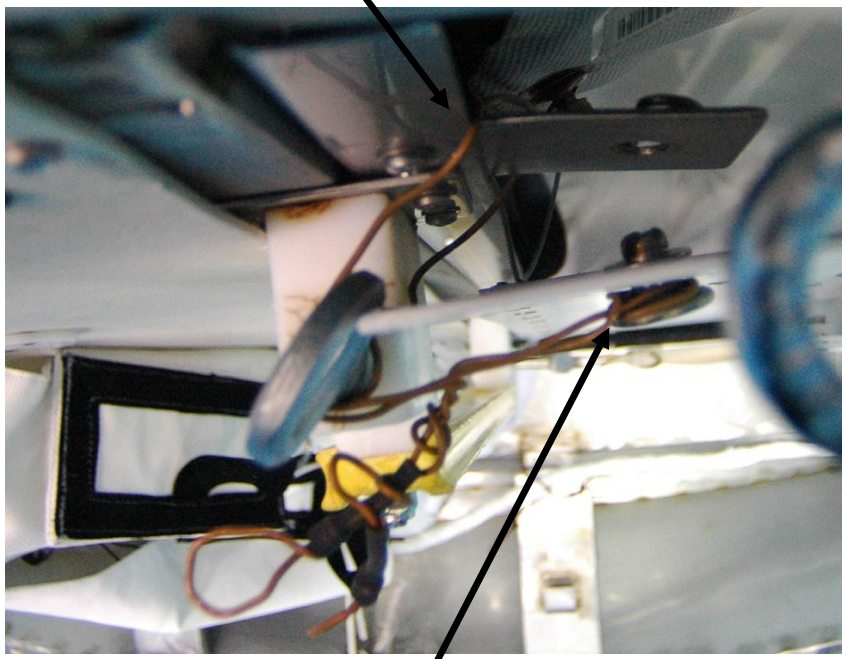
| IV (SSRMS) | EV1 (OI) |
|---|---|
| | 12. Wrap wire tie around Dzus fastener (either two wraps or one wrap and a double twist)<br>13. Twist loose wire tie ends together to form a loop<br>  <br><br>14. Repeat for remaining Dzus fasteners on MMOD Shield C2-02 (2 of 3 minimum required)<br>15. If there is a HR nearby, the loose ends of the wire tie can be wrapped around the HR (not required)<br>16. Perform WVS survey<br><br><u>CLEANUP</u> (00:10)<br>17. Retrieve adj equipment tethers (3) that were installed on shield; stow in PMA3 crewlock bag (not usable)<br>18. Retrieve MMOD Shield Handling Tool from shield; stow in PMA3 crewlock bag<br>19. Perform tool inventory of PMA3 crewlock bag<br>20. Inspect gloves |

## NOD FGB LAN CABLE REPOSITION/MMOD SHIELD INSTALL – TASK DATA



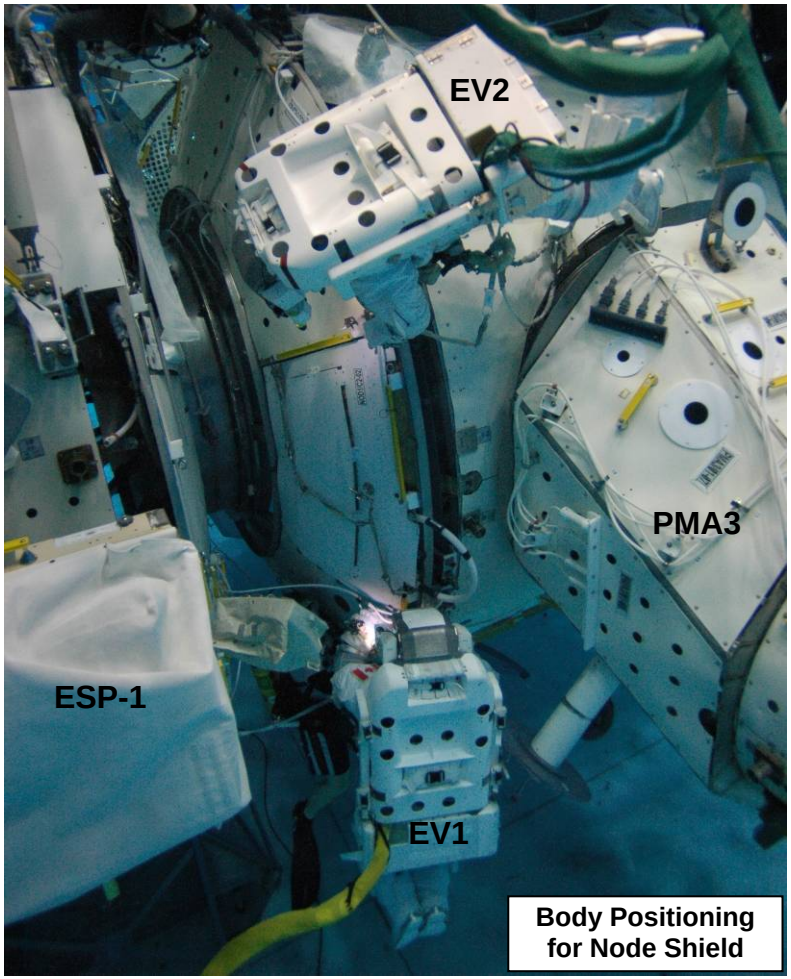
Wire tie attached to a HR (not required)

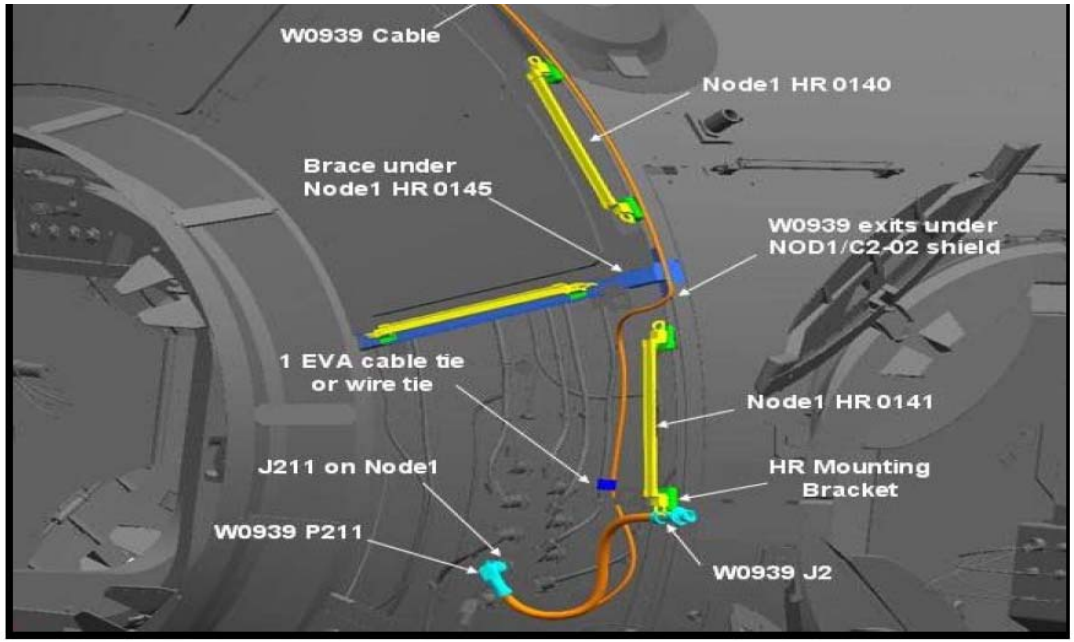
Wire tie under MMOD shield, and around Dzus fastener receptacle bracket



Wire tie around Dzus fastener

## NOD FGB LAN CABLE REPOSITION/MMOD SHIELD INSTALL – TASK DATA (Cont)

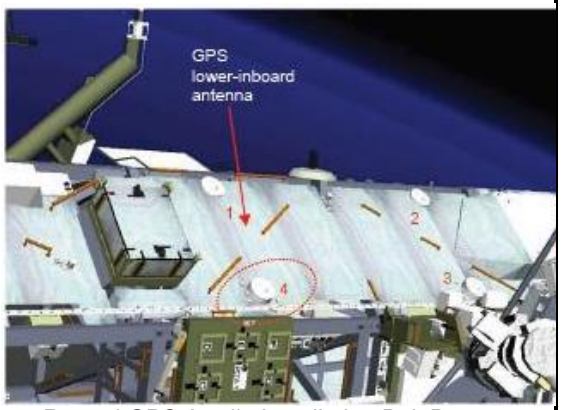


## GPS ANTENNA INSTALL (00:45 FOR 1 ANTENNA/01:00 FOR 2 ANTENNAS)

### IV (SSRMS)

**MCC-H**
GPS Antenna 2
1. √RPCM S02B_E RPC 6 – Open, Close Cmd Inh
2. √RPCM S01A_E RPC 5 – Open, Close Cmd Inh
GPS Antenna 4
3. √RPCM S02B_E RPC 8 – Open, Close Cmd Inh
4. √RPCM S01A_E RPC 7 – Open, Close Cmd Inh




5. Record GPS Ant #4 Installation Bolt Data:

| Bolt | Torque | Turns |
|---|---|---|
| Zenith/Stbd | | |
| Nadir/Stbd | | |
| Nadir/Port | | |

6. Record GPS Ant #2 Installation Bolt Data:

| Bolt | Torque | Turns |
|---|---|---|
| Zenith/Stbd | | |
| Nadir/Stbd | | |
| Nadir/Port | | |

### EV ()

CAUTION
Avoid inadvertent contact with GPS Antenna (Z-93 paint)

1. Translate to A/L; retrieve GPS antenna bag and stow on BRT
2. Translate to S0 Face 2 for GPS antenna installation

GPS ANTENNA INSTALLATION (00:30)

3. Temp stow GPS antenna bag:
   - ☐ For Antenna #4, use S0 HR 3509
   - ☐ For Antenna #2, use S0 HR 3540

4. BRT for electrical connector and bolt operations:
   - ☐ For Antenna #4, use S0 HR 3508
   - ☐ For Antenna #2, use S0 HR 3537

5. Remove electrical connector covers from electrical connectors:
   - ☐ For Antenna #4, temp stow connector covers in small trash bag
   - ☐ For Antenna #2, temp stow connector covers on MWS

6. Temp stow connectors as required to keep cables from being lost inside the truss
7. Retrieve GPS antenna and report serial number (s/n 1002 – Ant # ____, s/n 1006 – Ant # ____)
8. Install GPS antenna (expect a 4-6 lb soft dock force)

9. **PGT: A7/CW2/30.5**
   (9.2 ft-lb, 30 RPM)
   2" -Ext-7/16"
10. Engage bolts (3) in any order, ~10 turns to a hardstop
11. On IV/MCC-H GO: mate connectors (any order) as follows:

| GPS Antenna #4 | GPS Antenna #2 |
|---|---|
| ☐ W4503/P696 to J1 | ☐ W4503/P561 to J1 |
| ☐ W4502/P697 to J2 | ☐ W4502/P562 to J2 |

12. Install MLI shroud using new wire ties as required
13. Perform WVS survey
14. Transfer connector covers (2) from MWS to adj fuse tether in GPS antenna bag
15. When complete with GPS Antenna #2 and #4 installation, perform GPS antenna bag tool inventory
16. Retrieve GPS antenna bag from S0 HR; stow on BRT
17. Inspect gloves

# GPS ANTENNA INSTALL – TASK DATA

**Estimated Task Duration:**

| | With SSRMS | Without SSRMS |
|---|---|---|
| **One EV Crew** | **N/A** | **00:30/Antenna** |
| **Two EV Crew** | **N/A** | **N/A** |

**ORU Specs:**

| ORU | Part Number | Serial Number | Dimensions (in) | Mass (lbm) |
|---|---|---|---|---|
| GPS | SEG20100155-309 | 1002, 1006 (Qty 2) | 17.1" x 11" x 7.3" | 13.64 lbs |

**Tools:**

| EV |
|---|
| PGT w/2" or 6"-Ext-7/16" socket |
| ORU bag (or crewlock bag) |
| BRT |
| Wire ties |
| Sm trash bag |

**Foot Restraints:**

| Task | WIF | APFR Setting |
|---|---|---|
| **APFR** | **N/A** | **N/A** |

**EVA Fasteners:**

| Fastener Name | Head Size | Qty | Install Torque (ft-lb) | Release Torque (ft-lb) | Failure Torque (ft-lb) | Turns |
|---|---|---|---|---|---|---|
| GPS Antenna Bolt | 7/16 | 3 | 9.2 | N/R | 37.5 | 10 |

**EVA Connectors:**

| ORU | Harness | Connector | To | Function |
|---|---|---|---|---|
| GPS Antenna #4 (nadir/stbd) | W4503 | P696 | J1 (new) | GPS Antenna Pwr-1 and Htr-1 |
| | W4502 | P697 | J2 (new) | GPS Antenna Pwr-2 and Htr-2 |
| GPS Antenna #2 (nadir/stbd) | W4503 | P561 | J1 (new) | GPS Antenna Pwr-1 and Htr-1 |
| | W4502 | P562 | J2 (new) | GPS Antenna Pwr-2 and Htr-2 |

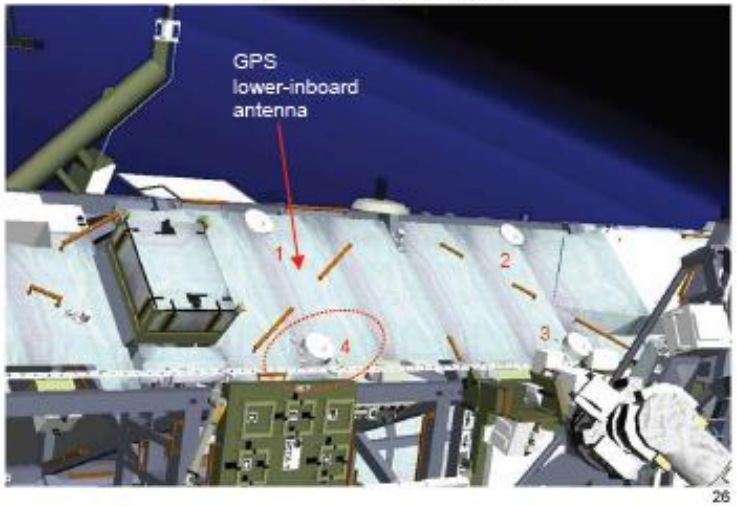
**Notes:**

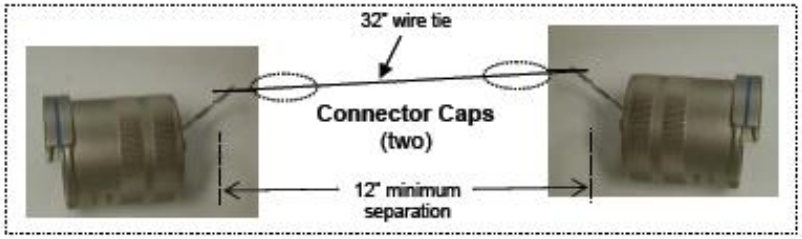
**Cautions:**

**Warnings:**

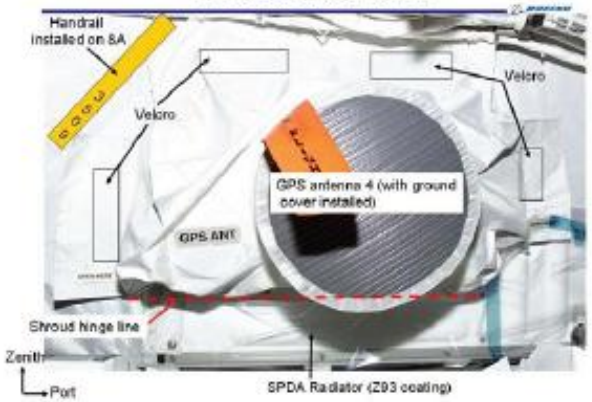
## GPS ANTENNA INSTALL – TASK DATA (Cont)

GPS Antenna Worksite

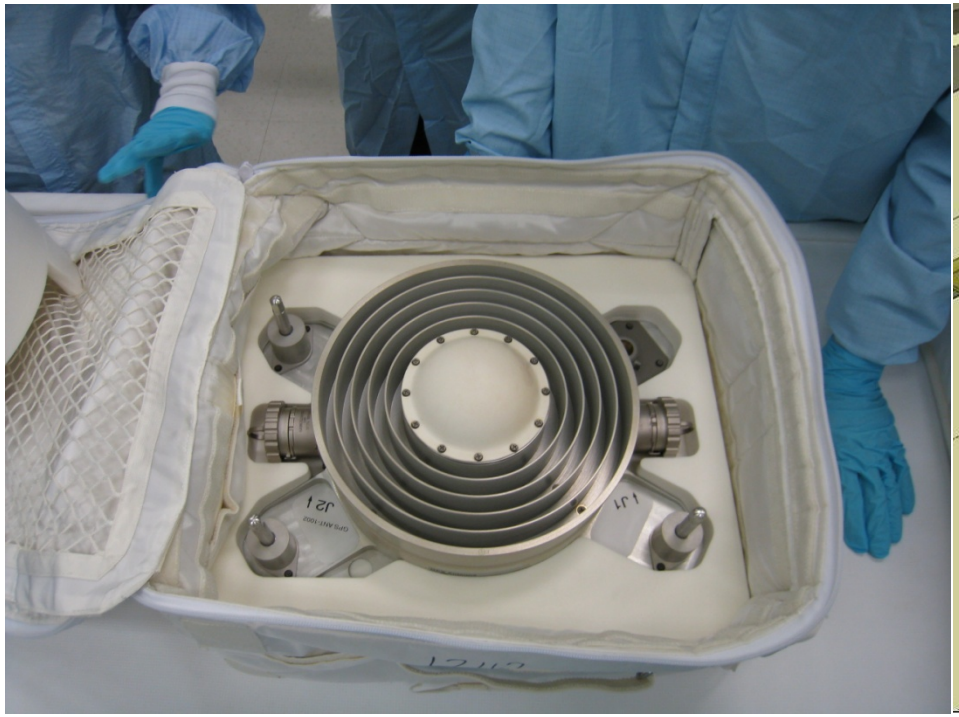




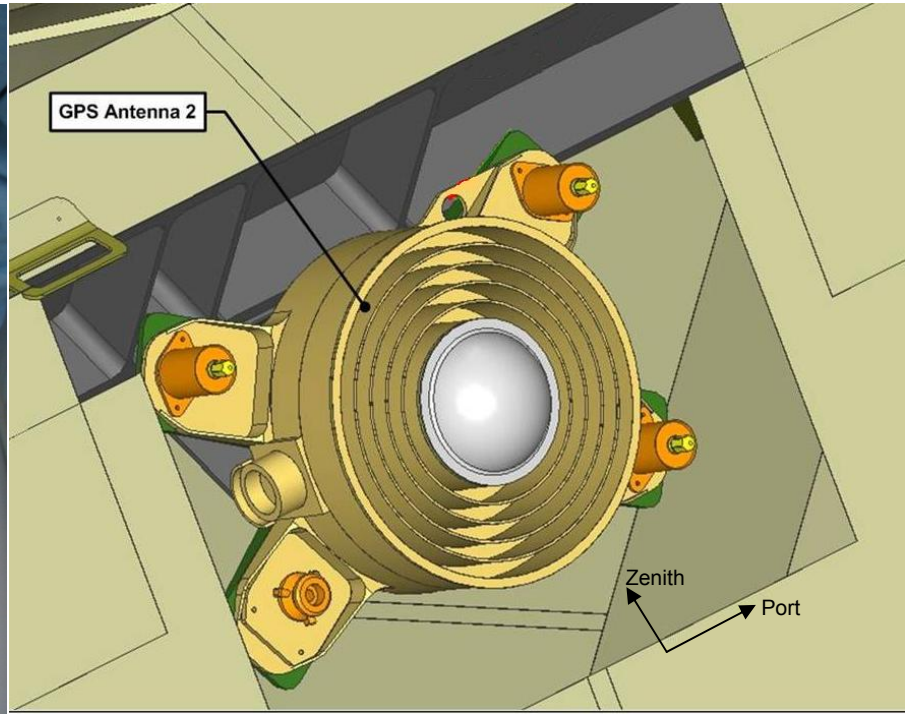
GPS Antenna 4 MLI



## GPS ANTENNA INSTALL – TASK DATA (Cont)



**Spare GPS Antenna**

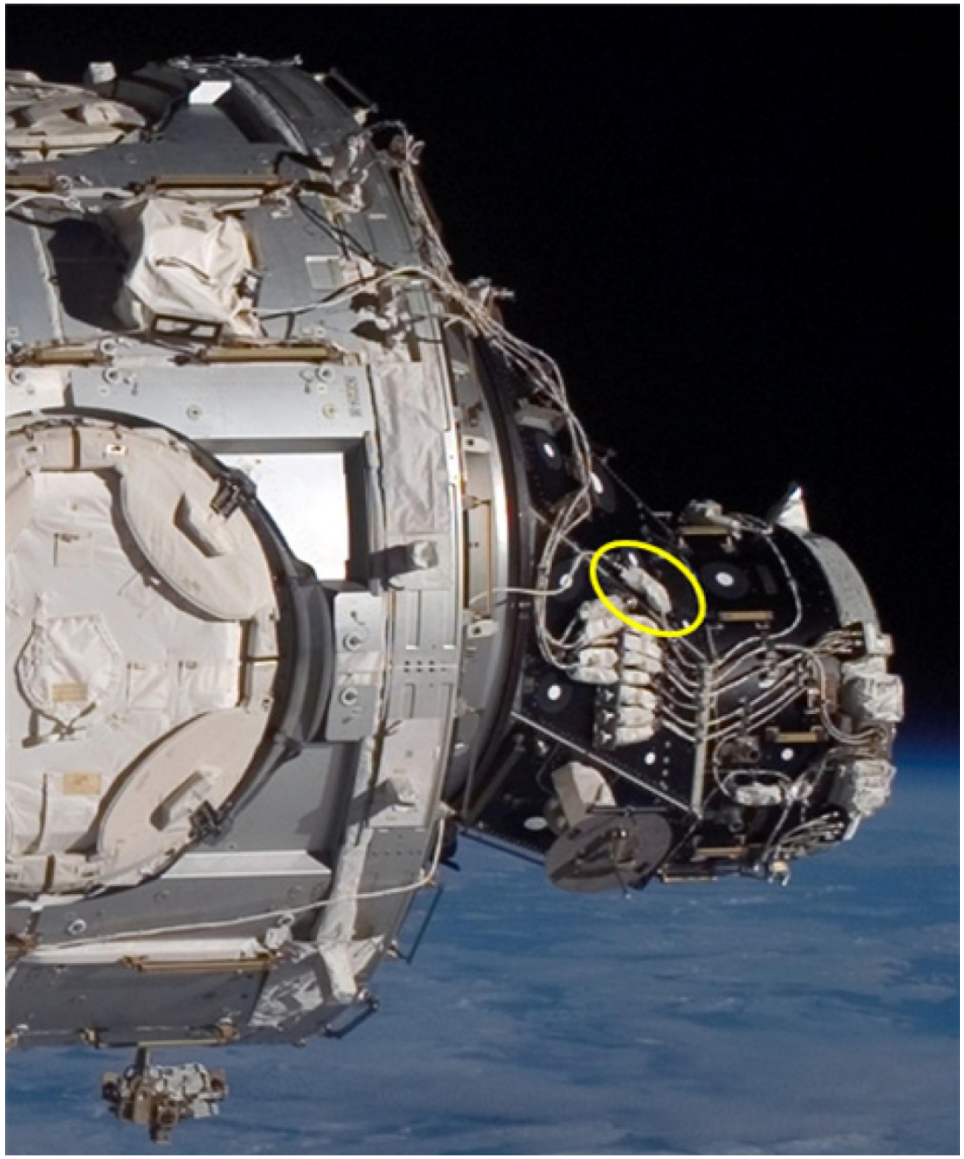



**Installation Orientation (GPS Antenna 2 shown)**

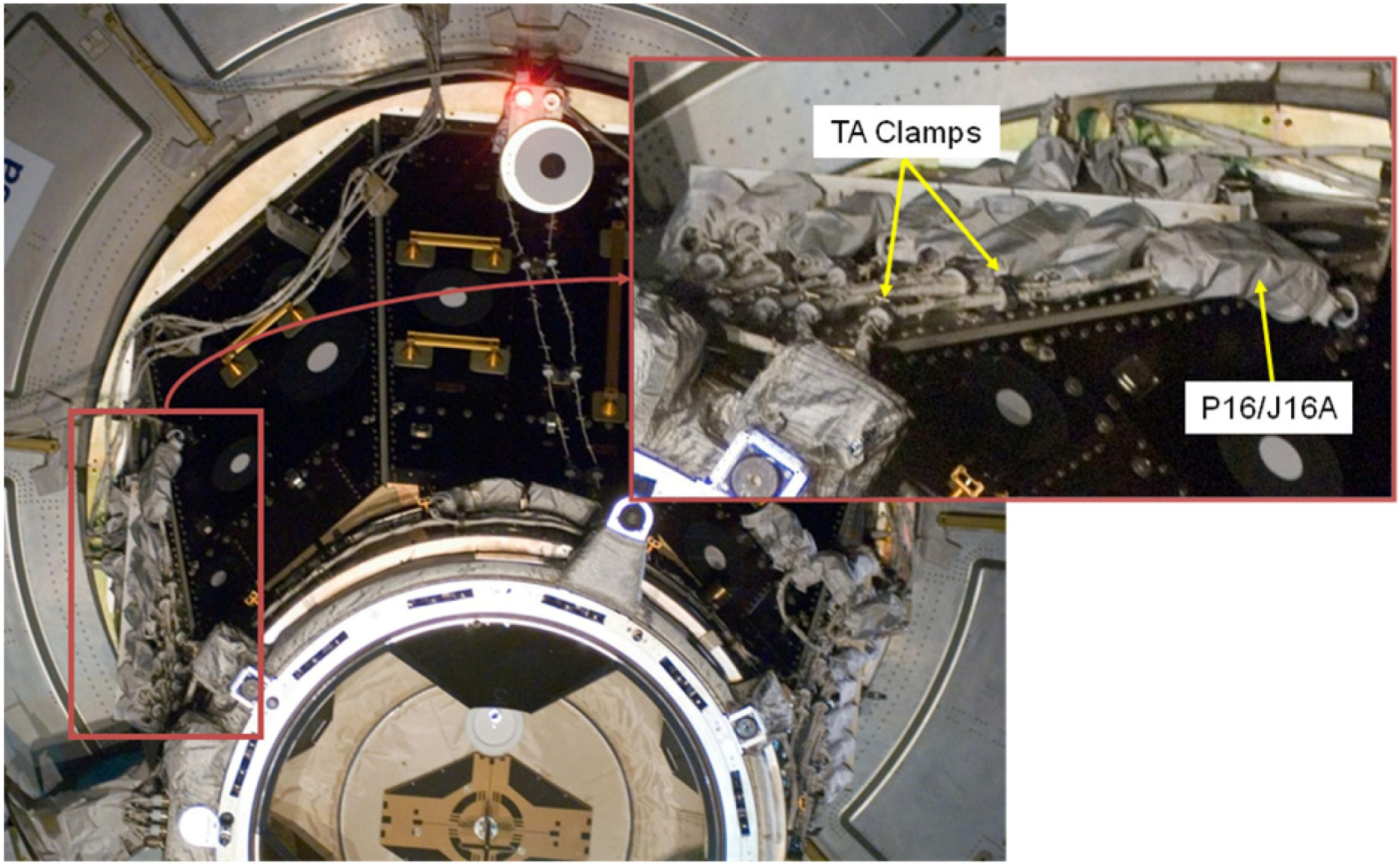
## A/L HR WIRE TIE INSTALL/PMA2 STBD SSPTS CONNECTOR INSULATING SLEEVE INSTALL

| IV (SSRMS) | EV1 (OI) |
|---|---|
| | A/L HANDRAIL WIRE TIE INSTALLATION (00:15)<br>1. Translate to A/L<br><br>CAUTION<br>Damage to A/L circumferential handrail presents a sharp edge.<br>Caution should be taken to avoid touching the nicked area<br><br>2. RET to old wire tie wrapped around A/L handrail<br>3. Remove old wire tie from A/L handrail; stow old wire tie in small trash bag<br>4. Retrieve long wire tie<br>5. Wrap one end around port-most stanchion (near external D-rings) of A/L circumferential handrail<br>6. Wrap remaining length of wire tie in a spiral fashion over the nicked area<br>7. Perform WVS survey |
| 1. Verify inhibits in place<br>√RPCM LA 2A3B_D RPC 1 – open, close cmd inhibit<br>√RPCM Z1 3B_A RPC 2 – open, close cmd inhibit | PMA2 CONNECTOR INSULATING SLEEVE INSTALLATION (00:20)<br>1. On IV/MCC-H GO: Translate to HR 0407 on stbd side of PMA2<br><br>2. RET to wire tie around P16/J16A connector insulating sleeve<br>3. RET to size 21/25 connector insulating sleeve<br><br>4. Remove wire tie<br>5. Remove connector insulating sleeve<br>6. Release MLI cover over P16/J16A and slide down cable to clear it of the plug and jack<br><br>7. Reinstall size 21/25 connector insulating sleeve over P16/J16A<br>8. Verify all metallic surfaces covered by connector insulating sleeve<br>9. Perform WVS survey |

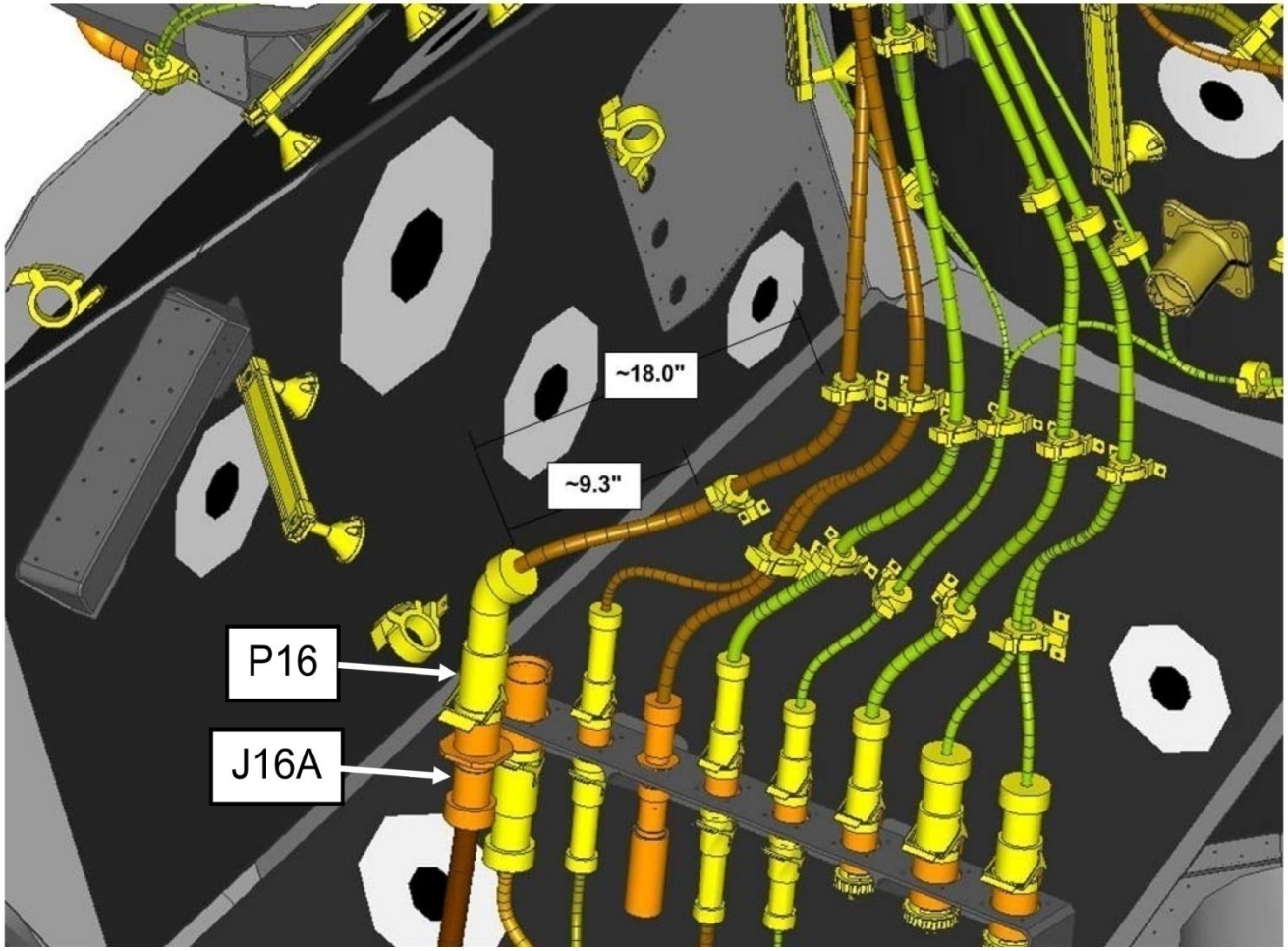
## PMA2 STBD SSPTS CONNECTOR INSULATING SLEEVE INSTALL – TASK DATA

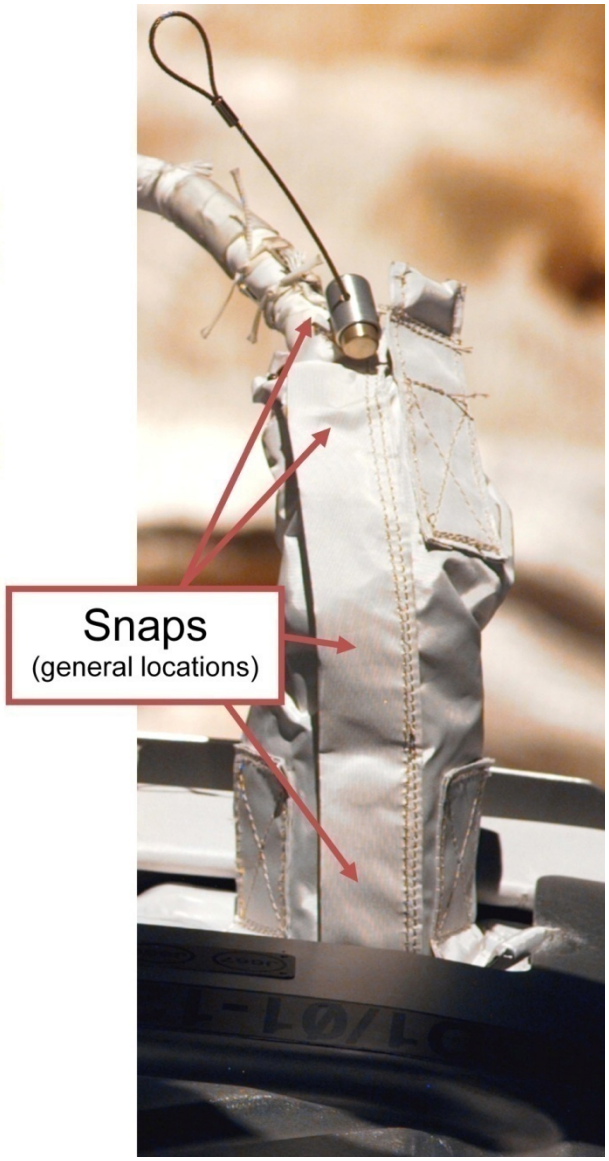


**PMA2 STBD SSPTS CONNECTOR INSULATING SLEEVE INSTALL – TASK DATA** (Cont)



**PMA2 STBD SSPTS CONNECTOR INSULATING SLEEVE INSTALL – TASK DATA** (Cont)

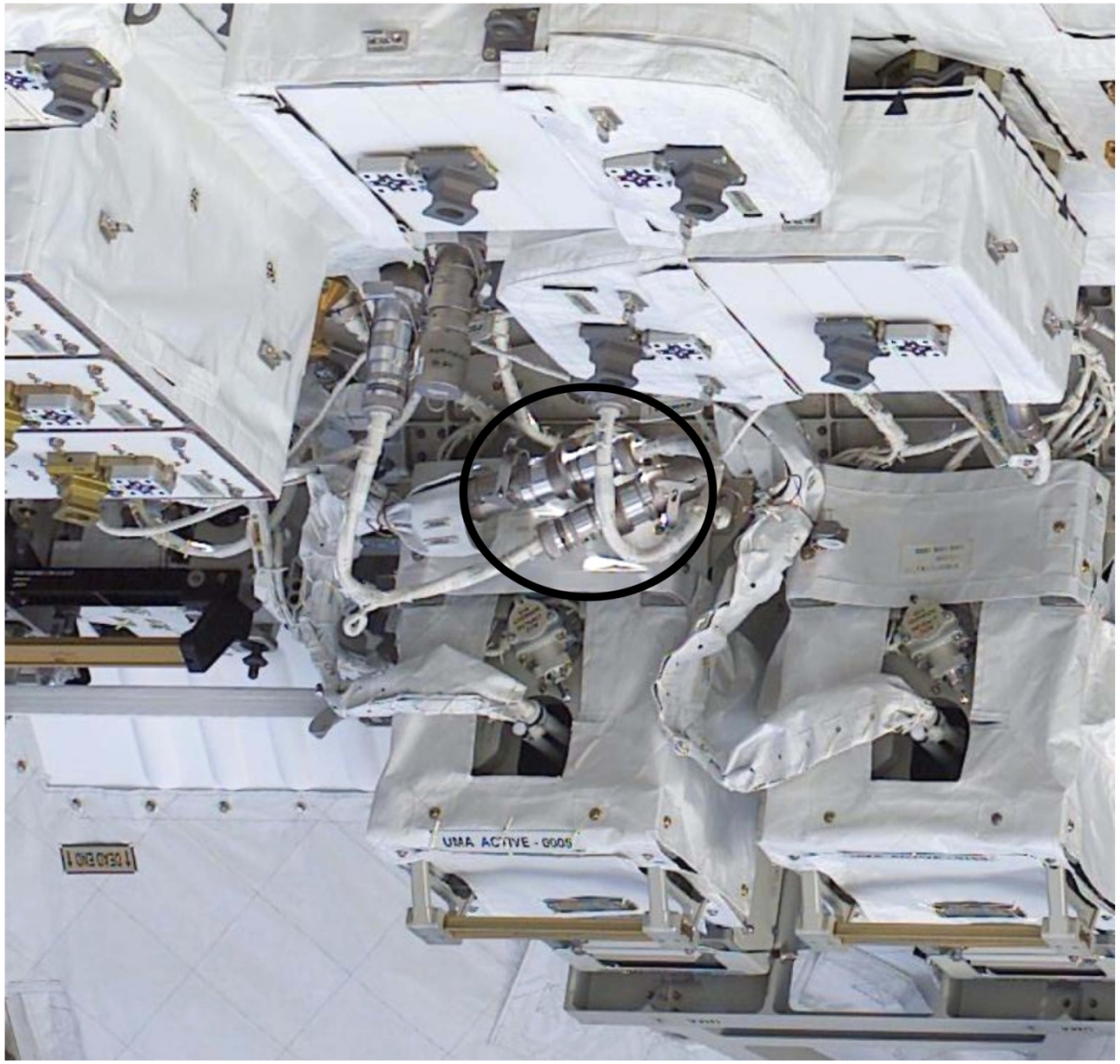


## MT/MBS AND ESP-2 CONNECTOR INSULATING SLEEVE INSTALL

| IV (SSRMS) | EV1 (OI) |
|---|---|
| 1. Verify inhibits in place<br>√RPCM S04B_A RPC 1 – open, close cmd inhibit<br>√RPCM S03A_A RPC 1 – open, close cmd inhibit | <u>MT/MBS CONNECTOR INSULATING SLEEVE INSTALLATION</u> (00:15)<br>1. On IV/MCC-H GO: Translate to nadir side of MT/MBS<br>2. On UMA1 J1 connector, adjust pre-existing MLI to fully uncover connector<br>3. Retrieve connector insulating sleeve size 33/37 from crewlock bag<br>4. Install connector insulating sleeve on UMA1 J1 connector<br>5. Verify all metallic surfaces covered by connector insulating sleeve<br>6. Perform WVS survey<br><br>7. On UMA1 J2 connector, adjust pre-existing MLI to fully uncover connector<br>8. Retrieve connector insulating sleeve size 33/37 from crewlock bag<br>9. Install connector insulating sleeve on UMA1 J2 connector<br>10. Verify all metallic surfaces covered by connector insulating sleeve<br>11. Perform WVS survey |
| 2. Verify inhibits in place<br>√RPCM S04B_F RPCs 10-13 – open, close cmd inhibit | <u>ESP-2 P57A CONNECTOR INSULATING SLEEVE INSTALLATION</u> (00:45)<br>1. Translate to stbd CETA cart (MT at WS4 places stbd CETA cart over S0 Bay 03)<br>2. Take the MT coupler to UNLOCK<br>3. Translate CETA cart starboard to clear a translation path into S0 Bay 03<br>4. Engage stbd CETA cart parking brake (left handle)<br>5. Take MT coupler to CAPTURE<br><br>6. On IV/MCC-H GO: Ingress S0 truss at Bay 03<br>7. Retrieve connector insulating sleeve size 15/17 from crewlock bag<br>8. Install connector insulating sleeve on ESP-2 P57A connector<br>9. Verify all metallic surfaces covered by connector insulating sleeve<br>10. Perform WVS survey<br><br>11. Egress S0 truss<br>12. Release stbd CETA cart parking brake (tap pedal twice)<br><br><u>CAUTION</u><br>CETA to MT max coupling rate is 0.5 ft/sec<br><br>13. Ensure safety tether clear and couple stbd CETA cart to MT<br>14. Take MT coupler to LOCK |

## MT/MBS AND ESP-2 CONNECTOR INSULATING SLEEVE INSTALL – TASK DATA




MT/MBS Connectors Requiring Connector Insulator Sleeve Installation

TOP

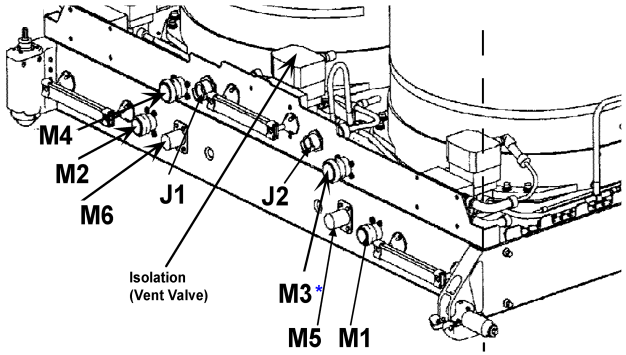
HOOK VELCRO

## EVA FLUID QD CUE CARD

**BLOCK A – REMOVE 1/2" SPD**
1. Push bail fwd toward open position with significant force (unstick male sleeve)
2. Pull up on Lock Knob
3. Slide slider aft from capture bail handle
4. Push bail forward

**BLOCK B – CLOSE VALVE**
1. If M4, rotate locking collar
2. √Aft white band visible
3. √Detent button can be depressed
4. Push bail towards open position with significant force (unstick male sleeve seal)
5. Assess & counteract side loads
6. Press detent button, move bail aft (close valve)
7. √Fwd white band visible; √detent button up
8. √For NH3 crystals on valve ext

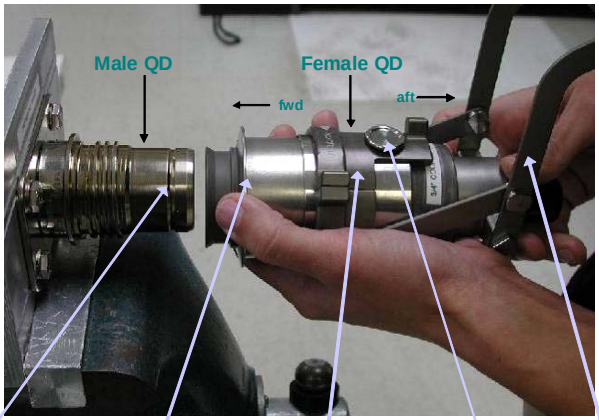
**BLOCK C – Demate QD**
1. √Detent button – up
2. Assess & counteract side loads
3. Pull back on release ring
4. Demate QD
5. √Fwd white band not visible (√release ring - retracted)




**EVA Fluid QDs**

| Line Name | From | To | Clamps (#) | QD Size | Function |
|---|---|---|---|---|---|
| F175/M3 * (Nadir) | PM | ATA M3 | 1 | 1/2" | NH3 out |
| F1/M2/M1 (Nadir) | NTA M2 | ATA M1 | 1 | 1/4" | N2 pressure |
| F174/M4 (Zenith) | Vent | ATA M4 | 1 | 1/2" | NH3 out |
| F2/M3/M2 (Zenith) | NTA M3 | ATA M2 | 1 | 1/4" | N2 pressure |

* Spool positioning device installation




Male Groove  Release Ring  Locking Collar  Detent Button  Bail

**BLOCK D – Mate QD**
1. Inspect QDs for FOD or damage
2. vDetent button – up
3. vFwd white band – not visible
4. Assess & counteract side loads
5. Mate QD
6. vFwd white band – visible
7. Snapback test (vFwd white band still visible)
8. Pull test
9. Visual gap test
10. Assess Side loads before Valve Open

**BLOCK E – OPEN VALVE**
1. Press detent button – down, move bail fwd
2. vAft white band visible; vdetent button – up
3. Verify detent button can be depressed
4. If M4, rotate locking collar to locked position

**BLOCK F – 1/2" SPD INSTALL**
1. Depress button and pull bail aft until aft white line no longer visible. NOTE: Do not fully close QD
2. Check SPD slider full aft
3. Install 1/2" SPD
   - Slide slider fwd to capture bail handle
   - Push lock knob down
   - Perform tug test

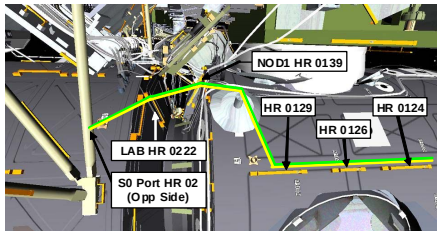
EVA-7a/128/O/A

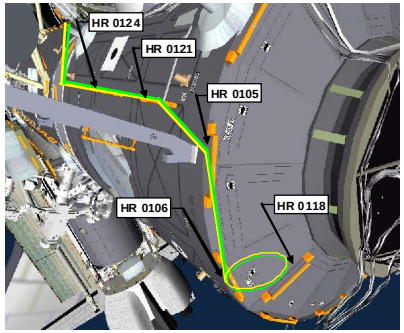
(reduced copy)

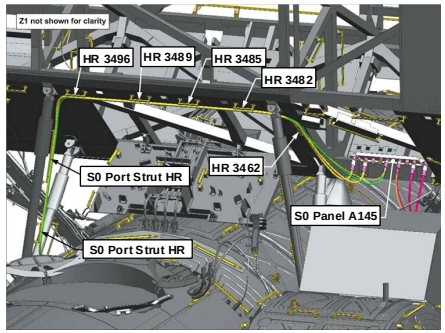
TOP
BACK OF 'EVA FLUID QD CUE CARD'

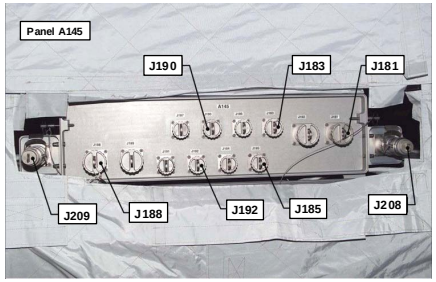
**HOOK VELCRO**

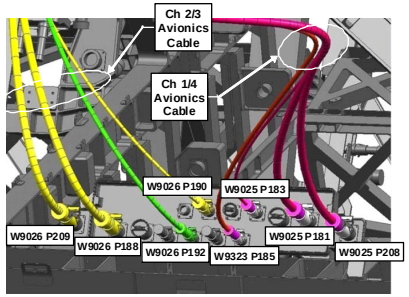
## NOD3 CH 2/3 AVIONICS CABLE ROUTING



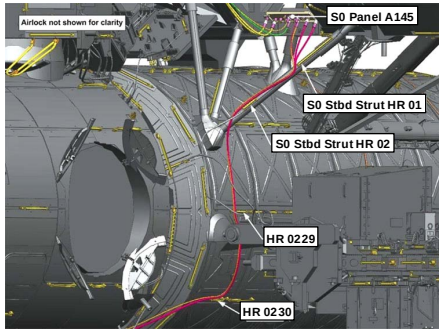



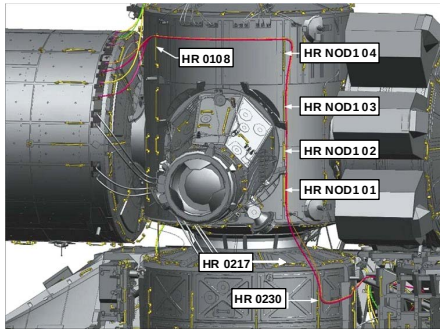



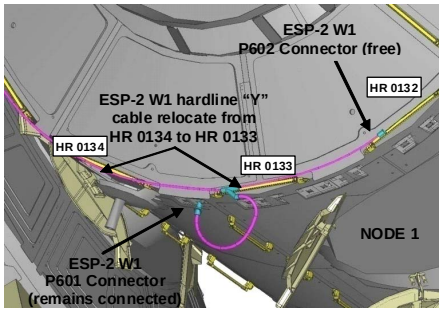




**S0 Panel A145**
**Ch 2/3 Connections – Port**
**Ch 1/4 Connections – Starboard**




**NOD3 Ch 1/4 Avionics Cable Routing**




**PMA3 Htr Cable/ESP-2 W1 Cable Reconfig**

EVA-7b/128/O/A

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TOOLS AND STOWAGE

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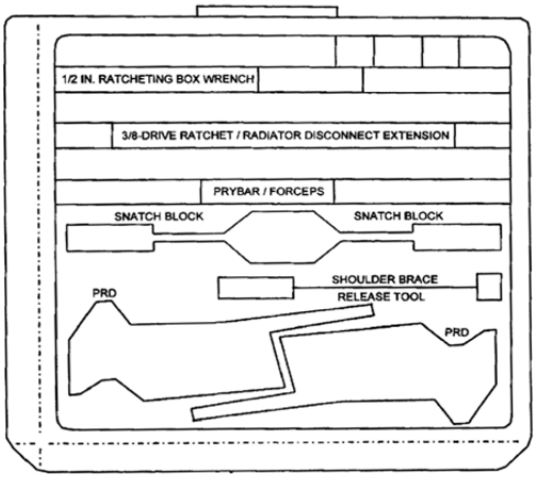
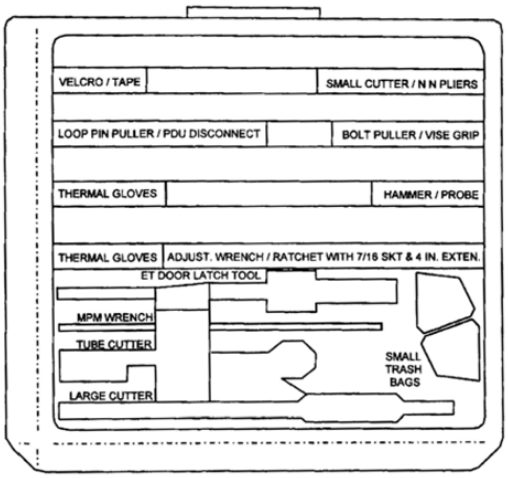
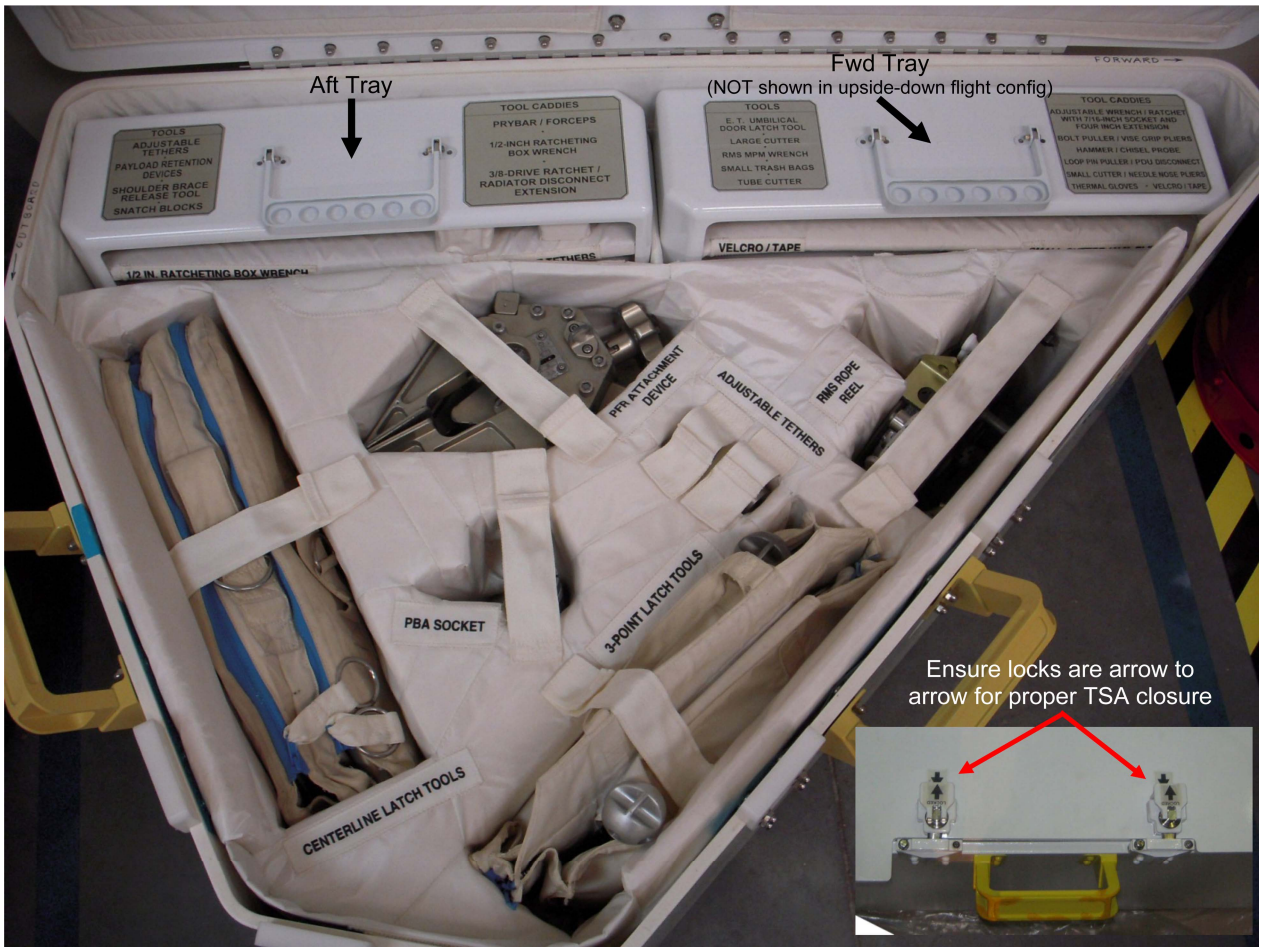
## STARBOARD LIGHTWEIGHT TOOL STOWAGE ASSEMBLY (TSA)



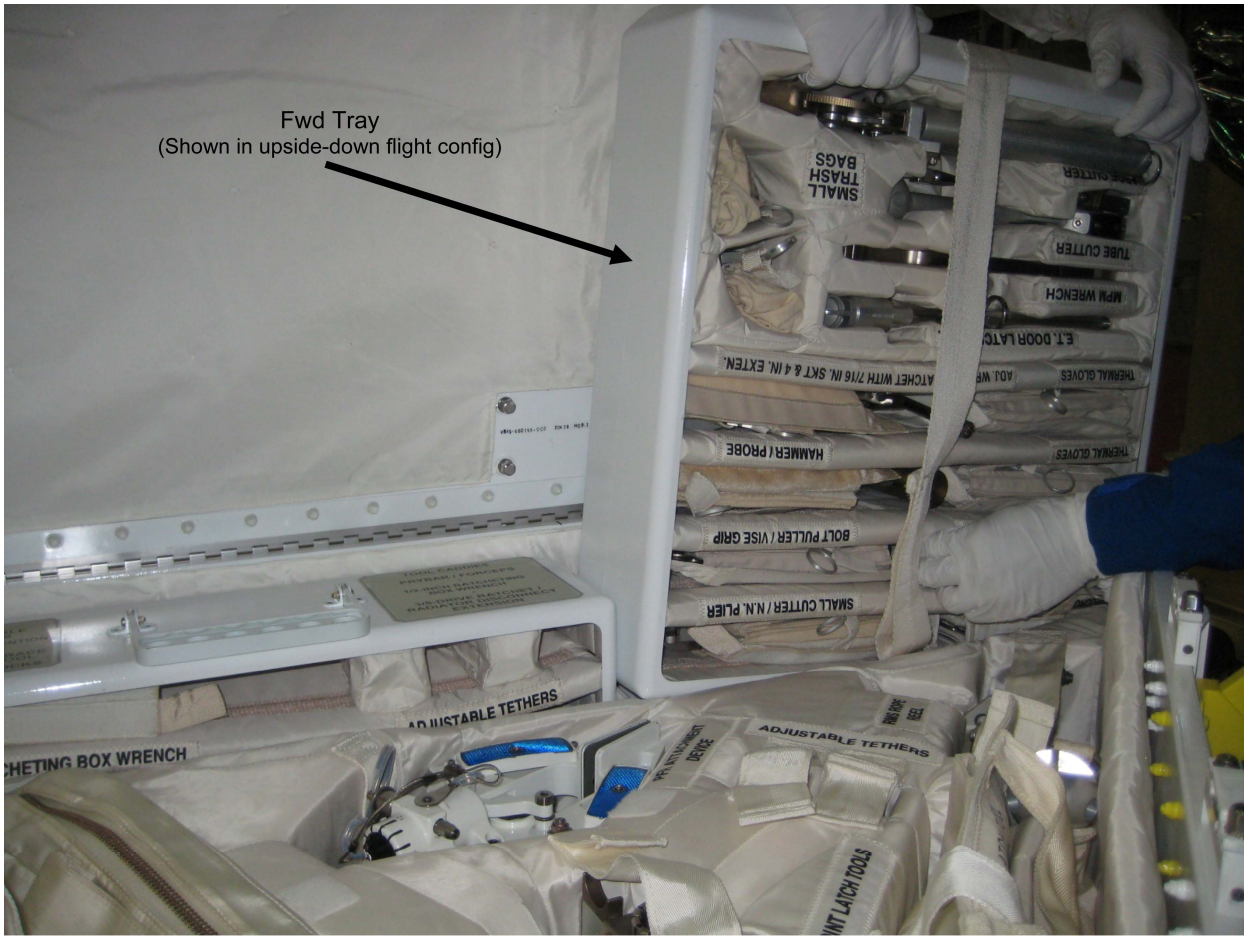

**Aft Tray Layout and Labels**




**Forward Tray Layout and Labels (installed upside down)**



## STARBOARD LIGHTWEIGHT TOOL STOWAGE ASSEMBLY (TSA) (Cont)




**Forward Tray Flight Configuration (installed upside down, as shown)**

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## TOOLBOX STOWAGE – PRE STS-128 (17A)

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

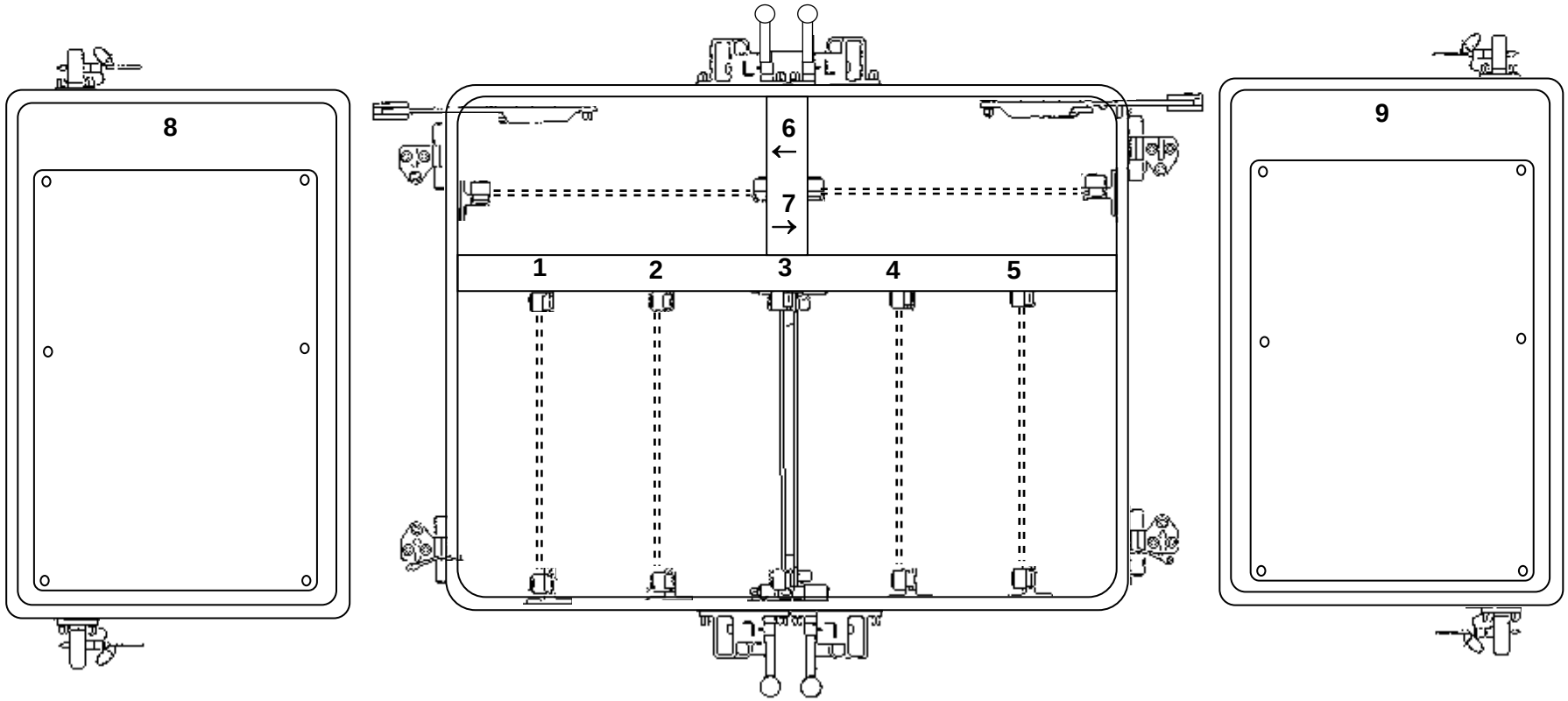
## TOOLBOX STOWAGE – POST STS-128 (17A)

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

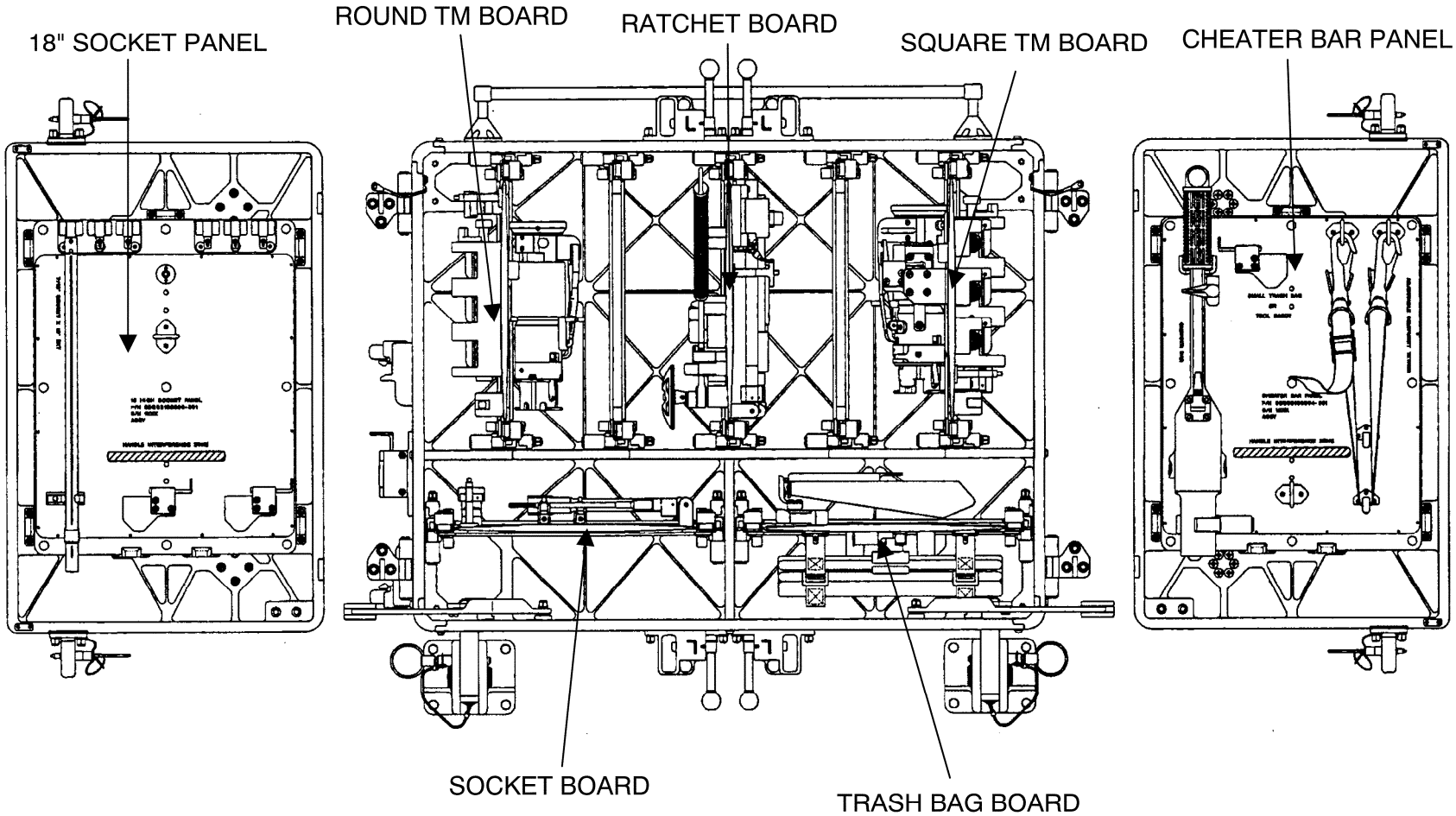
## TOOLBOX PANEL AND SLOT LABELS

NOTE

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

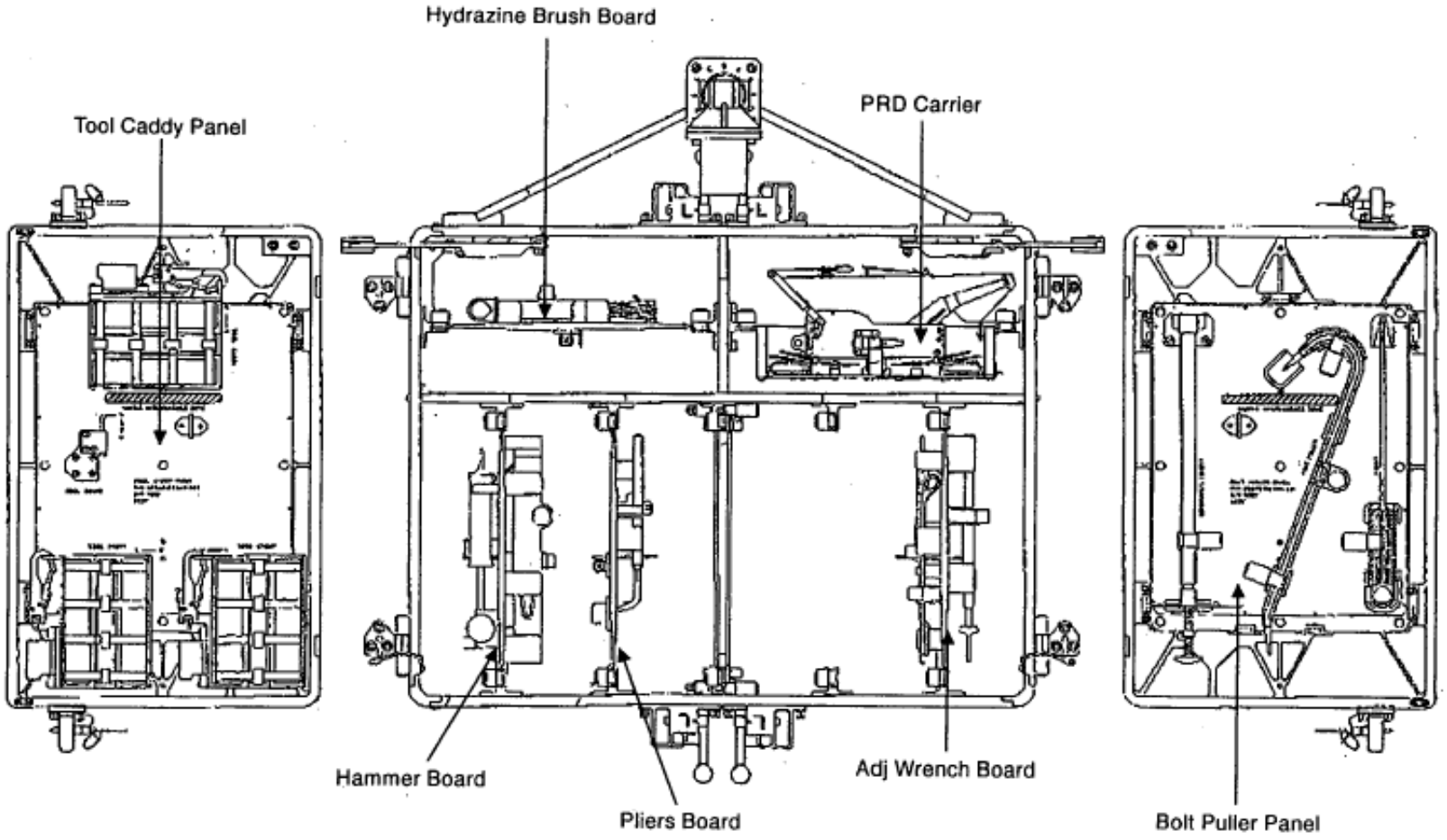


## Z1 TOOLBOX INTERNAL LAYOUT




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

## AIRLOCK TOOLBOX INTERNAL LAYOUT



## APFR MANAGEMENT – STS-128 (17A)

| APFR DESIGNATOR | APFR 1 (8A, 13A.1 Pitch knob problem) | APFR 2 (US EVA 9 Pitch knob problem, 10A sticky locking collar) | APFR 3 s/n 1005 (no pitch knob prob 9A-inc12 suspected sharp edge on locking collar and possible sticky locking collar) | APFR 4 (TS, old ORU tether, heat shield) | APFR 5 (TS, old ORU tether, heat shield) | APFR 6 (heat shield removed on 12A.1 stage) | APFR 7 s/n 1008 | IAPFR 1 | IAPFR 2 | CRANE (old ORU tether) | TS | ORU stanchion/ TERA headless | OTSD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Post STS-127** | P6 WIF 22 [12,QQ,C,1] Yaw & Roll Settings are Approximate | P1 WIF4 [8,QQ,G,11] | P1 WIF 1 [6,WW,K,4] | Z1 WIF08 [7,PP,B,6] TS at 4 o'clock | PMA1 WIF 2 [6,KK,F,12] Tool Stanchion (Tool Head Zenith on Fwd side of APFR) | S1 WIF 1 [10,TT,L,12] | P6 WIF 10 [12,GG,E,6] **Ingress Aid** Yaw & Roll Settings are Approximate | Z1 WIF 1 [12,PP,F,12] | Z1 WIF 3 [6,PP,F,12] | PMA1 WIF 5 | S0 port wedge face | S0 port wedge face | S0 WIF 7 CL=7 |
| **Post EVA 1** | P6 WIF 22 [12,QQ,C,1] Yaw & Roll Settings are Approximate | P1 WIF 4 [8,QQ,G,11] | SSRMS LEE WIF [12,FF,A,6] | Z1 WIF08 [7,PP,B,6] TS at 4 o'clock | PMA1 WIF 2 TS/HS [12,KK,F,6] | S1 WIF 1 [10,TT,L,12] | P6 WIF 10 [12,GG,E,6] **Ingress Aid** Yaw & Roll Settings are Approximate | Z1 WIF 1 [12,PP,F,12] | Z1 WIF 3 [6,PP,F,12] | PMA1 WIF 5 | S0 port wedge face | S0 port wedge face | S0 WIF 7 CL=7 |
| **Post EVA 2** | P6 WIF 22 [12,QQ,C,1] Yaw & Roll Settings are Approximate | P1 WIF 3 [3,HH,G,6] | A/L WIF 10 [4,PP,F,12] | Z1 WIF08 [7,PP,B,6] TS at 4 o'clock | PMA1 WIF 2 TS/HS [12,KK,F,6] | S1 WIF 1 [10,TT,L,12] | P6 WIF 10 [12,GG,E,6] **Ingress Aid** Yaw & Roll Settings are Approximate | Z1 WIF 1 [12,PP,F,12] | Z1 WIF 3 [6,PP,F,12] | PMA1 WIF 5 | S0 port wedge face | S0 port wedge face | S0 WIF 7 CL=7 |
| **Post EVA 3** | P6 WIF 22 [12,QQ,C,1] Yaw & Roll Settings are Approximate | Z1 WIF 11 [12,UU,H,12] (Get-ahead) | A/L WIF 10 [4,PP,F,12] | Z1 WIF10 [3,PP,B,6] TS at 4 o'clock | PMA1 WIF 2 TS/HS [12,KK,F,6] | S1 WIF 1 [10,TT,L,12] | P6 WIF 10 [12,GG,E,6] **Ingress Aid** Yaw & Roll Settings are Approximate | Z1 WIF 1 [12,PP,F,12] | Z1 WIF 3 [6,PP,F,12] | PMA1 WIF 5 | S0 port wedge face | S0 port wedge face | S0 WIF 7 CL=7 |

## SAFETY TETHERS – STS-128 (17A)

| | **55-ft tethers** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | #71<br>s/n 1021<br>Lg-sm<br>(has retracting issues – AR written-2J/A)<br>(2J/A saw kink in braided cable) | #73<br>s/n 1023<br>has retracting issues – ARs 1J, 2J/A)<br>(2J/A saw kink in braided cable & noted brown smudges on the LAT) | #60<br>s/n 1008<br>Lg-sm<br>(has retracting issues)<br>(2J/A – LATs are pretty brown & may need inspection before use) | #70<br>s/n 1020<br>Lg-sm<br><br>(2J/A – LATs are pretty brown & may need inspection before use) | #66<br>s/n 1016<br>Sm-sm<br><br>2J/A noted brown smudges on the LAT-GO for EVA | #67<br>s/n 1017<br>Lg-sm | #68<br>s/n 1018<br>Lg-sm | #69<br>s/n 1019<br>Lg-sm | #72<br>s/n 1022<br>Lg-sm |
| 127 Stage | INSIDE:<br>tether staging area | INSIDE:<br>tether staging area | S0<br>HH 3539 or HH 3544<br>Tether on 3539 had retracting issues | S0<br>HH 3539 or HH 3544<br>Tether on 3539 had retracting issues | INSIDE:<br>tether staging area | N/A (Up in STS-128 MPLM) | N/A (Up in STS-128 MPLM) | N/A (Up in STS-128 MPLM) | N/A (Up in STS-128 MPLM) |
| | | | | | | | | | |
| Post EVA 1 | Attached to SSRMS LEE handrail and APFR | INSIDE:<br>tether staging area | S0<br>HH 3539 or HH 3544<br>Tether on 3539 had retracting issues | S0<br>HH 3539 or HH 3544<br>Tether on 3539 had retracting issues | INSIDE:<br>tether staging area | INSIDE:<br>tether staging area or in MPLM | INSIDE:<br>tether staging area or in MPLM | INSIDE:<br>tether staging area or in MPLM | INSIDE:<br>tether staging area or in MPLM |
| Post EVA 2 | INSIDE:<br>tether staging area | INSIDE:<br>tether staging area | S0<br>HH 3539 or HH 3544<br>Tether on 3539 had retracting issues | S0<br>HH 3539 or HH 3544<br>Tether on 3539 had retracting issues | INSIDE:<br>tether staging area | INSIDE:<br>tether staging area or in MPLM | INSIDE:<br>tether staging area or in MPLM | INSIDE:<br>tether staging area or in MPLM | INSIDE:<br>tether staging area or in MPLM |
| Post EVA 3 | SHUTTLE:<br>MPLM for Return | SHUTTLE:<br>MPLM for Return | SHUTTLE:<br>MPLM for Return | SHUTTLE:<br>MPLM for Return | SHUTTLE:<br>MPLM for Return | INSIDE:<br>tether staging area | INSIDE:<br>tether staging area | INSIDE:<br>tether staging area | INSIDE:<br>tether staging area |

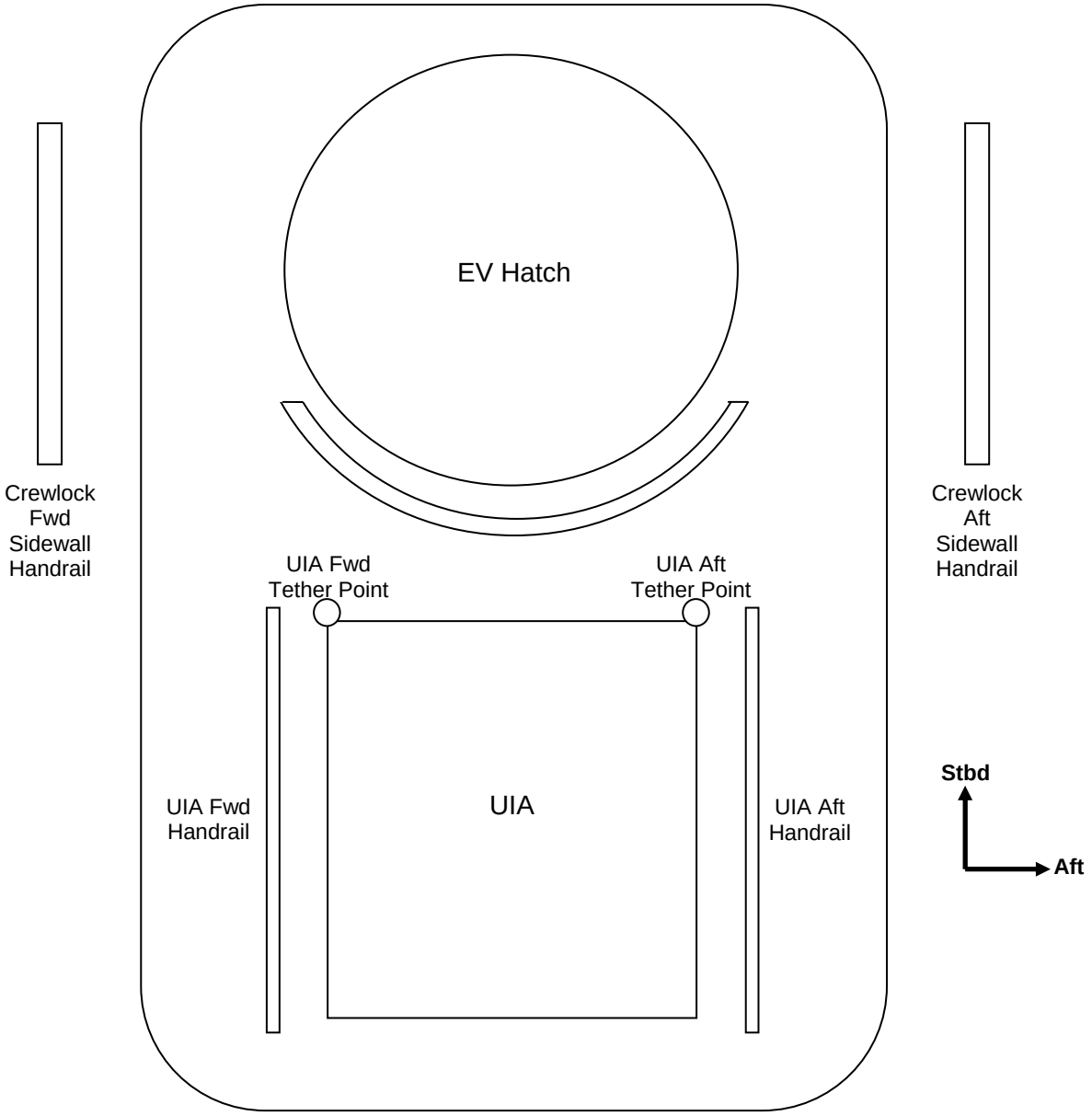
## **SAFETY TETHERS – STS-128 (17A)** (Cont)

| | **85-ft tethers** | | | | | |
|---|---|---|---|---|---|---|
| | #22<br>s/n 1002<br>Lg-sm<br><br>(2 J/A – retracting issue) | #28<br>s/n 1008<br>Lg-sm | #21<br>s/n 1001<br>Lg-sm | #24<br>s/n 1004<br>Lg-sm | #23<br>s/n 1003<br>(Shuttle safety tethers) | #26<br>s/n 1006<br>(Shuttle safety tethers) |
| 127 Stage | INSIDE:<br>tether staging area | INSIDE:<br>tether staging area | N/A<br>(Up in STS-128<br>Shuttle Middeck) | N/A<br>(Up in STS-128<br>Shuttle Middeck) | N/A<br>(Up in STS-128 MPLM) | N/A<br>(Up in STS-128 MPLM) |
| | | | | | | |
| Post EVA 1 | INSIDE:<br>tether staging area | INSIDE:<br>tether staging area | INSIDE:<br>tether staging area | INSIDE:<br>tether staging area | INSIDE:<br>MPLM or Shuttle | INSIDE:<br>MPLM or Shuttle |
| Post EVA 2 | INSIDE:<br>tether staging area | INSIDE:<br>tether staging area | INSIDE:<br>tether staging area | INSIDE:<br>tether staging area | INSIDE:<br>MPLM or Shuttle | INSIDE:<br>MPLM or Shuttle |
| Post EVA 3 | INSIDE:<br>tether staging area | INSIDE:<br>tether staging area | INSIDE:<br>tether staging area | INSIDE:<br>tether staging area | Shuttle | Shuttle |

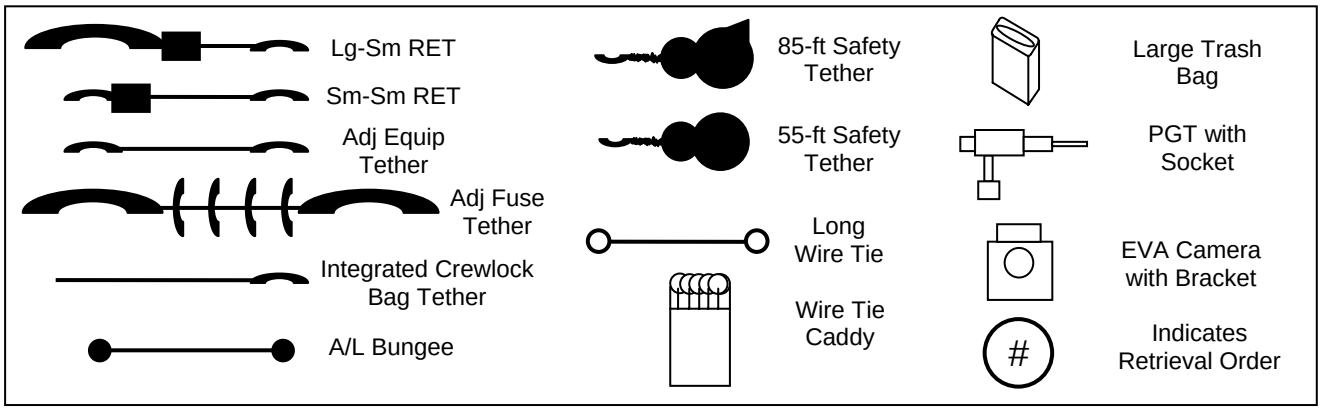
NOTE

During US EVA #8, EV2 reported that her 55-ft safety tether (P/N SEG33106674-307 s/n 1023, #73) was not retracting properly. EV2 attempted to perform the usual technique of pulling out some cable and then letting it reel in, but there came a point when EV2 was neither able to extend or retract the line with 6-8 ft of tether cable still extended. EV2 also cycled the tether from UNLOCK to LOCK and back to UNLOCK, with no joy. The tether was temp stowed as is until later (EV2 was attached to an 85-ft tether at this point.) During EVA cleanup, EV1 attempted to troubleshoot the tether, placing it in LOCK and extending quite a few more feet of cable from the tether. When the tether was placed back in UNLOCK it retracted completely, with a little bit of coaxing for the last couple feet of cable (typical behavior). The tether was brought inside. No further action required

## STS-128 CREWLOCK CONFIGURATION MANAGEMENT

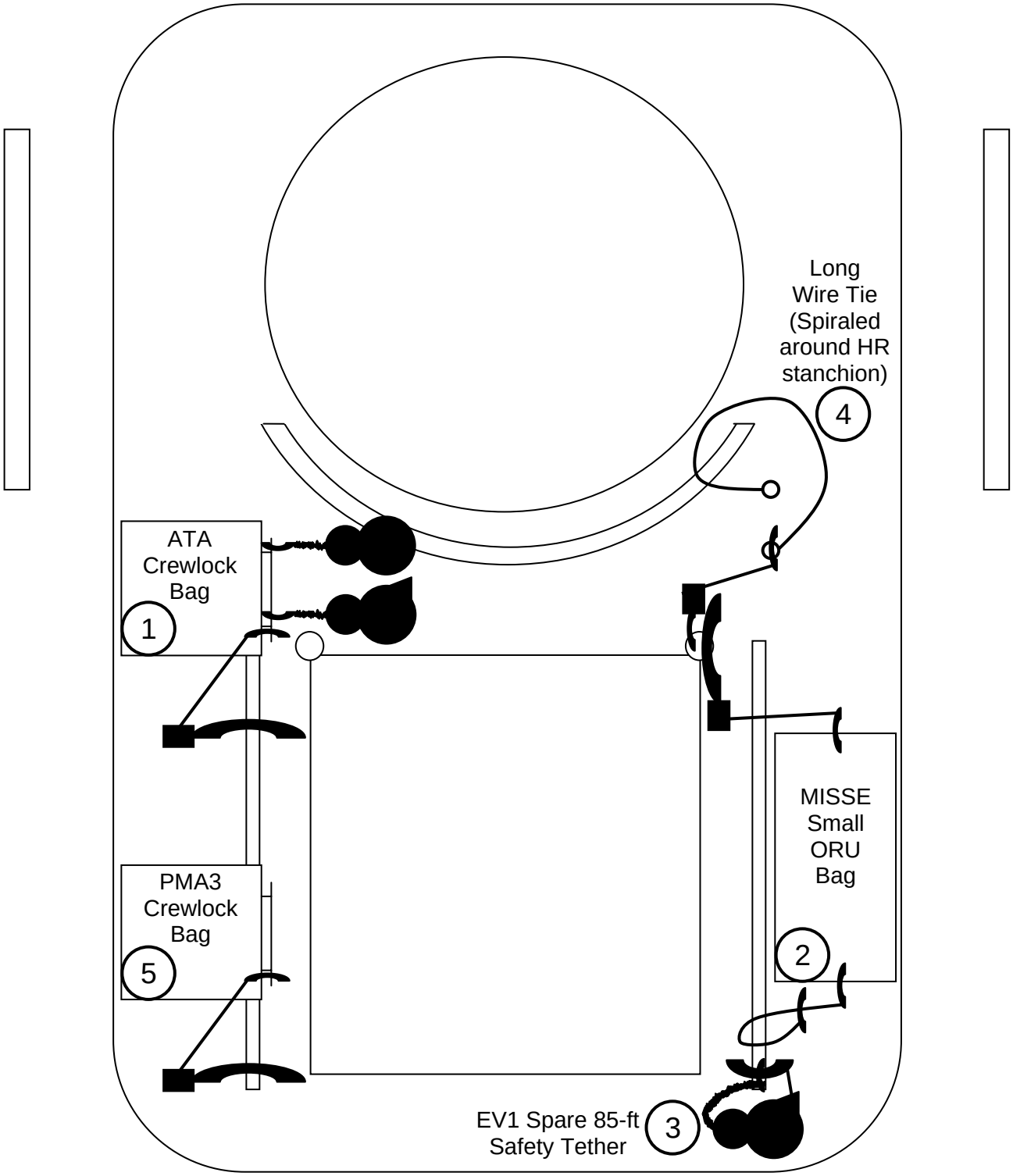



**ISS Crewlock**



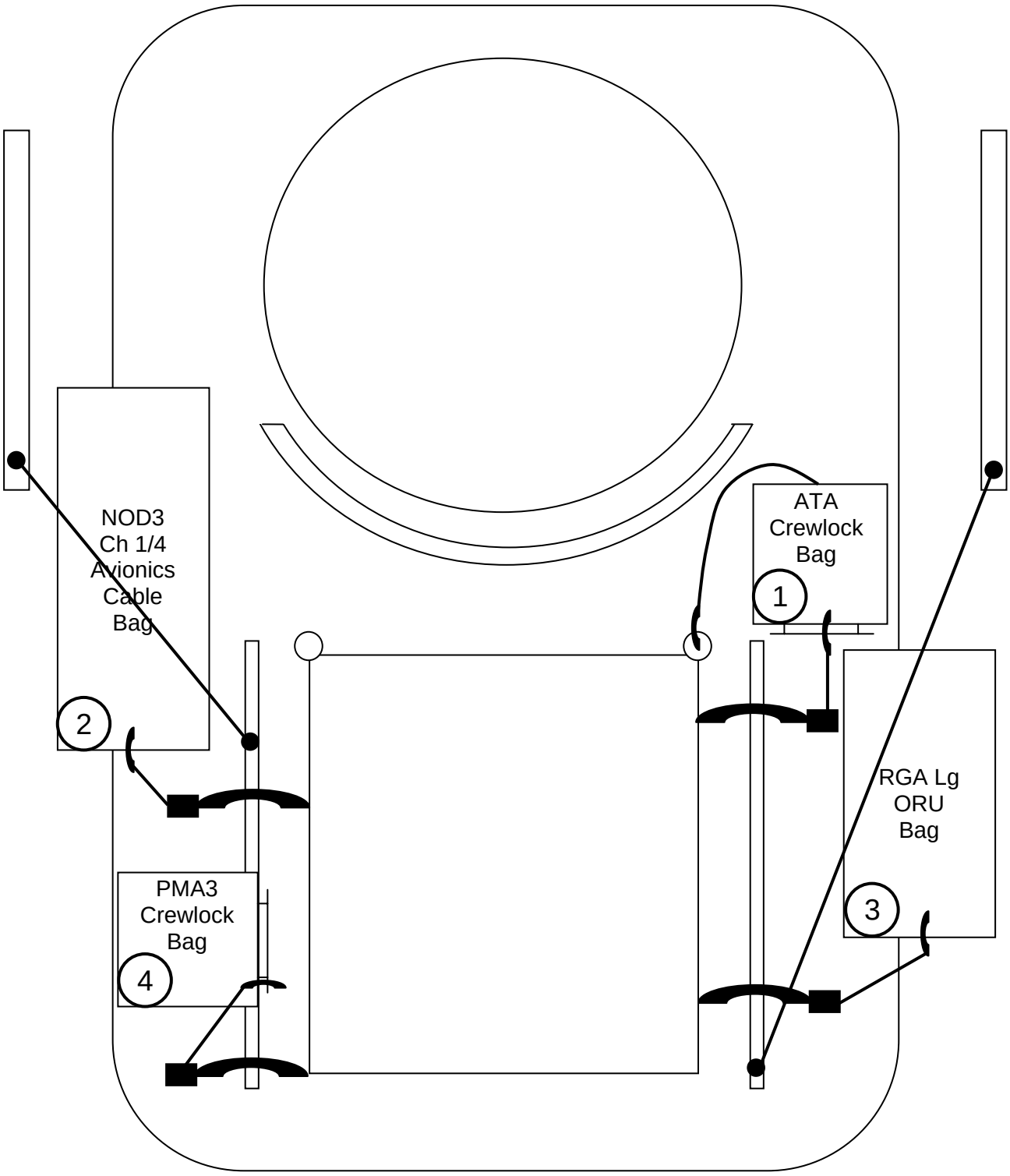

**Tool Legend**

## STS-128 CREWLOCK CONFIGURATION – EVA 1



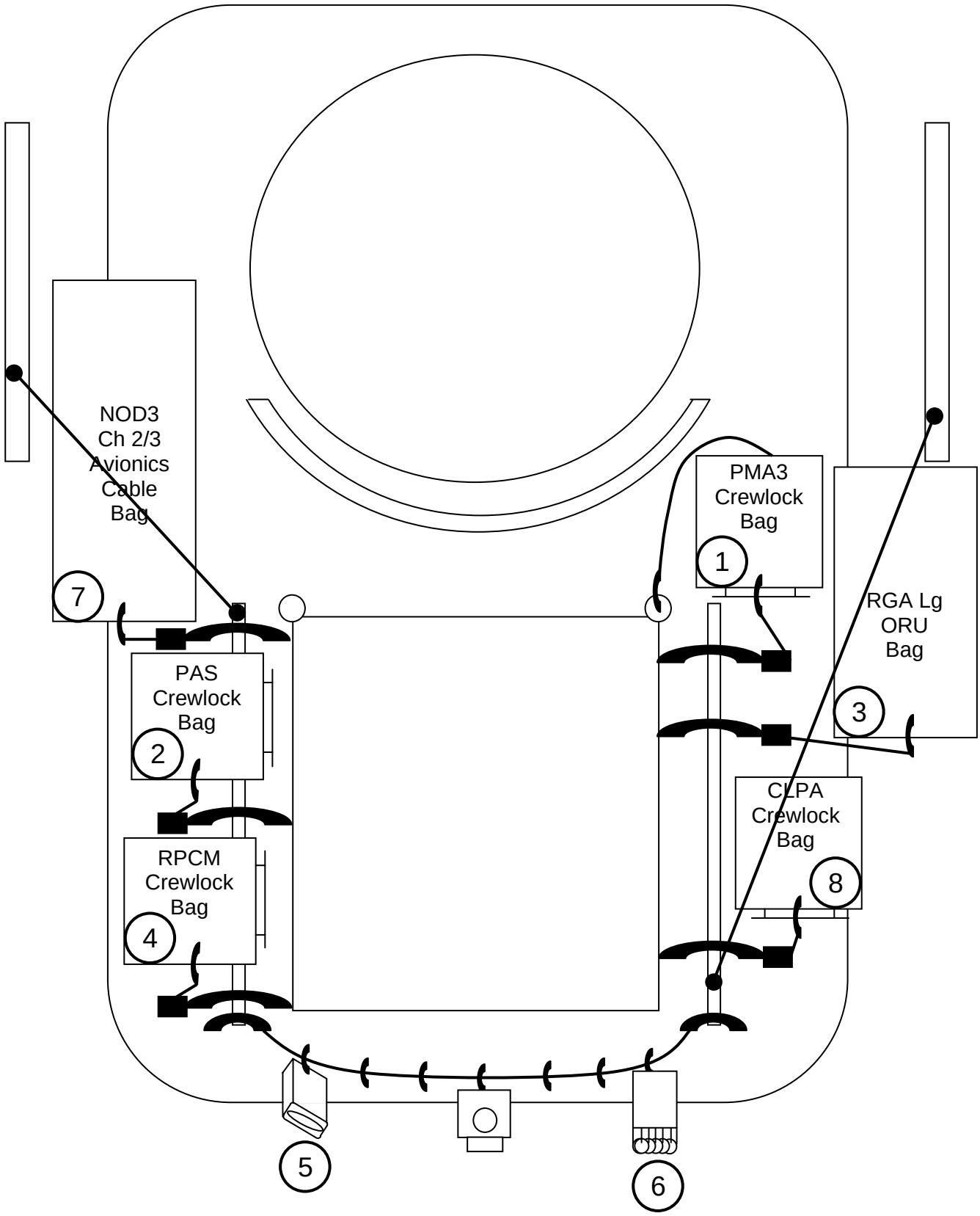

**EVA 1 Crewlock Configuration**

## STS-128 CREWLOCK CONFIGURATION – EVA 2




**EVA 2 Crewlock Configuration**

## STS-128 CREWLOCK CONFIGURATION – EVA 3




**EVA 3 Crewlock Configuration**

EMU MAINT/RECHARGE


WATER RECHARGE ..... TEMP FS 10-2
EMU POWERUP ..... TEMP FS 10-2
WATER FILL ..... TEMP FS 10-2
WATER FILL VERIFICATION ..... TEMP FS 10-2
EMU LiOH CHANGEOUT ..... 10-4
MIDDECK EMU BATTERY RECHARGE (STAND-ALONE) ..... 10-4a
MIDDECK EMU BATTERY RECHARGE/LiOH REPLACEMENT ..... 10-5
INITIATE ..... 10-5
TERMINATE ..... 10-6
IN-SUIT EMU BATTERY RECHARGE/CHARGE VERIFICATION ..... 10-7
INITIATE ..... 10-7
TERMINATE ..... 10-7
EMU POWERDOWN ..... 10-7
HELMET LIGHT/PGT BATTERY RECHARGE ..... 10-8
INITIATE ..... 10-8
TERMINATE ..... 10-9
REBA BATTERY INSTALLATION ..... 10-9
EMU BATTERY REMOVAL/INSTALL ..... 10-10
HELMET LIGHT BULB CHANGEOUT ..... 10-11
REBA BATTERY RECHARGE ..... 10-12
INITIATE ..... 10-12
TERMINATE ..... 10-13
STS-128 CONSUMABLES TRACKING CUE CARD ..... FS CC 10-15
STS-128 EVA BATTERY RECHARGE PLAN ..... FS CC 10-16

## WATER RECHARGE

**IF EMU NOT ALREADY POWERED UP:**

EMU POWERUP

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

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

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

MD(flr) 5. √EMU O2 ISOL VLV – OP

AW82B 6. EV1,2 O2 vlv (two) – OP

DCM 7. PWR – SCU

WATER FILL

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

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

SM 60 TABLE MAINT

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

11. Log value before recharge

| Recharge # | H2O TKB % |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |

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

13. √H2O TKB quantity decreasing

> NOTE
> Full charge requires ~15 min

WATER FILL VERIFICATION

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

SM 60 TABLE MAINT

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

16. Log value after recharge

| Recharge # | H2O TKB % |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |

Cont next page

TOP

**HOOK VELCRO**

## STS-128 CONSUMABLES TRACKING CUE CARD

| | |
|---|---|
| **EV1:** OL | **EV3:** ST |
| **EV2:** FG | **EV4:** |

| | |
|---|---|
| **PWR Usage:** | Use 1024 and 1025 in that order until drained |
| **SAFERs:** | Use 1003 and 1004 |
| **Dump CWC:** | 1059 for all EVAs |

| | | EMU | LiOH/Metox (s/n) | EMU Battery (s/n) | HL Battery (s/n) | REBA (s/n) | PGT Battery (s/n) | Spare PGT Batt (s/n) |
|---|---|---|---|---|---|---|---|---|
| **FD 4: Pre-EVA 1** | Campout | | 0019 (Mtx)<br>0020 (Mtx) | | | | | |
| **FD 5: EVA 1** | OL | 3015 | ___ (LiOH)<br>~ launched in suit | 2080<br>~ launched in suit | 1022, 1025 | 1006 | 1006 | 1009 |
| | ST | 3005 | ____ (LiOH) | 2079 | 1026, 1030 | 1009 | 1008 | |
| **Post EVA 1** | | | Regenerate Camput Metox | | Recharge EVA 1 Batts* | Recharge EVA 1 Batts* | Recharge EVA 1 Batts* | |
| **FD 6** | | | | Recharge EVA 1 Batts* | | | | |
| **FD 6: Pre-EVA 2** | Campout | | 0011 (Mtx)<br>0013 (Mtx) | | | | | |
| **FD 7: EVA 2** | OL | 3015 | ____ (LiOH) | 2082 | 1028, 1029 | 1006 | 1006 | 1009 |
| | FG | 3009 | ____ (LiOH)<br>~ launched in suit | 2081<br>~ launched in suit | 1031, 1035 | 1008 | 1008 | |
| **Post EVA 2** | | | | | Recharge EVA 2 Batts* | Recharge EVA 2 Batts* | Recharge EVA 2 Batts* | |
| **FD 8** | | | | | | | | |
| **FD 8: Pre-EVA 3** | Campout | | 0007 (Mtx)<br>0005 (Mtx) | | | | | |
| **FD 9: EVA 3** | OL | 3015 | ____ (LiOH) | 2078 | 1022, 1025 | 1006 | 1006 | 1009 |
| | FG | 3009 | 0021 (Mtx) | 2080 | 1026, 1030 | 1008 | 1008 | |
| **Post EVA 3** | | | | | Recharge EVA 3 Batts* | Recharge EVA 3 Batts* | Recharge EVA 3 Batts* | |

* See Battery Recharge Plan for battery slot assignments in Battery Stowage Assembly

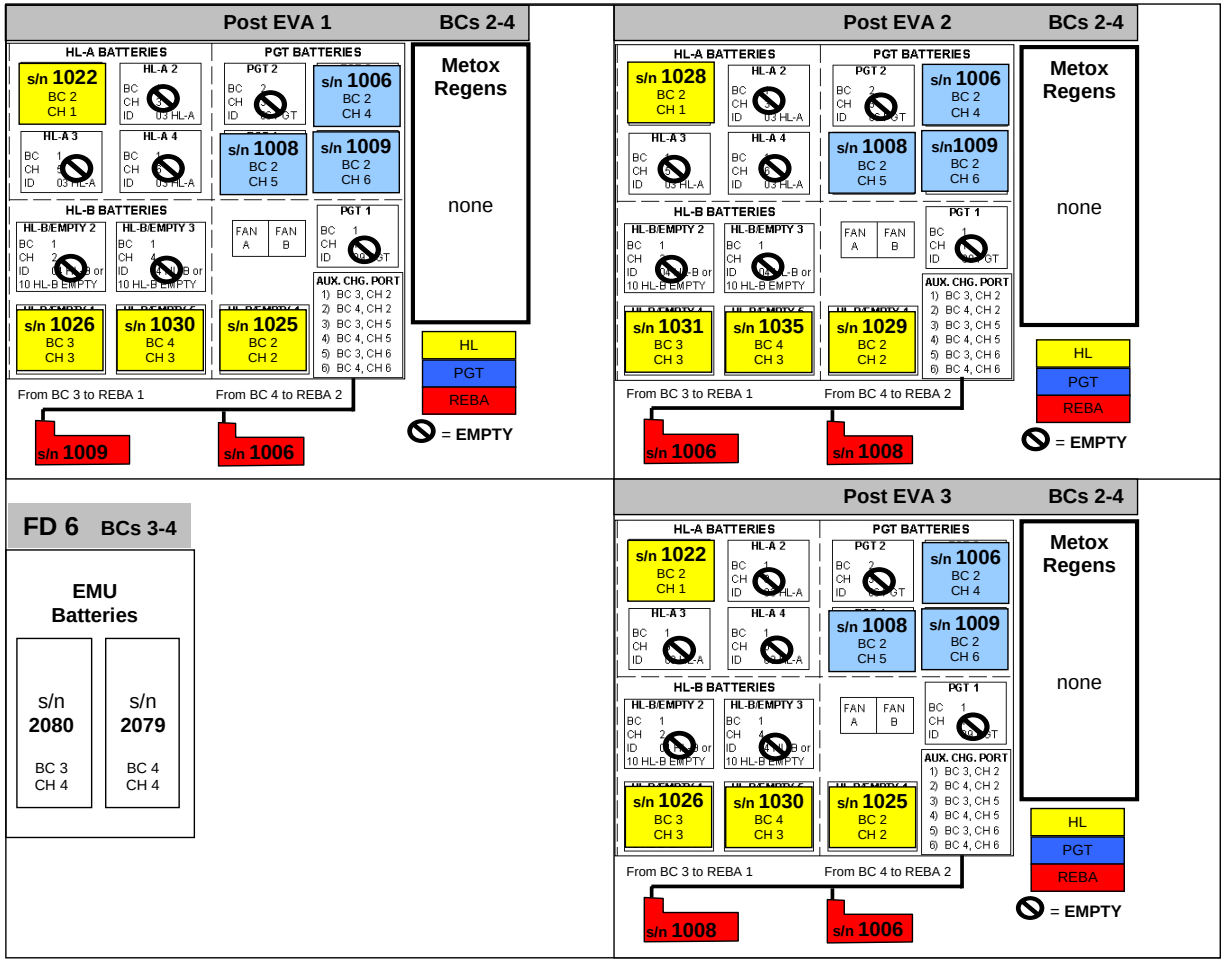
EVA-5a/128/O/A

(reduced copy)

TOP
BACK OF 'STS-128 CONSUMABLES TRACKING CUE CARD'

**HOOK VELCRO**

## STS-128 EVA BATTERY RECHARGE PLAN




EVA-5b/128/O/A

(reduced copy)

DISPLAY LOSS DURING POWER TRANSFER (WARM RESTART)..... TEMP FS 12-2
VACUUM H2O RECHARGE (MANNED)..... TEMP FS 12-2
LiOH REPLACEMENT (MANNED)..... 12-3
BATTERY REPLACEMENT (MANNED) ..... 12-4
WATER DUMP ..... 12-6
SCU SWAP (UNMANNED)..... 12-7
SCU SWAP (MANNED)..... 12-7
EMU COLD RESTART (MANNED) ..... 12-7
12.1 STS EVA DECONTAMINATION..... 12-8
CONTAMINATION TEST..... 12-15
SAFER BATTERY CHANGEOUT ..... 12-18
BENDS TREATMENT ADAPTER (BTA) INSTALLATION (IN-SUIT) ..... 12-19
BTA PREP ..... 12-19
BTA TREATMENT ..... 12-19
BENDS TREATMENT ADAPTER (BTA) INSTALLATION (POST SUIT DOFFING)..... 12-21
BTA PREP ..... 12-21
BTA TREATMENT ..... 12-21
EMU RESIZE..... 12-24
EMERGENCY UNDOCKING EVA TRANSFER ..... FS CC 12-27
EXPEDITED SUIT DOFFING CUE CARD ..... FS CC 12-28
STS-128 NOMINAL EMU SIZING ..... FS 12-29
EMU CONTINGENCY RESIZE MATRIX (STS-128/17A)..... FS 12-33

## DISPLAY LOSS DURING POWER TRANSFER (WARM RESTART)

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

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

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

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

## VACUUM H2O RECHARGE (MANNED)

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

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

TOP

HOOK
VELCRO

# EMERGENCY UNDOCKING
# EVA TRANSFER

**Critical**

- OI EMU 3015
  - Battery installed
  - OI Comm Cap
  - Time permitting: Remove ERCA (Camera), REBA
- Fg EMU 3009
  - Battery installed
  - Fg Comm Cap
  - Time permitting: Remove Metox (if required), ERCA (Camera), REBA
- Bag D
  - OI ECOK
  - Fg ECOK
  - OI LCVG
  - Fg LCVG
- 85-ft Safety Tethers (2)

**Desired**

- EMU Servicing Kit (s/n 5005 preferred)

EVA-6a/128/O/A

TOP
BACK OF 'EMERGENCY UNDOCKING EVA TRANSFER'

HOOK
VELCRO

## EXPEDITED SUIT DOFFING CUE CARD

CAUTION
Verify EV crew is clear of hatch mechanism

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

DOFFING SAFER (5 min)

SAFER 2. Remove latch covers
3. Latch → ENG
4. Latch ccw until release (~90 deg)
5. Doff SAFER

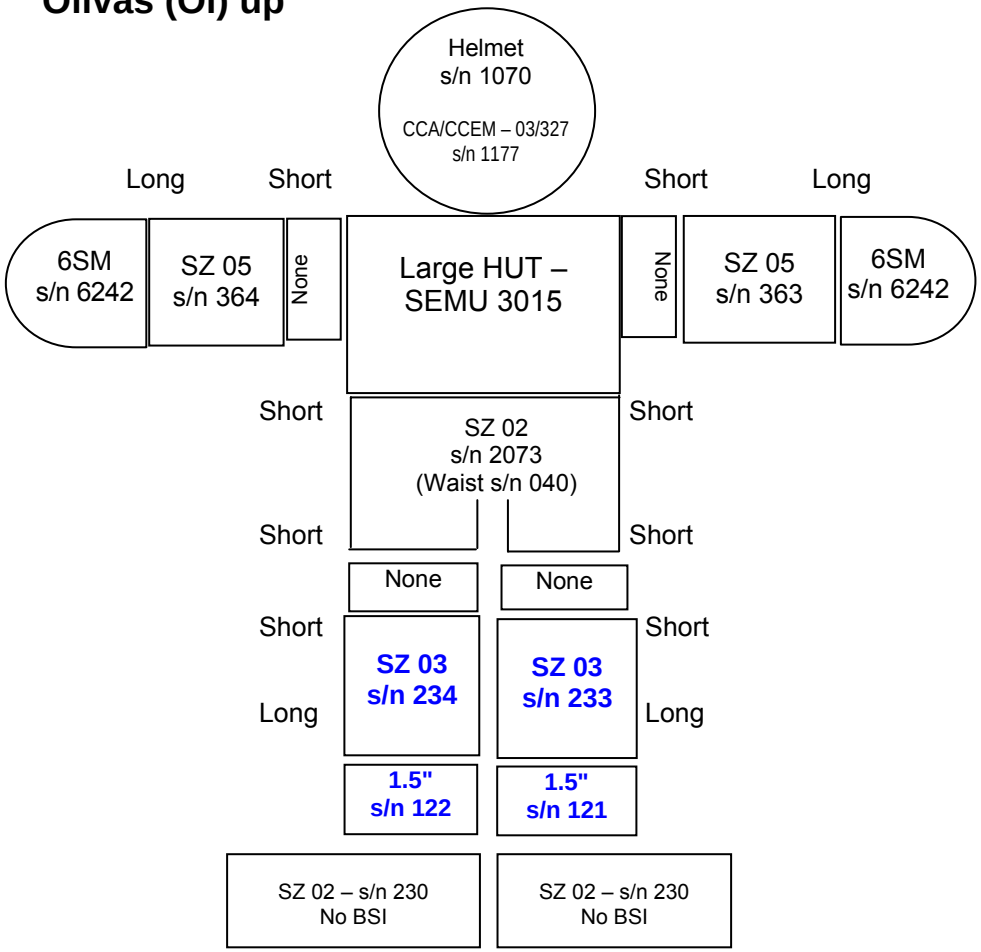
SUIT DOFFING (10 min)

DCM 6. O2 ACT → OFF
7. PURGE vlv → op (up)
PLSS 8. sw REBA → OFF (toward left arm of suit)
9. Engage EMU in EDDA
PLSS 10. EMU TV Power Cable ←|→ EMU EV
DCM 11. √STATUS: SUIT P < 0.4
12. Gloves ←|→ EMU
13. Helmet ←|→ EMU
DCM 14. sw FAN → OFF
15. Doff EMU
16. If taking EMUs to shuttle:
UIA sw PWR EV-1,2 (two) → OFF
√PWR EV-1,2 LEDs (four) – Off
DCM SCU ←|→ DCM
LTA →|← HUT
Gloves →|← EMU
Helmet →|← EMU
Go to the EMERGENCY UNDOCKING EVA TRANSFER Cue Card (opposite side)

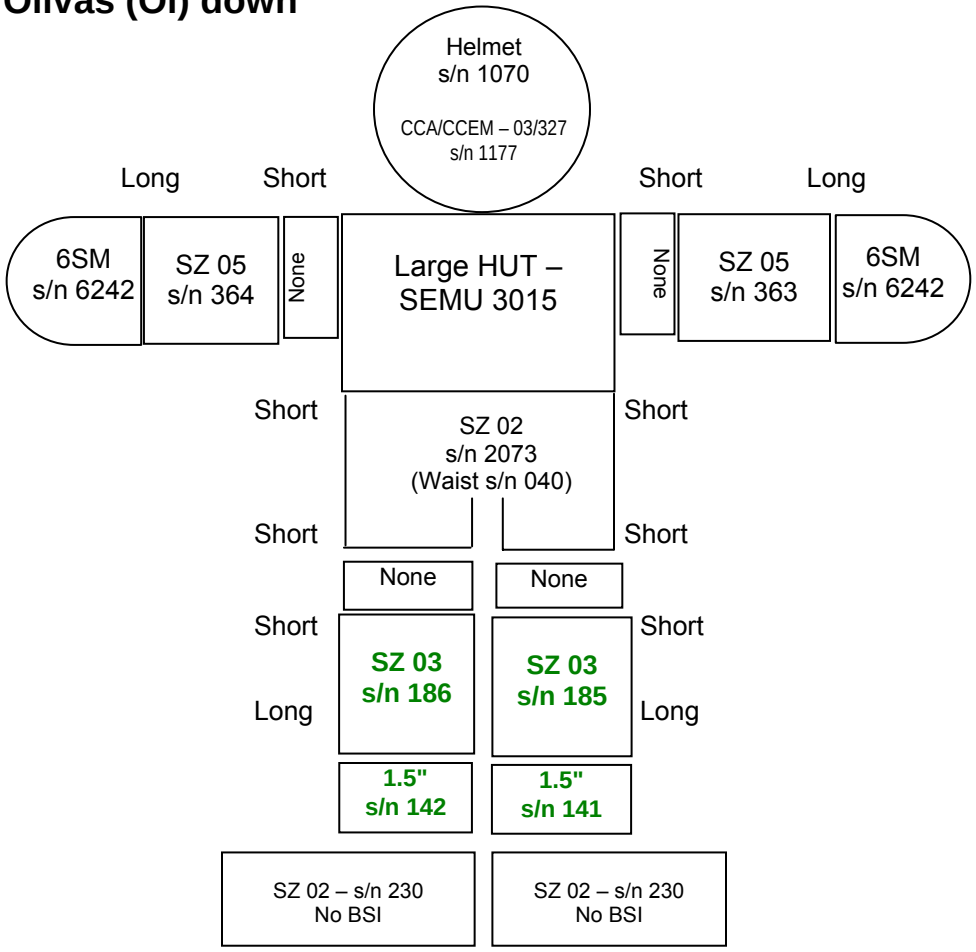
EVA-6b/128/O/A

## STS-128 NOMINAL EMU SIZING

### Olivas (OI) up




### Olivas (OI) down

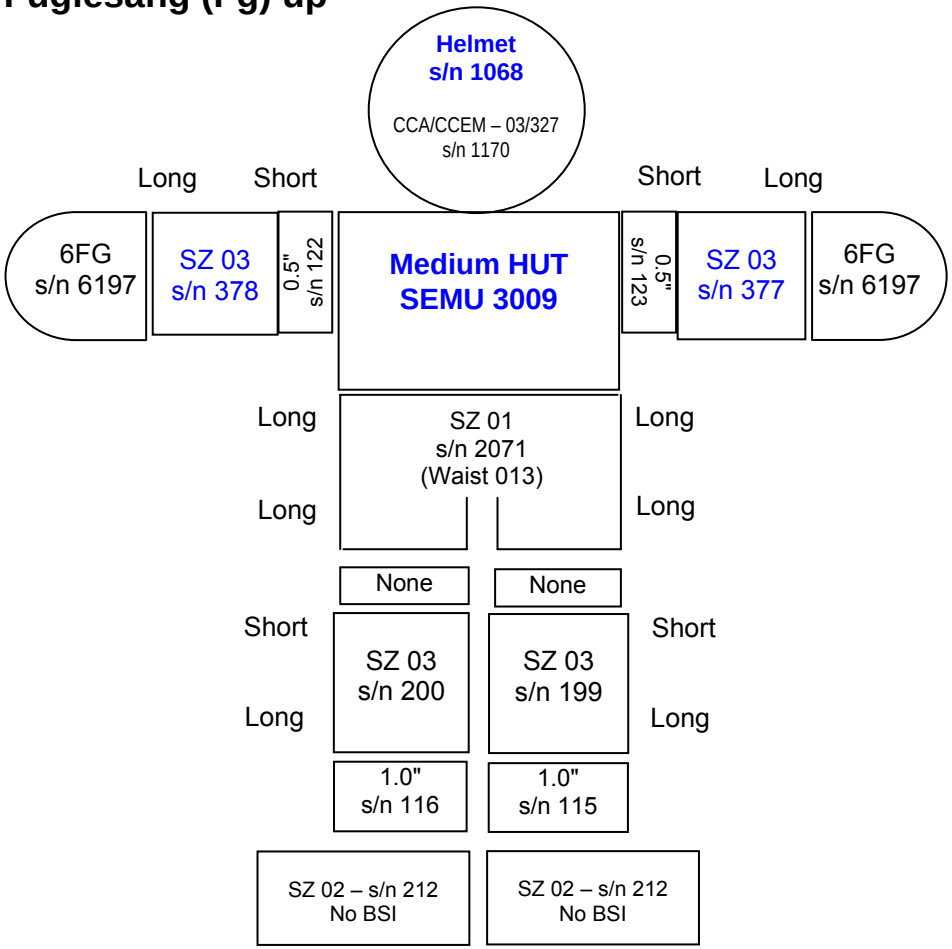



| | Croakie | Fresnel Lens | Valsalva | LCVG/BLVD | MAG | TCU Top | TCU Bottom | Comfort Gloves | Socks |
|---|---|---|---|---|---|---|---|---|---|
| **OI** | None | None | Modified | 06/05 (s/n 3214) Thermal Slippers 07 | -709 (Med) | Large | Large | Custom Tipless | Polypropylene Liner |

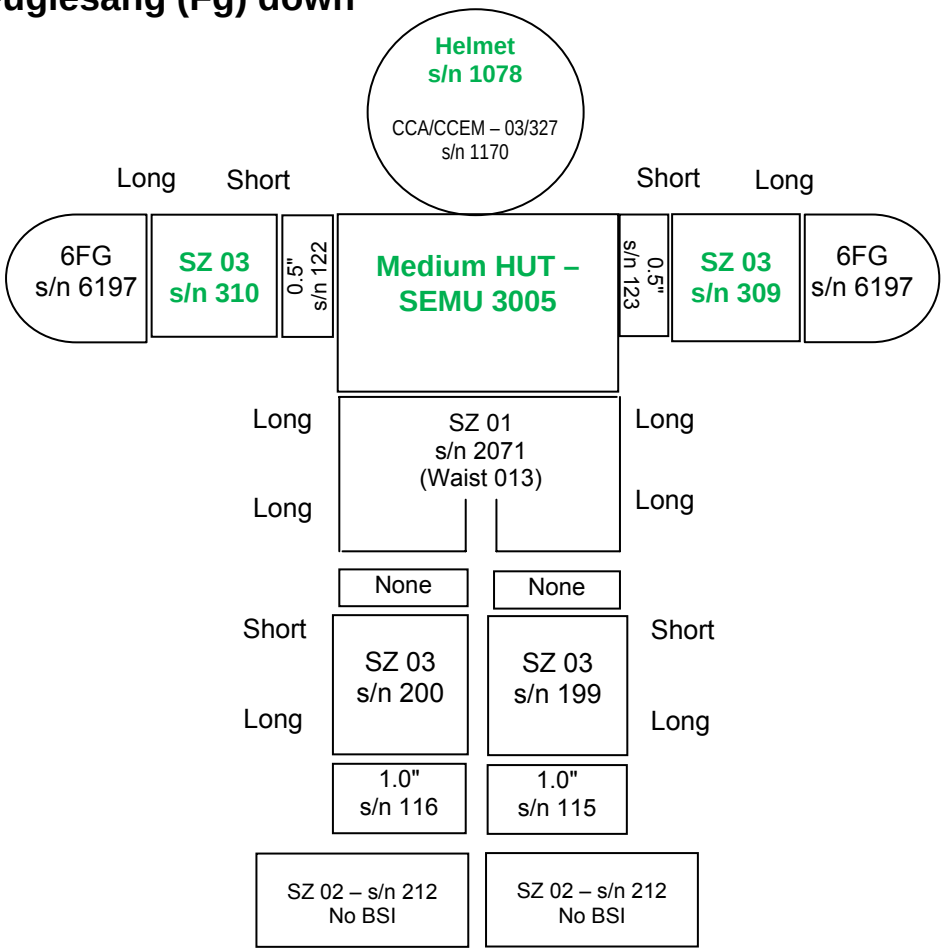
**Blue** – Items launched on Shuttle to remain on ISS
**Green** – Items returning from ISS

## STS-128 NOMINAL EMU SIZING (Cont)

### Fuglesang (Fg) up




### Fuglesang (Fg) down

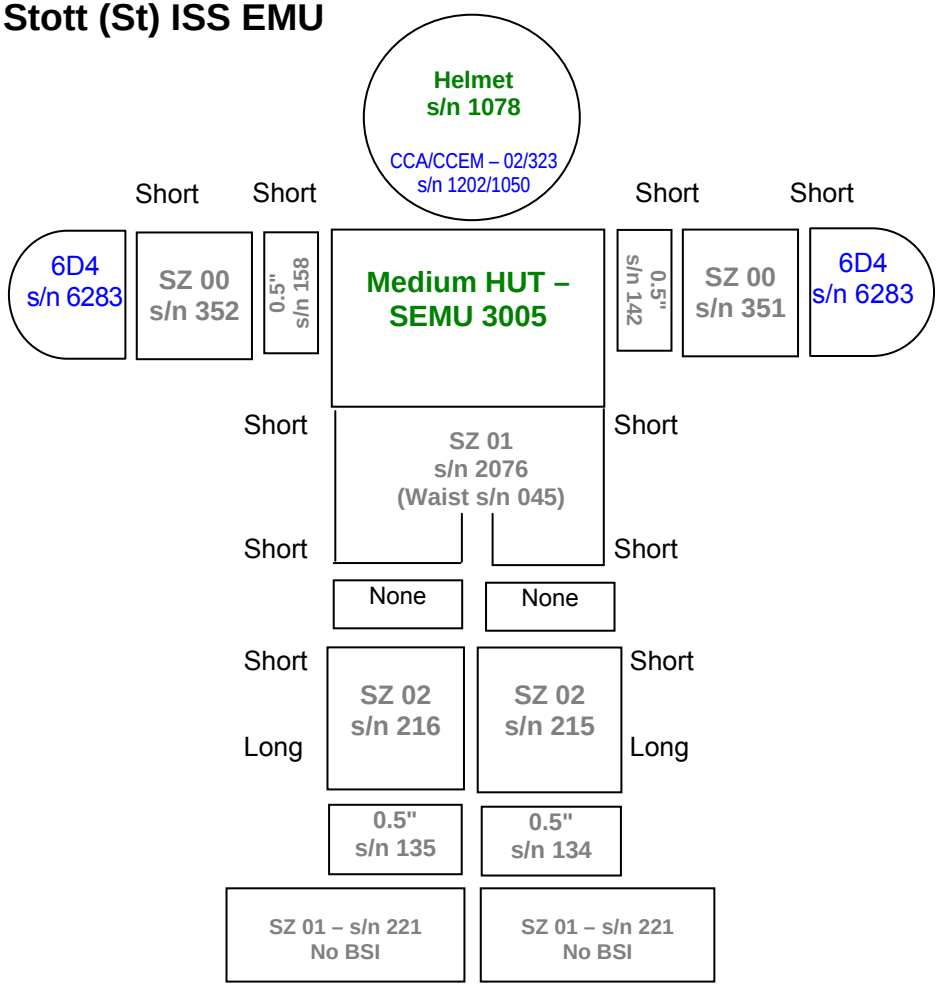



| | Croakie | Fresnel Lens | Valsalva | LCVG/BLVD | MAG | TCU Top | TCU Bottom | Comfort Gloves | Socks |
|---|---|---|---|---|---|---|---|---|---|
| **Fg** | Modified | (4.0 dio) | Standard | 05/05<br>Thermal Slippers 07 | -711<br>(Large) | M | M | Custom GR | Polypropylene Liners (M) |

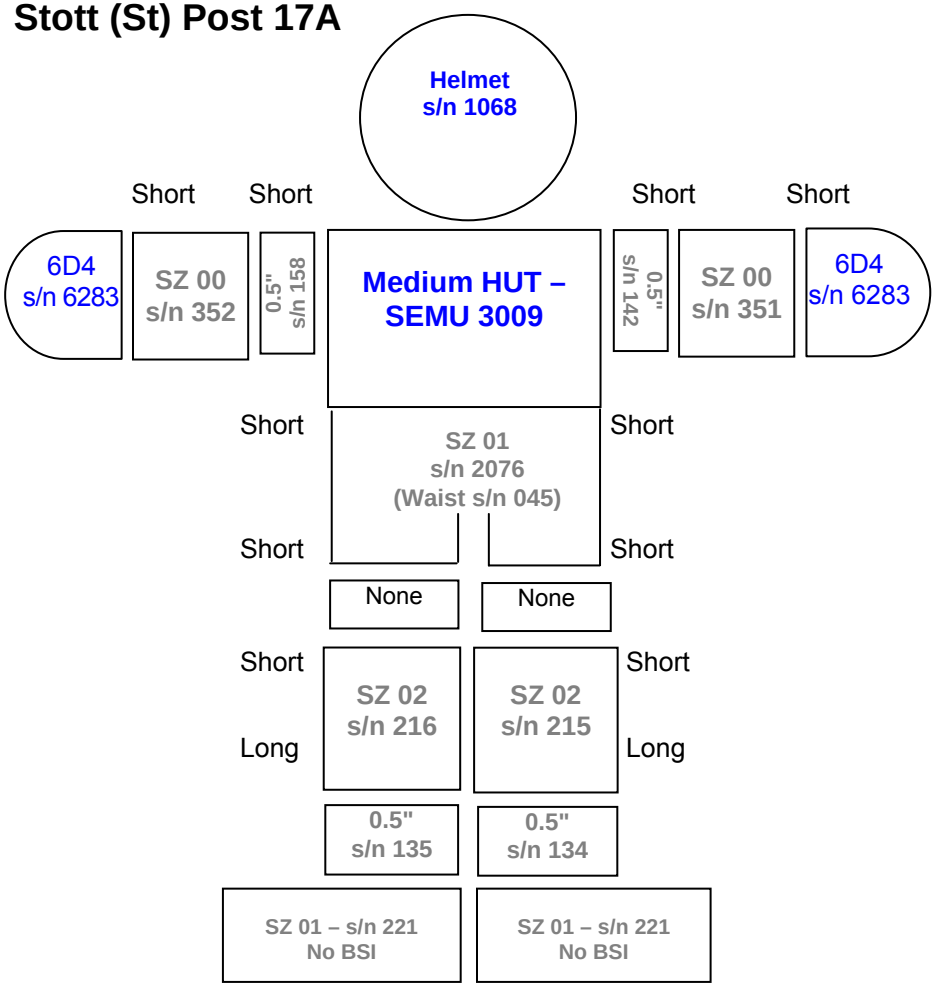
**Blue** – Items launched on Shuttle to remain on ISS
**Green** – Items returning from ISS

## STS-128 NOMINAL EMU SIZING (Cont)

### Stott (St) ISS EMU




### Stott (St) Post 17A

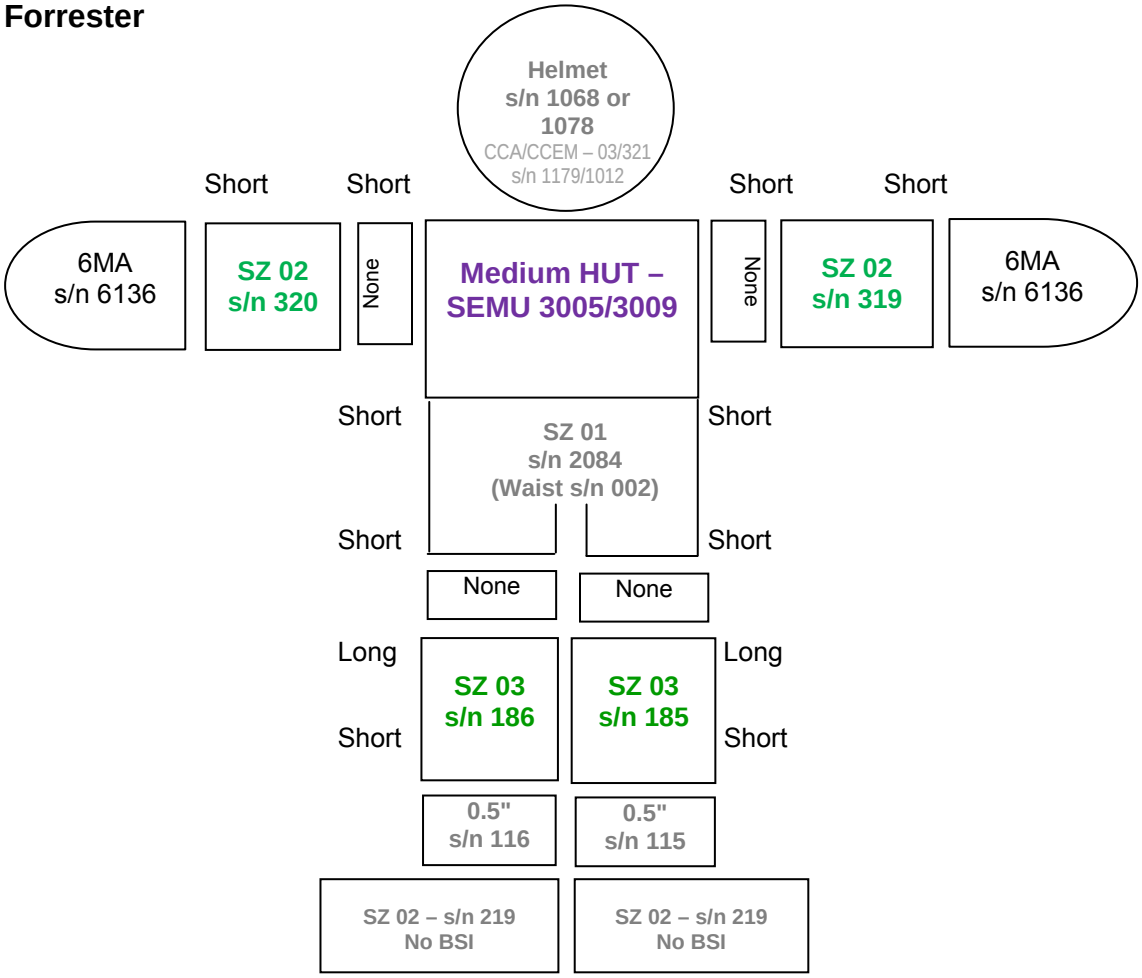



| | Croakie | Fresnel Lens | Valsalva | LCVG/BLVD | MAG | TCU Top | TCU Bottom | Comfort Gloves | Socks |
|---|---|---|---|---|---|---|---|---|---|
| **St** | Modified | DCM: 1.5<br>Cuff: 3.0 | Standard | 01/04<br>Thermal Slippers 04 | -709<br>(Med) | Small | Med | Thin (M) | Polypropylene Liners (M) |

**Blue** – Items launched on Shuttle to remain on ISS
**Green** – Items returning from ISS
**Gray** – ISS items to remain on ISS

## STS-128 NOMINAL EMU SIZING (Cont)

### Forrester




| | Croakie | Fresnel Lens | Valsalva | LCVG/BLVD | MAG | TCU Top | TCU Bottom | Comfort Gloves | Socks |
|---|---|---|---|---|---|---|---|---|---|
| **Fr** | Modified (Use St or Fg) | None | Standard | Use s/n 3216 (Wf 2) – on ISS | -709 (Med) | Medium | Small | Spectra Comfort | Thermax Liner |

**Blue** – Items launched on Shuttle to remain on ISS
**Green** – Items returning from ISS
**Gray** – ISS items to remain on ISS
**Purple** – Use whichever s/n available

## EMU CONTINGENCY RESIZE MATRIX (STS-128/17A)

| FOR LOSS OF: | EV1 – Olivas | EV2 – Fuglesang | EV3 – Stott |
|---|---|---|---|
| **HUT/PLSS** | Use EMU 3011, Large<br>1. Remove glove/arm assys<br>2. Use primary arms, gloves<br>3. √Arm red connects to right, √locks, √cams<br>4. Use primary LTA<br>5. Swap EMU PLSS identifier stripes, national flag<br>6. Swap helmet, comm cap, LiOH/Metox, EMU battery, REBA | Use EMU 3005, Medium (St)<br>1. Remove ring/glove/arm assys<br>2. Use primary ring, arms, gloves<br>3. √Arm red connects to right, √locks, √cams<br>4. Use primary LTA<br>5. Swap EMU PLSS identifier stripes, national flag<br>6. Swap helmet, comm cap, LiOH/Metox, EMU battery, REBA | Use EMU 3009, Medium (Fg)<br>1. Remove ring/glove/arm assys<br>2. Use primary arms, gloves<br>3. √Arm red connects to right, √locks, √cams<br>4. Use primary LTA<br>5. Swap EMU PLSS identifier stripes, national flag<br>6. Swap helmet, comm cap, LiOH/Metox, EMU battery, REBA |
| **CCA** | Use size 03/327 Wk 1 s/n 1208<br>Location: EVA Return Mesh Bag | Use size 03/327 Wk 1 CCA s/n 1208<br>Location: EVA Return Mesh Bag | Use size 02/323 s/n 1175/1036<br>Location: St ECOK |
| **Lower Arm Segment** | Use size 05 arm<br>s/n 411/412 from ISS. Cams S/L (red = right, blue = left)<br>1. √Locks, √cams | Use size 03 arm<br>s/n 375/376 from ISS. Cams S/L (red = right, blue = left)<br>1. √Locks, √cams | Use size 00 arm<br>s/n 371/372 from ISS (up on 17A). Cams S/S<br>(red = right, blue = left)<br>1. √Locks, √cams |
| **Gloves** | Back-up:<br>Use 6SM gloves s/n 6265<br>Location: Bag D | Back-up:<br>Use 6FG gloves s/n 6209<br>Location: Bag D<br>Adjust arm cams L/L | Back-up:<br>Use 6D4 gloves s/n 6284<br>Location: St ECOK<br>√Arm cams S/L |
| **Waist Brief** | Use size 01 waist brief s/n 2075 (031) from ISS. Cams L/L<br>1. Use prime legs, leg rings, and boots<br>2. √Locks, √cams<br>3. Swap EMU brief identifier stripes | Use size 01 waist brief s/n 2075 (029) from ISS. Cams L/L<br>1. Use prime legs and boots<br>2. √Locks, √cams<br>3. Swap EMU brief identifier stripes | Use size 01 waist brief s/n 2075 (029) from ISS. Cams S/S<br>1. Use prime legs and boots<br>2. √Locks, √cams<br>3. Swap EMU brief identifier stripes |
| **Leg Segment** | Use size 03 leg from ISS s/n 231 or 232. Cams S/L<br>1. √Locks, √cams | Use size 03 leg from ISS s/n 231 or 232. Cams S/L<br>1. √Locks, √cams | Use size 02 leg from ISS EMU 3006 s/n 207 or 208. Cams S/L<br>1. √Locks, √cams |
| **Boot** | Use size 02 boots s/n 227 from ISS<br>1. √NO BSI or Toe Cap<br>2. √Locks | Use size 02 boots s/n 227 from ISS<br>1. √NO BSI or Toe Cap<br>2. √Locks | Use size 01 boots s/n 231 from ISS<br>1. √NO BSI or Toe Cap<br>2. √Locks |
| **Sizing Rings** | • 1.5" Leg: Use s/n 125 or 126 from ISS | • 0.5" Arm: Use s/n 167 or 168 from ISS<br>• 1.0" Leg: Use s/n 144 or 145 from ISS | • 0.5" Arm: Use s/n 167 or 168 from ISS<br>• 0.5" Leg: Use s/n 115 or 116 from ISS |
| **LCVG** | (06/05)<br>1. Use s/n 3223<br>Location: A/L Floor Bag<br>2. Transfer biomed and dosimeter | (06/05)<br>1. Use s/n 3223<br>Location: A/L Floor Bag<br>2. Transfer biomed and dosimeter | (01/04)<br>1. Use s/n 3197<br>Location: Stott ECOK<br>2. Transfer biomed and dosimeter |

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# TPS REPAIR

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

A PDF and a WORD version of the procedures can be found at: http://mod.jsc.nasa.gov/do3/FDF/FDFBooks/Status%20Sheets/index.html. Select the "As Flown" Status sheet for STS-128 and the link to the procedures can be found with the link to the EVA FS. The procedures can also be found on the FDF Books CD provided to the FAO console


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## STS-128/17A WORKAROUNDS CRIBSHEET

### EVA 1 CONTINGENCIES

| TASK | FAILURE | ACTION |
|---|---|---|
| **ATA Removal** | **EMPTY ATA REMOVAL** | |
| | A. Bolt 3: Initial torque cannot be released using ratchet wrench | 1. Retrieve 7/16 flush socket from round TM board in slot 5 of Z1 stbd toolbox<br>2. Use Torque multiplier to break torque. Only 1 turn on the bolt (5 turns with PGT/TM equals one turn on the bolt)<br>**PGT: [B4 (19.4), CCW1, 30.5]**<br>√TM anti-backlash in neutral 1 turn only on the bolt (5 turns with PGT/TM equals one turn on the bolt)<br>3. If no joy, increase PGT setting:<br>**PGT: [B7 (25.5), CCW1, 30.5]**<br>√TM anti-backlash in neutral<br>1 turn only on the bolt (5 turns with PGT/TM equals one turn on the bolt)<br>4. Once torque broken, remove TM, socket swap and return to nominal release torque<br>**PGT: [B7 (25.5), CCW2, 30.5], 7/16 -6-ext** |
| | B. Bolt 1, 2, and 4: Initial torque cannot be released | 1. Increase torque on bolt for 1 turn **PGT: [B7 (25.5), CCW2, 30.5]**. Return to nominal release torque **PGT: [B6 (24.0), CCW2, 30.5]**<br>2. If no joy, attempt to release with ratchet wrench in ccw direction<br>3. If no joy, retrieve cheater bar & reattempt to release |
| | C. ATA fails to release from soft dock | 1. If bolt 2 or 4, attempt to use BRS pin tool to exercise plungers<br>2. Use prybar to pry the ATA from structure near sticky plungers |
| **FRAM** | **EUTEF** | |
| | A. Active FRAM fails to seat on passive FRAM | 1. Check for FOD in mechanism<br>2. Check alignment. (Engage 2 forward shear pins first to ensure connector door is not jamming) |
| | B. Primary FRAM bolt fails to release | 1. Confirm socket fully engaged to release anti-rotation mechanism<br>2. Increase PGT setting:<br>**PGT: [B2 (16.0), CCW2, 30.5], 7/16 -6-ext**<br>1 turn only to break torque; reset PGT to **A7 (9.2)** for full run-out of bolt<br>3. Increase PGT setting:<br>**PGT: [B4 (19.4), CCW2, 30.5], 7/16 -6-ext**<br>1 turn only to break torque; reset PGT to **A7 (9.2)** for full run-out of bolt<br>4. If no joy, check MCC-H for re-securing EuTEF on EPF |
| | C. Primary FRAM bolt fails to engage | 1. Verify FRAM seated<br>2. Check for FOD<br>3. Back out primary bolt fully:<br>**PGT: [A7 (9.2), CCW2, 30.5], 7/16 - 6-ext**<br>If no joy backing bolt out, see Block B<br>4. Reattempt engagement<br>**PGT: [A7 (9.2), CW2, 30.5], 7/16 - 6-ext** |

| TASK | FAILURE | ACTION |
|---|---|---|
| | | 5. Increase PGT setting:<br>**PGT: [B2 (16.0), CW2, 30.5], 7/16 - 6-ext**<br>6. Increase PGT setting:<br>**PGT: [B4 (19.4), CW2, 30.5], 7/16 - 6-ext**<br>7. Consider hold for thermal stabilization between active and passive FRAM<br>8. Engage contingency locking pins:<br><br>NOTE<br>4 of 4 contingency pins required for PLB LMC; 3 of 4 contingency pins required for EPF<br><br>– Front pins<br>**PGT: [A4 (6.3), CW2, 30.5], 7/16 - 6-ext**<br>14.11 – (1.25 * Turns on Primary Bolt) turns<br><br>NOTE<br>Aft contingency pins can only be installed if the primary bolt turn count is 6.5 turns or less. With greater than 6.5 turns on the primary bolt, the contingency pins are not needed and, in some cases where the primary bolt is mostly installed, cannot be installed<br>– Aft pins for LMC FRAM<br>– Prep CPK by disengaging J-hook on locking mechanism; ensure J-hook fully seated in unlock position<br>– Slide T-handle until contingency pin contacts primary FRAM pin (# on locking mechanism counter = # of turns on primary FRAM bolt)<br>– Disengage J-hook from unlock position. J-hook is spring loaded and will "pop" into place if not precisely aligned with numbered slot. Fully seat J-hook in lock position<br><br>– Aft pins for reinstallation on EPF<br>– Remove bolt from STOW location and engage in INSTALL location<br>– Manually turn bolt as far as possible<br>– **PGT: [B1 (12.0), CW2, 30.5], 7/16 - 6-ext** 16.858 – (1.25 * Turns on Primary Bolt) turns |
| | **MISSE 6** | |
| | A. PEC Dust cap fails to release from LWAPA | Increase torque. Use tether hook on tether point for leverage |
| | B. PEC Dust cap fails to install on PEC | 1. Verify keying feature properly aligned prior to installation<br>2. Verify cap fully seated<br>3. Discard cap in trash bag |
| | C. Wing tab connector fails to release from PEC | 1. Verify releasing connector counterclockwise<br>2. Increase torque |

| TASK | FAILURE | ACTION |
|---|---|---|
| | D. Wing tab connector fails to mate to LWAPA | 1. Verify wing tab in disengaged posn prior to installation<br>2. Verify connector fully seated<br>3. Inspect:<br>FOD<br>EMI band<br>Bend radius<br>Connector keying features<br>4. If installation no joy, close TA clamps to secure cable to LWAPA |
| | E. PEC PIP pins used to restrain PEC open will not release | Lightly tap detent end of PIP pin (end opposite pull ring) with hammer (6" max stroke, use metal side of hammer) |
| | F. PEC cannot be restrained closed with PIP pin(s) | 1. One PIP pin is sufficient to restrain the PEC closed during translation<br>2. If both PIP pins fail, secure PEC closed with adjustable tether. Remove tether after installed with clamps in sidewall carrier. (PIP pins not required for landing) |
| | G. LWAPA Socket PIP pins will not release PEC | 1. Increase force on pull ring, stop if deformation occurs<br>2. Strike detent end of PIP pin (end opposite pull ring) with hammer (6" max stroke, use metal side of hammer); reattempt step 1<br>3. If no joy, place the edge of a prybar along the detent end of PIP pins, strike with hammer (6" max stroke, use metal side of hammer); reattempt step 1<br>4. If no joy, insert BMRRM tool axially into detent end of PIP pin and strike with hammer (4" max stroke, use metal side of hammer); reattempt step 1<br>WARNING<br>Top of stem is sharp edge once PEC is removed<br>5. If no joy, reinstall PIP pins, hammer if necessary (6" stroke max)<br>6. **PGT: [B1 (12.0), CCW2, 30.5], 7/16 - 6-ext** Release override bolt 6 turns (turn count critical)<br>7. Clamp FRT to bolt behind washer<br>8. **PGT: [B1 (12.0), CCW2, 30.5], 7/16 - 6-ext** Remove bolts ~5.1 turns. Discard bolt in trash bag<br>9. Repeat step 4-7 for 2nd bolt |
| | H. Clamp PIP pin will not release for PEC install | 1. Increase force on pull ring, stop if deformation occurs<br>2. Lightly tap detent end of PIP pin with hammer |

## STS-128/17A WORKAROUNDS CRIBSHEET (Cont)

| TASK | FAILURE | ACTION |
|---|---|---|
| | I. Sidewall carrier clamp will not release | 1. Inspect for damage<br>2. Increase force on clamp lever<br>3. Tether to clamp and release clamp hinge bolt (just zenith of carrier handrail) **PGT: [B1 (12.0), CCW2, 30.5]** (96 turns) – bolt not captive<br>4. Discard bolt in trash bag (ok to land with 1 clamp only) |
| | J. Sidewall carrier clamp will not latch on MISSE | 1. Inspect for damage and verify PEC orientation<br>2. Increase force on clamp lever<br>3. Engage second latch, secure loose clamp with wire tie (ok to land with 1 clamp only) |
| | K. Clamp PIP pin will not install | 1. Lightly tap PIP pin with hammer<br>2. PIP pin not required for landing |

### EVA 2 CONTINGENCIES

| TASK | FAILURE | ACTION |
|---|---|---|
| | **ATA Release from LMC** | |
| | A. Bolt 1, 2, and 4: Initial torque cannot be released | 1. Increase torque on bolt for 1 turn **PGT: [B7 (25.5), CCW2, 30.5]**. Return to nominal release torque **PGT: [B6 (24.0), CCW2, 30.5]**<br>2. If no joy, attempt to release with ratchet wrench<br>3. If no joy, retrieve cheater bar & reattempt to release |
| | B. Bolt 3: Initial torque cannot be released | 1. Use Torque multiplier to break torque. 1 turn on the bolt (5 turns with PGT/TM). **PGT: [B4 (22.0), CCW1, 30.5]** √TM anti-backlash in neutral<br>2. Return to nominal release torque without TM **PGT: [B6 (24.0), CCW2, 30.5]** |
| | **ATA Install on P1** | |
| | A. Bolt 1, 2, and 4 will not install on P1 | 1. Verify bolts 2 and 4 over soft-dock plungers<br>2. Verify spherical bearings not blocking clevis. If misaligned, use BRS pin tool to center bearing Install remaining bolts (3 of 4 bolts required if bolt 1 out. 4 of 4 required if any other bolt not installed)<br>3. If no joy and issue is on other than bolt 1, perform tie down procedure |
| | B. Bolt 3 will not install on P1 | 1. Verify bolts 2 and 4 over soft-dock plungers<br>2. Verify bolt 3 spring is being depressed<br>3. Increase torque, **PGT: [B7 (25.5), CW2, 30.5]**<br>4. **PGT/TM: [B1 (12.0), CW1, 30.5]** √TM anti-backlash in neutral<br>5. If alignment in question, install bolts 2 and 4 before reattempting to install bolt 3<br>6. If no joy, perform tie down procedure |
| | C. ATA fails to engage in soft dock | 1. If bolt 2 or 4, use BRS pin tool to exercise plungers<br>2. If plunger problem exists on bolt 3, depress bolt spring, drive bolt 3 to override plungers **PGT: [B7 (25.5), CW2, 30.5], 7/16 – 6-ext** |

| TASK | FAILURE | ACTION |
|---|---|---|
| | **Empty ATA to LMC** | |
| | A. Bolt 1, 2, and 4 will not install on LMC | 1. Verify bolts 2 and 4 over soft dock plungers<br>2. Verify spherical bearings not blocking clevis. If misaligned, use BRS pin tool to center bearing<br>3. Increase torque on bolt for 1 turn **PGT: [B7 (25.5), CW2, 30.5]**. Return to nominal install torque **PGT: [A7 (9.2), CW2, 30.5]** (4 of 4 bolts required for landing) |
| | B. Bolt 3: Will not install on LMC | 1. √Alignment of all 4 bolts and 2,4 over soft dock plungers<br>2. Verify ATA MLI not causing interference<br>3. Verify bolt 3 spring is being depressed<br>4. Increase torque **PGT: [B7 (25.5), CW2, 30.5]**<br>5. **PGT/TM: [A7 (9.2), CW1, 30.5]**<br>√TM anti-backlash in neutral<br>6. If alignment in question, install bolts 2 and 4 before reattempting to install bolt 3 (4 of 4 bolts required) |
| | C. ATA fails to engage in softdock | 1. Verify no FOD and MLI clear of interface<br>2. If bolt 2 or 4, use BRS tool or probe to exercise plungers<br>3. If plunger problem exists on bolt 3, depress bolt spring, drive bolt 3 to override plungers **PGT: [B7 (25.5), CW2, 30.5], 7/16 – 6-ext** |
| | **SSRMS Snares fail to Release ATA** | |
| | A. SSRMS fails to release FGB | Go to FS 16-56 [FGB GRAPPLE SHAFT RELEASE, step 1] |
| **Retrieval from ATA** | **FGB** | |
| | A. FSE bolt initial torque cannot be released | 1. For one turn only, Ratchet Collar – RCCW, reattempt release, then PGT **[B7]** for remaining turns<br>2. If no joy, **PGT: [B7 (25.5), CCW2, 30.5]**; release all remaining bolts, then retrieve EVA ratchet from crewlock bag; re-attempt release of last bolt (failure ~60 ft-lb) – discard any FOD in trash bag<br>3. If no joy, retrieve cheater bar and reattempt to break bolt<br>4. If no joy, contact MCC (FGB not certified to land on ATA) |
| | B. FSE bolt jams mid-travel during release | 1. Ratchet Collar – **RCCW**, attempt 1 turn of bolt, then **PGT [B7],** release remaining turns<br>2. If no joy, release all remaining bolts and attempt to remove FGB by tilting<br>3. If no joy, retrieve EVA ratchet from crewlock bag, re-attempt release of last bolt (failure ~60 ft-lb) – discard any FOD in trash bag<br>4. If no joy, retrieve cheater bar and reattempt to break bolt<br>5. If no joy, retrieve prybar/hammer and attempt to physically slide FGB down to opening of key feature |

| TASK | FAILURE | ACTION |
|---|---|---|
| | | 6. Use prybar to put a bending moment into bolts, providing a gap to slide FGB down to opening in key feature<br>7. If no joy, contact MCC. (FGB not certified to land on ATA) |
| | C. Ball Plunger (spring loaded ball detent soft dock) at GP3 location is stuck | 1. Apply more force when attempting to slide FGB baseplate past bolts<br>2. If no joy, attempt to depress/unstick plunger using BRS pin tool<br>3. If no joy, depress plunger with BRS pin tool while simultaneously hitting the support bracing of FGB with hammer to move FGB past plunger<br>4. If BRS pin tool unable to exercise plunger, retrieve bolt puller to exercise plunger |
| **Return FGB to S1 ATA** | **FGB to S1 ATA** | |
| | A. FGB fails to install onto ATA | 1. Verify FGB GP3 ball plunger is not stuck<br>2. As reqd, release bolts an additional 2-3 turns: **PGT: [B7 (25.5), CCW2, 30.5]** |
| | B. FGB mounting bolt fails to engage | 1. **PGT: [B7 (25.5), CCW2, 30.5]** back out bolt 2-3 turns, then reattempt engagement **PGT: [A7 (9.2), CW2, 30.5]**<br>2. If no joy, **PGT: [B7 (25.5), CCW2, 30.5]**, back out all bolts 2-3 turns, inspect for FOD; Reattempt 2-3 turns at a time in a cross pattern (start with GP2) **PGT: [A7 (9.2), CW2, 30.5]** |

**EVA 3 CONTINGENCIES**

| TASK | FAILURE | ACTION |
|---|---|---|
| **PAS Deploy** | **PAS DEPLOY** | |
| | A. Deploy/Stow clevis bracket bolt fails to break torque | 1. Use PGT in manual ratchet mode **[RCCW, 30.5]**<br>2. Retrieve torque wrench from A/L staging bag. Set to 41 ft-lb and reattempt release |
| | B. ADP/PIP pin does not release | Retrieve hammer from PAS Crewlock Bag and with ADP in full open position, tap it in farther to relax collets. Reattempt removal |
| | C. Yoke PIP pin does not release after loosening clevis bolts | 1. Loosen Stow Clevis Bracket bolts (4) **PGT [B7 (25.5), CCW2, 30.5]-7/16-6-in ext,** approx 4 turns each<br>2. Re-attempt removal of yoke PIP pin and/or yoke ADP, secure using pre-installed wire tie<br>3. If does not release after loosening bolts; retrieve hammer from PAS Crewlock and tap out PIP pin |
| | D. SARJ launch bolt fails to break torque | Increase to **PGT [B7 (25.5), CCW2, 30.5]** for 1 turn, then return to original setting |
| | E. Cup-cone bolt fails to break torque | Increase to **PGT [B7 (25.5), CCW2, 30.5]**. (Do not go to hard stop at this setting) |

| TASK | FAILURE | ACTION |
|---|---|---|
| | F. Strut cone cannot be removed from cup interface | 1. Inspect for clearance between cup and cone, if reqd, **PGT [A7 (9.2), CCW2, 30.5]-6 ext 7/16**: Release bolt to hardstop<br>2. Wiggle brace (worked during VITT deploys) Consider hold for thermal stabilization. Check MCC-H before proceeding to hammer<br>3. Retrieve hammer and tap brace with plastic end of hammer |
| | G. Clevis bracket bolt fails to achieve full torque and turns | Back out the bolts fully and reattempt installation |
| | H. Yoke PIP pin does not install | 1. Open handle of Yoke ADP and reattempt installation. If joy, close ADP handle<br>2. If no joy, manipulate yoke to align PIP pin holes. If joy, close ADP handle |
| | I. Yoke will not install in Deploy Clevis Bracket | 1. Loosen Deploy Clevis Bracket bolts (4), approx 4-6 turns, **PGT [RCW, 30.5]**-7/16-6-in ext<br>2. Re-attempt yoke installation, wiggle brace/yoke<br>3. If joy, remove yoke, re-tighten Deploy Clevis Bracket bolts (4) **PGT [B5 (22.0), CW2, 30.5]-6 ext 7/16**, to hard stop, approx 4-6 turns<br>4. Apply final torque, **PGT [RCW, 30.5]**-7/16-6-in ext, 2 clicks |
| | J. ADP will not install in Deploy Clevis Bracket | 1. Loosen Deploy Clevis Bracket bolts (4), approx 4-6 turns<br>a. Some bolts will require Torque Wrench 2-in ext at 31 ft-lb<br>b. Remaining bolts, **PGT [RCW, 30.5]**-7/16-6-in ext<br>2. Re-attempt ADP installation<br>3. Re-attempt PIP pin installation<br>4. Engage Deploy Clevis Bracket bolts (4) to hard stop, approx 4-6 turns<br>❑ Some bolts will require RAD (attempt w/fingers first)<br>❑ **PGT [A7 (9.2), CW2, 30.5]-RAD w/7/16-2-in ext** (count turns at bolt head)<br>❑ Remaining bolts, **PGT [B5 (22.0), CW2, 30.5]-6 ext 7/16**<br>5. Apply Final Torque<br>❑ Torque wrench 2-in ext at 31 ft-lb<br>❑ Remaining bolts, **PGT [RCW, 30.5]-6 ext 7/16** |

| TASK | FAILURE | ACTION |
|---|---|---|
| **Detent Release Tool** | **Detent Release Tool** | |
| | A. Unable to install DRT in softdock position | 1. Verify DRT knob fully driven in release direction (cw)<br>2. Check hinge interface for FOD or other interference<br>3. Squeeze DRT tongs and verify pins are fully recessed inside DRT housing<br>4. Inspect DRT for FOD or other interference<br>5. Attempt to install tool at different angle relative to hinge<br>Attempt install with second DRT if not yet installed |
| | B. Unable to achieve 7 turns or black markings not visible | 1. Inspect tool/hinge area to verify both DRT pins engaged in hinge holes, no FOD or other interference<br>2. Access DRT lever arms to determine if one arm is driven significantly more than the other (indicating possible stuck plunger)<br>3. **PGT [A1 (2.5), CCW2, 30.5]**: Drive DRT knob until points of silver marking visible (~7 turns total)<br>4. If DRT arms equally driven, install second DRT (if reqd), loosen tiedown tethers and attempt UCCAS/PAS deploy<br>5. Remove DRT, **PGT [A1 (2.5), CW2, 30.5]**, inspect for damage<br>6. Cycle uninstalled DRT, verify knob turn 7 turns ccw, points of silver marking exposed and pins locked in extended position<br>7. Reattempt DRT installation |
| | C. Unable to release/remove DRT from hinge | 1. If knob not fully flush with top of DRT housing<br>a. Cycle DRT knob to full install position (ccw), then full release (cw)<br>b. **PGT [A1 (2.5), CW2, 30.5]**: Drive knob in release direction till flush with top of DRT housing<br>c. Secure DRT with wire tie through hinge ADP hole and leave in place<br>2. If knob flush with top of DRT housing<br>a. Apply additional force to retract pins using equipment hooks or tether wrapped around lever arms<br>b. Re-engage DRT to fully driven position until points of silver markings visible, ~7 ccw<br>c. Secure DRT with wire tie through hinge ADP hole and leave in place |

| TASK | FAILURE | ACTION |
|---|---|---|
| **RGA R&R** | **RGA R&R** | |
| | A. Bolt fails to release | 1. Increase torque:<br>**PGT: [RCCW, 30.5]** for one turn only<br>2. If no joy, release all other engaged bolts and reattempt release on failed bolt<br>3. If no joy, reinstall all bolts and perform tether tiedown plan using AET; ensure AET completely covered by MLI upon installation. If time available, use LDTD tether instead of AET |
| | B. RGA ball plungers stuck, RGA fails to remove from guide rails | 1. Increase extraction force<br>2. Retrieve BRS pin tool. Insert in interface between baseplate and lower guide rail. Apply a bending moment to help clear the lower detent from the stuck lower plunger<br>3. Use hammer on RGA baseplate |
| | C. Bolt fails to install | 1. Inspect RGA alignment & bolts<br>2. If bound midtravel, back out at **PGT [A2]**, and then re-engage at **PGT [A2]**<br>3. If no joy, increase torque: **PGT: [B7 (25.5), CW2, 30.5** and reattempt for one turn, then return to nominal setting **PGT [A2 (3.8), CW2, 30.5]**<br>4. If no joy, install remaining bolts and perform tether tiedown plan using AET; ensure AET completely covered by MLI upon complete installation. If time available, use LDTD tether instead of AET. 4 of 4 bolts required, or 2 of 4 bolts with tiedown required to leave the RGA installed |
| | D. Fails to slide in track | 1. Verify all bolts popped up<br>2. If attempting install, remove & check for FOD in track, exercise plungers with BRS pin tool<br>3. Check alignment, reattempt Installation |
| **RPCM R&R** | **RPCM R&R** | |
| | A. RPCM jacking bolt will not release | 1. Verify socket is fully installed on the bolt (releases the anti-rotation locking tangs)<br>2. Increase torque for one turn only.<br>**PGT: [B1 (12.0), CCW2, 30.5]**<br>3. If no joy, perform tether tiedown plan using AET; ensure AET completely covered by MLI upon complete installation. If time available, use LDTD tether instead of AET |
| | B. Spare RPCM did not achieve full turns (6 turns) | 1. Verify RET hook installed correctly<br>2. Remove RPCM with PGT settings:<br>**[A7 (9.2), CCW2, 30.5]**, verify no FOD<br>3. If no joy on removal, perform Block A<br>4. Reattempt installation with PGT settings:<br>**[A2 (3.8), CW2, 30.5]**<br>5. If no joy, perform tether tiedown plan using AET; ensure AET completely covered by MLI upon complete installation. If time available, use LDTD tether instead of AET |
| | C. Status indicator did not travel to LOCK | As long as torque and turns achieved, no action |

## STS-128/17A WORKAROUNDS CRIBSHEET (Cont)

| TASK | FAILURE | ACTION |
|---|---|---|
| **PMA2 HTR Cable Disconnect from PMA3** | **PMA3 HTR CABLE DISCONNECT FROM PMA3** | |
| | A. Unable to mate PMA3 heater cable W1103/P602 | If mate not possible due to length, reroute PMA3 heater cable on NOD1 to achieve additional cable length. If still not sufficient, release wire ties as required on ESP-2 W1 cable |
| **Lan_Cable Reposition** | **LAN Cable Reposition** | |
| | A. Cable has insufficient slack | Place inside MMOD shield |
| **NOD1 Slidewire Removal** | **NOD1 Slidewire Remove** | |
| | A. Fwd stanchion bolt fails to release | 1. Release Aft Stanchion Bolt to remove tension from slidewire<br>2. If no joy, cut slidewire near stanchion using EMU scissors and stow both halves of slidewire in bag |
| | B. Stanchion fails to release from mount | Cut slidewire near stanchion using EMU scissors, leave bracket in place |
| **GPS Install** | **GPS Antenna** | |
| | A. Unable to torque bolt | 1. Inspect GPS alignment & bolt. If good alignment and no FOD, increase torque to **PGT: [B7 (25.5), CW2, 30.5]** (2 of 3 required) for one turn, then return to nominal setting **PGT: [A7 (9.2), CW2, 30.5]**<br>2. If no joy, ratchet collar – RCW, reattempt for one turn, then return to nominal setting **PGT [A7]**<br>3. If 2 bolts not engaged, perform tiedown plan using AET; ensure AET completely covered by MLI upon complete installation. If time available, use LDTD tether instead of AET |
| | B. Unable to engage softdock | Remove and check for FOD, report to MCC |

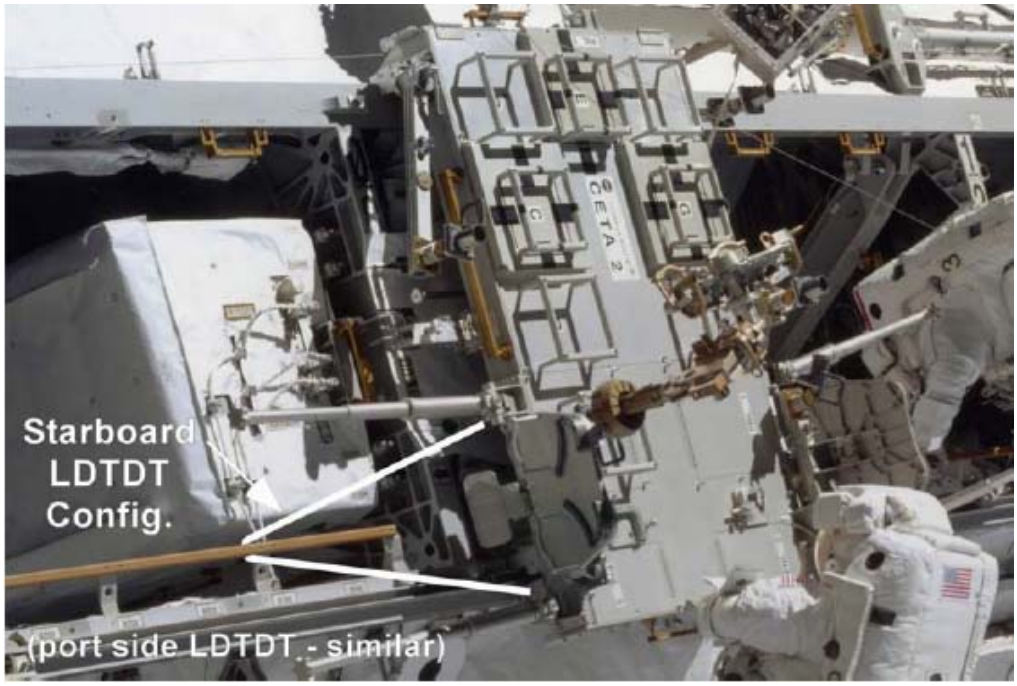
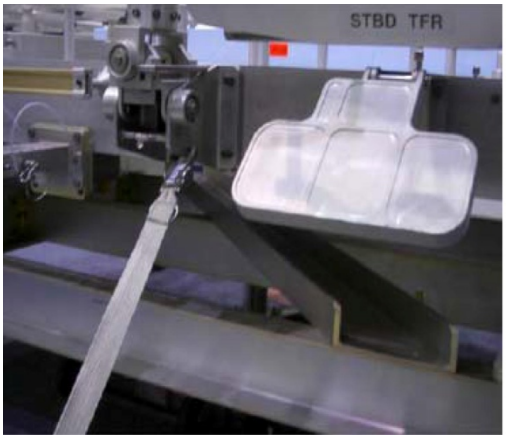
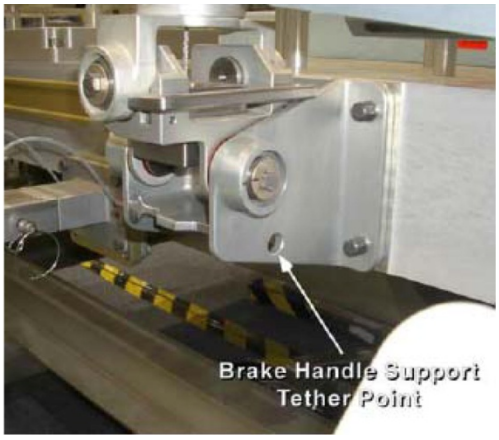
### GENERIC CONTINGENCIES

| TASK | FAILURE | ACTION |
|---|---|---|
| **I. Generic** | **APFR/IAPFR** | |
| | A. APFR/IAPFR fails to install into WIF | 1. Verify APFR collar in install position (black-on-black)<br>2. Check for FOD in WIF or structural interference<br>3. Attempt APFR install in alternate clocking<br>4. If no joy, attempt APFR install in alternate WIF<br>5. If no joy, APFR failure<br>– Use another APFR |
| | B. Joint fails to actuate | 1. Verify no load is applied to joint and/or jiggle APFR joint while actuating knob<br>– For pitch joint, push knob in during rotation (Class I pitch joints known to be stiff)<br>2. Increase force applied in order to free joint |

| TASK | FAILURE | ACTION |
|---|---|---|
| | C. Boot becomes stuck in APFR boot plate | 1. Have other EV crewmember assist with getting boot out<br>2. Loosen 7/16-in EVA bolts (3) on heel clip using EVA ratchet or PGT:<br>**PGT: [B1 (12.0), CCW2, 30.5], 7/16 - 6-ext**<br>3. Remove 7/16-in EVA bolts (3 – captive) on heel clip (non captive) using EVA ratchet or PGT:<br>**PGT: [B1 (12.0), CCW2, 30.5], 7/16 - 6-ext**<br>5 turns |
| | D. Boot becomes stuck in IAPFR boot plate | 1. Have other EV crewmember assist with getting boot out<br>2. If wearing Small EMU boot, have other EV crewmember adjust boot sizing to Large<br>3. Loosen 7/16-in EVA bolts (2) on heel clip using EVA ratchet or PGT:<br>**PGT: [B2 (16.0), CCW2, 30.5], 7/16 - 6-ext**<br>4. Remove 7/16-in EVA bolts (2) on heel clip using EVA ratchet or PGT:<br>**PGT: [B2 (16.0), CCW2, 30.5], 7/16 - 6-ext**<br>4 turns |
| | **Ballstack** | |
| | A. ECOM fails to release from ISS structure | On MCC-H GO: Tether ballstack to handrail and leave outside |
| | B. ECOM fails to release from MUT EE | Leave together and return inside |
| | C. Ballstack fails to rigidize | On MCC-H GO: Use secondary tethers to assist in restraining payload |
| | **BRT** | |
| | A. BRT jaws fail to release | 1. Loosen rigidizing collar to relieve sideloads<br>2. Shake BRT while depressing paddles to alleviate sideloads from handrail<br>3. Detach BRT from suit and tether to structure |
| | **Cannon Connector** | |
| | A. Connector fails to release | 1. Check for FOD, damage or misalignment<br>2. Verify cable routing is not impeding connector rotation. (Release TA-clamps as required)<br>3. Use cannon connector tool for more leverage |
| | B. Connector/Cap fails to softdock | 1. Verify collar unlocked. (White on connector shell tip should align with white on receptacle backplate)<br>2. Check for FOD or damage |
| | C. Connector/Cap fails to lock | 1. Remove connector/cap, check for FOD or damage<br>2. Check alignment, remate, rock connector back and forth as required. (Once locked, white on connector shell tip should align with black on receptacle backplate)<br>3. Use cannon connector tool for more leverage |
| | D. High cable stiffness prevents mating | 1. Verify all TA-clamps are released<br>2. Use second crewmember<br>3. Use APFR |

| TASK | FAILURE | ACTION |
|---|---|---|
| | E. Connector/Jack pin bent | 1. Describe pin location and condition<br>– Obtain WVS view of interface if possible<br>2. On MCC-H GO: For 16, 20, or 22 gauge pins only, retrieve pin straightener and attempt pin repair<br>3. On MCC-H GO: Retrieve needle nose pliers and attempt pin repair<br>– MCC-H will verify pin size prior to retrieving tools |
| | F. Connector/Jack FOD | On MCC-H GO: Obtain connector cleaner tool to remove FOD |
| | G. Connector EMI band bent | On MCC-H GO: Obtain needle nose pliers or forceps to remove band |
| | **CETA Cart** | |
| | A. Wheel bogie fails to release from truss | 1. Verify brakes are fully released<br>2. Ensure trigger is being depressed while attempting to rotate handle<br>3. On MCC-H GO: Perform {6.100.125 CETA Cart Wheel Bogie R&R}<br>– There is no spare wheel bogie on-orbit, so after the CETA cart is relocated the failed wheel bogie will be reinstalled |
| | B. Wheel bogie fails to install on truss | There is no spare wheel bogie on-orbit. 4 of 4 bogies are required. Real time call on whether MT couple or CETA cart tiedown required. For tiedown see Block G |
| | C. Parking brake fails to engage | 1. Use parking brake handle on other side of CETA cart<br>2. Couple CETA cart to MT and utilize other WIF if possible |
| | D. Parking brake fails to disengage | 1. Hold pedal down for brake release<br>2. Use pedal on other side of CETA cart to release parking brake |
| | E. Dynamic brake fails to engage | Limit translation rates to allow manual stopping |
| | F. CETA active coupler fails to capture or lock | 1. Cycle active coupler<br>2. If at least 1 CETA cart is stbd of the MT, swap active couplers<br>3. On MCC-H GO: Tie down CETA cart. See Block G |

| TASK | FAILURE | ACTION |
|---|---|---|
| | G. CETA cart tie down | On MCC-H GO: Perform the following tie down procedure (see figure 1)<br>a. Translate CETA cart to TBD location (not over truss segment joint)<br>b. Engage parking brake<br>c. Retrieve 2 Long Duration Tie Down (LDTD) tethers from P6 AUX Bag (fwd face of Z1)<br>d. Route 1 LDTD tether on stbd side of CETA cart as follows:<br>1. Attach 1 hook to zenith brake handle support tether point<br>2. Loop tether strap around CETA rail HR standoff<br>3. Attach second hook to nadir brake handle support tether point<br>4. Lightly cinch tether and close buckle<br>5. Close MLI flap over buckle and any excess strap<br>e. Repeat on port side of CETA cart |
| | H. Coupler knob fails to unlock | 1. On MCC-H GO: Release active coupler by removing wire ties (2) (reinstall of wire ties not required) and PIP pins (2)<br>2. On MCC-H GO: Release passive coupler via EVA bolt:<br>**PGT: [B7 (25.5), CCW2, 30.5], 7/16 - 6-ext** TBD turns<br>– Bolt is attached by lanyard |
| | I. Swing arm fails to deploy | Use alternate swing arm or WIF |
| | J. Swing arm fails to stow | On MCC-H GO: Remove swing arm via EVA bolts (4):<br>**PGT: [B7 (25.5), CCW2, 30.5], 7/16 - 6-ext** TBD turns (Captive bolts?) |
| | K. Swing arm fails to lock | Restrain in stowed position with wire ties |

| TASK | FAILURE | ACTION |
|---|---|---|
| |  | |
| |   | |
| | Figure 1.- CETA Cart Tie Down. | |
| | **EVA Wrench (Torque & Ratchet)** | |
| | A. Ratchet teeth slip | Ratchet to new set of teeth and reapply torque |
| | B. Wrench does not ratchet | Hold the ratchet selector and socket in opposite hands and rotate in opposite directions |

| TASK | FAILURE | ACTION |
|---|---|---|
| | **Fluid QD Ops** | |
| | NOTE<br>If troubleshooting requires the crew to leave the worksite, verify that female QDs are covered to prevent exposure to direct sunlight. For thermal clocks refer to Flight Rules | |
| | **Mating Ops** | |
| | A. QD fails to mate | 1. Check for debris, damage, or crystals<br>2. Verify release ring is retracted. (Fwd white band is not visible)<br>3. Check alignment and verify no side loads |
| | B. Release ring snap back test fails | 1. Push release ring forward. (Release ring will not slide fwd if QD is in FID)<br>2. QD is in FID; demate QD, verify fwd white band not visible, and remate QD |
| | C. Gap check fails (visual or FID gauge) | Retract release ring, demate QD, verify fwd white band not visible, and remate QD |
| | **Valve Ops** | |
| | D. Detent button is partially unthreaded | Rethread detent button<br>a. Load bail handle (button will free spin if not loaded)<br>– If valve is open, pull bail handle aft<br>– If valve is closed, push bail handle fwd<br>b. Rotate button cw (8 turns max) |
| | E. Detent button is missing<br><br>NOTE<br>Detent button is only required for BDT ops and 1 in SPD ops | 1. Use equipment hook to depress detent button shaft<br>2. Use tether strap around gloved finger to depress detent button shaft<br>3. Retrieve and use Beta Gimbal Anti-rotation Latch Tool to depress detent button shaft<br>4. On MCC-H GO: Install spare detent button. (Buttons are stowed IVA and must be configured prior to EVA use) |
| | F. Bail fails to travel fwd | 1. Check for debris, damage, or crystals<br>2. Retrieve and use QD bail drive lever (3/4, 1, & 1-1/2 in only); notify MCC-H |
| | G. Bail fails to travel to full fwd (valve open) position (button does not pop up) | 1. Neutralize sideloads<br>2. Apply greater opening force to QD bail handle<br>3. Retrieve and use QD bail drive lever (3/4, 1, & 1-1/2 in only); notify MCC-H<br>4. If applicable, retrieve and install SPD; notify MCC-H |
| | H. Detent button fails to depress during valve closing<br><br>WARNING<br>Bail may kick back and contact crew when button is depressed if a leaking primary seal allowed pressure build-up in spring cavity | 1. Verify locking collar fully rotated (1/2, 3/4, & 1 in only)<br>2. Push and hold bail handle fwd (to open) with significant force to relieve load on button while simultaneously depressing the detent button<br>– If button depresses, vent by pulling bail aft until release ring covers aft white band<br>– Push bail fwd to valve open and check button depresses<br>3. Retrieve QD bail drive lever and repeat step 2 (3/4, 1, & 1-1/2 in only); notify MCC-H |

| TASK | FAILURE | ACTION |
|---|---|---|
| | | 4. Contact MCC to reduce NH3 temperature if possible<br>5. On MCC-H GO: Retrieve and install QD button depress tool (BDT) (1/4, 3/4, & 1 in only) |
| | I. Bail fails to travel to full aft (valve closed) position (button does not pop up) | 1. Inspect QD for retaining wire protrusion<br>2. Neutralize possible side loading<br>3. Depress button and increase force on bail<br>4. Retrieve and use QD bail drive lever (3/4, 1, & 1-1/2 in only); notify MCC-H |
| | **Demating Ops** | |
| | J. Female QD fails to demate | 1. Verify release ring is fully retracted while attempting to demate<br>2. Verify TA or P clamps are released<br>3. Verify detent button is up (locking collar can be rotated under button)<br>4. Verify trigger linkage is still attached to release ring (1-1/2 in only)<br>5. Neutralize sideloads or manipulate flexhose to relieve mating forces on female QD<br>6. Apply greater force to release ring and female QD<br>7. Retrieve and use QD release tool (QRT) to apply greater force; notify MCC-H (1-1.5 in only) |
| | K. Thermal bootie fails to remain securely closed | Install wire tie around bootie to keep QD fully covered |
| | L. Cap will not demate | 1. Verify pulling out on cap before rotating to ensure locking tab is disengaged<br>2. Wait for day pass if possible and reattempt cap removal<br>3. If force is too great for hand actuation or crystals visible around the QD, male may be leaking; notify MCC-H<br>– Prepare for quick mate on MCC-H GO<br>4. Retrieve QD cap tool (1/4, 1/2, & 1 in only)<br>– Use QD cap tool to turn stuck cap a maximum of 2 turns (cap vents at ~2 turns). Finish removal of cap by hand (~1 additional turn) |
| | **Leaks** | |
| | M. Mated QD leaks in valve open position (bail fwd) | 1. Remove SPD and fully open valve (bail fwd)<br>2. If leak continues close valve (bail aft)<br>3. Re-perform FID checks |
| | N. Male QD leaks after cap removal | Reinstall cap; notify MCC-H<br>– Prepare for quick QD mate on MCC-H GO |
| | O. Female QD leaks during or after bail actuation to fwd position (valve open) | 1. Return bail to aft position (valve closed)<br>2. Perform release ring snap back test<br>– If FID is observed, demate and remate QD<br>– If no FID, neutralize sideloads and cycle bail to fwd position (valve open) |

| TASK | FAILURE | ACTION |
|---|---|---|
| | P. Leaking QD after SPD install | 1. Remove SPD, open valve fully (bail fwd), verify detent button is up, and aft white line is visible<br>– If leak stops rotate locking collar to lock<br>2. Close valve (bail aft), verify detent button is up, fwd white line is visible, and rotate locking collar to lock<br>3. If applicable, close valve of appropriate QD in flowpath, verify detent button is up, and fwd white line is visible |
| | Q. Female QD leaks after demate | 1. Remate female QD. Cycle valve open/closed. Demate QD<br>2. If leak continues, point away from crew. (Ammonia quantity is limited due to previously vented line) |
| | R. Male QD leaks after demate (male sleeve may be visibly stuck open) | 1. Remate female QD and open valve (bail fwd)<br>a. Depress button and use significant force to push bail forward; Release button<br>b. With QD in open position (bail fwd) apply significant force to aft end of the female QD in back and forth, up and down directions<br>c. Attempt to close valve (bail aft)<br>d. Demate QD and inspect<br>2. Install cap (1/4, 1/2, & 1 in only) |
| | S. Leak detected by MCC-H after valve ops (possible male sleeve stuck open) | 1. Cycle QD to open position (bail fwd)<br>a. Depress button and use significant force to push bail forward; release button<br>b. With QD in valve open (bail fwd) position apply significant force to aft end of the female QD in back and forth, up and down directions<br>c. Attempt to close valve (bail aft)<br>d. Demate QD and inspect<br>2. If applicable, close valve of appropriate QD in flowpath, verify detent button is up, and fwd white line is visible |
| | T. Frozen NH3 present on female or male QD | 1. Leave QD exposed to vacuum; wait maximum of 5 min for sublimation (check periodically)<br>2. On MCC-H GO: Continue QD ops |

| TASK | FAILURE | ACTION |
|---|---|---|
| | | |

**Mate QD**

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

**Open Valve**

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

**Close Valve, Demate QD**

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

| TASK | FAILURE | ACTION |
|---|---|---|
| | **MMOD Shield** | |
| | A. MMOD shield Dzus fastener fails to release<br><br>WARNING<br>Do not touch back side of MMOD shield or handle fastener fragments due to sharp edges<br><br>Fastener and shield/ tool interface must be covered to avoid potential projectiles | 1. On MCC-H GO: Retrieve pry bar and emptied med ORU bag<br>2. Release other Dzus fasteners<br>3. Assess clearance between MMOD shield and tools<br>4. If possible, rotate fastener to position tangs off of tools<br>5. Place med ORU bag over failed fastener<br>6. Insert pry bar under MMOD shield by failed fastener and pry shield away from structure |
| | B. MMOD shield Dzus fastener fails to engage | 1. Verify center fastener is engaged first<br>2. Check Dzus fastener aligned with bracket (floating receptacles on endcones)<br>3. Verify fastener clocking correct per alignment mark<br>4. Push firmly and rotate<br>5. Engage other fasteners: 2 out of 3 required<br>6. If 2 of 3 not achieved:<br>– Option 1 (Wire Tie) (See figure in EVA 3 procedures): 1 properly secured wire tie = 1 Dzus fastener; Using a long wire tie, squish the loop on one end, feed it through the bracket on structure (may need to push floating receptacle inboard to get it out of way), secure wire tie w/3 twists. Feed one end of wire tie around Dzus head (on outside of shield) and secure with 3 twists. If HR nearby can also secure wire tie to HR. (Goal is for the wire tie to push shield in toward body of structure and toward center if endcone shield)<br>– Option 2 (LDTDT): Use 1 adj (attach to tether point on T tool and to structure HR) and 1 LDTDT across shield to hold shield in position |
| | C. T-handle tool fails to engage shield | Remove adjacent fasteners and attempt reinstallation |
| | D. MLI grounding strap Dzus fails to release | On MCC-H GO: Cut ground wire near Dzus fastener |

| TASK | FAILURE | ACTION |
|---|---|---|
| | **MUT EE** | |
| | A. MUT EE jaws fail to release | 1. Verify locking collar fully released<br>2. Shake MUT EE while depressing paddles to alleviate sideloads from handrail<br>3. Release MUT EE ECOM socket and tether MUT EE to structure |
| | **MWS** | |
| | A. MWS EE is sticky | Known problem. Report degree of stickiness to MCC-H and any noted correlation with thermal environment. Post EVA, report s/n of affected unit (s/n located on "stem" of T-bar) |
| | B. MWS EE cord fails to retract | 1. Verify MWS EE tether lock in unlock position<br>2. Cycle MWS EE tether lock<br>3. Check tether reel opening for FOD<br>4. Pull out small amount of tether and allow reel to retract while holding light tension on the tether |
| | C. MWS T-bar fails to pivot | 1. Check sideloads on T-bar while depressing button<br>2. Slip T-bar clutch (40-60 lb force required) |
| | **NZGL Connectors** | |
| | A. Bail bar fails to slide over-center | 1. Inspect bail for FOD<br>2. Inspect bail linkage for damage and report to MCC-H<br>3. Check alignment and sideloads<br>4. Verify sufficient TA-clamps are open<br>5. Increase force on bail<br>6. Attach 2 hooks from adj tether to connector bail and use adj strap to pull bail into demated position<br>7. On MCC-H GO: Retrieve vise grips to help increase force on bail |
| | B. Backshell fails to slide (after over-center mechanism has been overcome) | 1. Verify sufficient TA-clamps are open<br>2. Check for cable harness and hardware interference<br>3. Check alignment and sideloads<br>4. Inspect bail and connector for FOD<br>5. Inspect bail linkage for damage and report to MCC-H<br>6. Wiggle/jiggle connector while pushing or pulling on backshell<br>7. Attach 2 hooks from adj tether to connector bail and use adj strap to pull bail into demated position<br>8. On MCC-H GO: Retrieve vise grips to help increase force on bail |

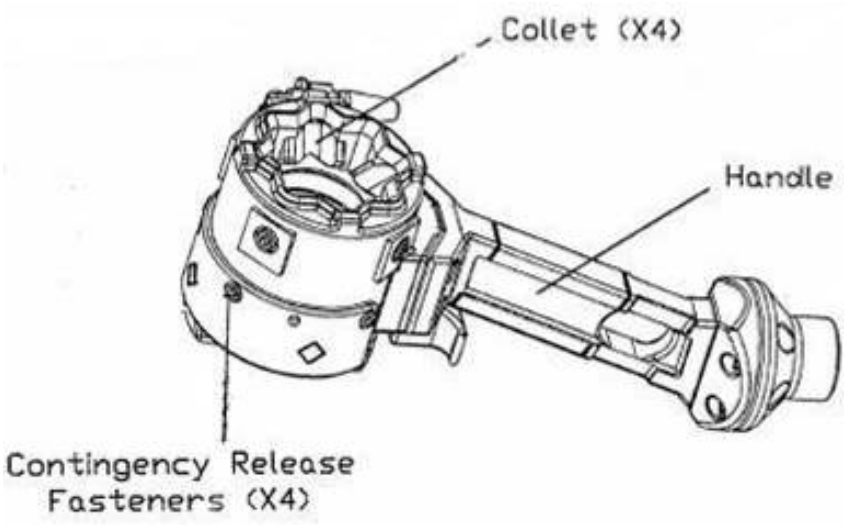
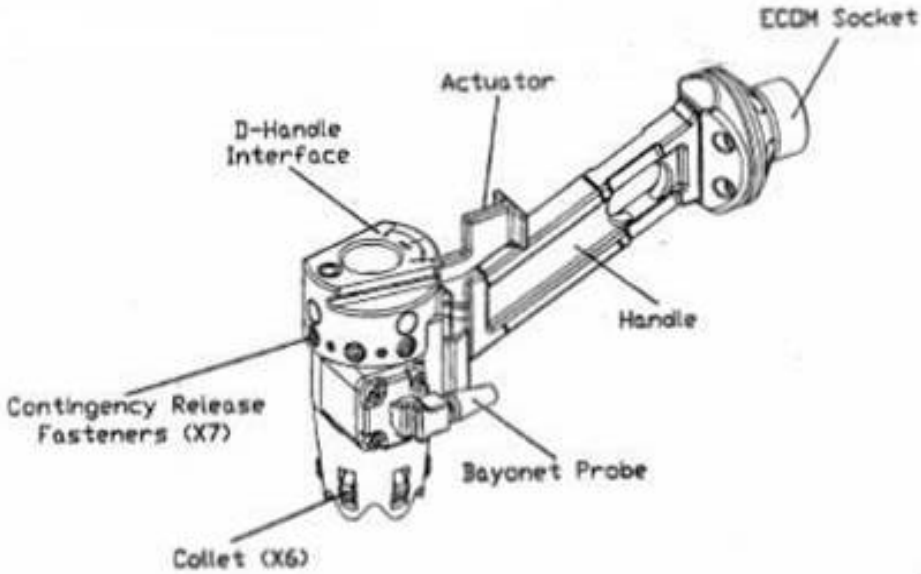
| TASK | FAILURE | ACTION |
|---|---|---|
| | C. Connector fails to release from soft dock | 1. Verify bail fully thrown, undamaged, and backshell fully aft<br>2. If backshell springs forward, pull and hold in fully aft position (will have to overcome spring force, approx 5-10 lb) while attempting to demate connector<br>3. Verify sufficient TA-clamps are open<br>4. Check for cable harness and hardware interference<br>5. Check alignment and sideloads<br>6. Relieve compression on connector interface due to cable loads by pulling backshell away from jack<br>7. Push the plug toward the jack to compress the soft dock<br>8. Wiggle/jiggle connector. (Use slight rolling motion) |
| | D. Connector fails to soft dock | 1. Verify correct plug and jack<br>2. Verify bail fully aft<br>3. Verify backshell fully aft and remains fully aft. If backshell not fully aft, pull and hold in fully aft position while attempting to soft dock connector<br>4. Inspect the following:<br>– O-ring seal<br>– FOD<br>– Bend radius<br>– Soft dock springs<br>– Connector keying feature<br>5. Verify alignment (avoid excessive rolling or rocking the plug as this could unseat soft dock springs)<br>– Connector should snap into soft dock with little force once half shells are aligned |
| | E. Connector fails to mate | 1. Verify half-shells are fully seated on both sides<br>2. Verify cable and backshell free to move (no clamps)<br>3. Push forward on connector backshell while actuating bail<br>4. Detach from soft dock and inspect:<br>– Pins<br>– FOD<br>– EMI band<br>– Bend radius<br>– TA clamps<br>– P clamps<br>– Bail linkages and rivets<br>– Soft dock springs<br>– O-ring seal and main joint gasket<br>– Connector keying feature<br>5. Cycle bail while disconnected (push forward on connector backshell for additional leverage) |

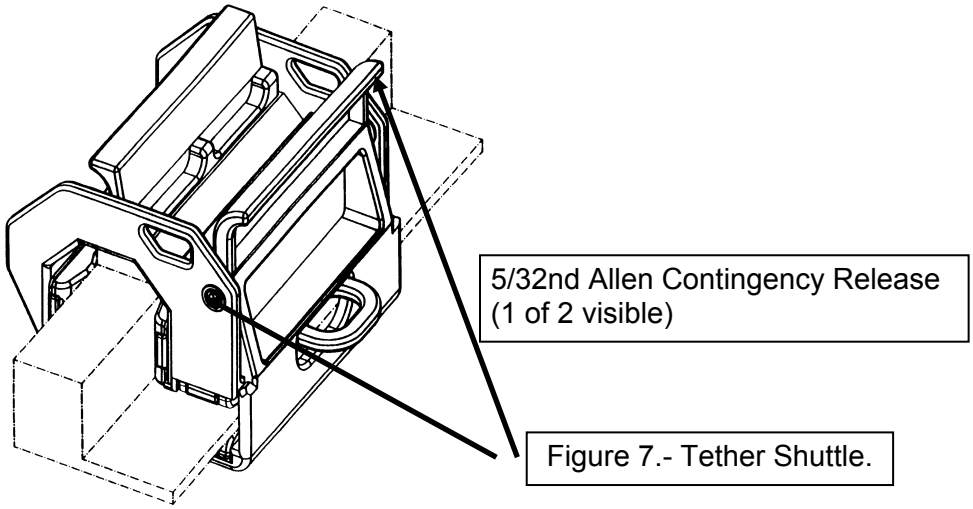
| TASK | FAILURE | ACTION |
|---|---|---|
| | F. Connector pin bent | 1. Rotate connector to bail up position and describe pin location and condition<br>– Obtain WVS view of interface if possible<br>2. On MCC-H GO: For 16, 20, or 22 gauge pins only, retrieve pin straightener and attempt pin repair<br>3. On MCC-H GO: Retrieve needle nose pliers and attempt pin repair<br>– MCC-H will verify pin size prior to retrieving tools<br>4. Inspect plug and jack prior to re-mating |
| | G. Connector FOD | 1. On MCC-H GO: Retrieve connector cleaner tool<br><br>NOTE<br>One N2 cartridge is already captured in the tool (the other is lanyarded inside the caddy). In order to puncture the cartridge, it must be threaded into the tool until the indicator line passes out of sight under the collar of the tool.<br><br>Puncture connector cleaner cartridge only when ready to perform actual cleaning.<br><br>Use entire N2 cartridge prior to reentering airlock<br><br>2. Attempt cleaning |
| | H. Connector EMI band bent | On MCC-H GO: Retrieve needle nose pliers or forceps to remove band<br>– Bail may need to be pushed forward while demated to expose EMI band for removal |
| | I. Connector bail linkage failure | 1. On MCC-H GO: Re-attempt connector mate/demate with broken bail<br>– Impart load through undamaged side of bail linkage<br>– Assist bail motion with hand on backshell once bail linkage has passed over-center<br>– May take multiple pushes on the bail to mate/demate connector<br>2. Tether hook or vise grips may be used for additional leverage |
| | J. Connector soft dock spring bent | On MCC-H GO: Retrieve needle nose pliers and remove bent spring |
| | K. Connector O-ring or main joint gasket seal loose (seal and O-ring required in 1-G only) | 1. Remove seal with tether hook<br>2. On MCC-H GO: Retrieve additional tools to remove seal (Ex: wire tie, needle nose pliers, probe, loop pin puller) |
| | L. Connector cap (Twist) will not release | 1. Increase force<br>2. Use tether hook for additional leverage |

| TASK | FAILURE | ACTION |
|---|---|---|
| | **On-Orbit Installed HR** | |
| | A. HR will not install in seat track or fails to soft dock | 1. Verify HR installed in correct direction per arrow on underside of HR<br>2. Verify HR shoes are completely released and soft dock armed<br>3. Check for FOD on HR and seat track<br>4. Verify HR bolt completely released:<br>**PGT: [A1 (2.5), CCW2, 30.5], 7/16 - 6-ext**<br>5. If HR in seat track but soft dock will not engage, attempt to drive HR bolts<br>6. On MCC-H GO: Depending on HR priority, attempt to install 180 out or a different HR at this location |
| | B. HR bolt fails to fully engage | 1. If torqued, remove HR:<br>**PGT: [A2 (3.8), CCW2, 30.5], 7/16 - 6-ext**<br>– To break torque<br>**PGT: [A1 (2.5), CCW2, 30.5], 7/16 - 6-ext**<br>– For removal<br>– Check for FOD on HR and seat track and reinstall using original torque<br>2. Increase PGT setting:<br>**PGT: [A3 (4.8), CW2, 30.5], 7/16 - 6-ext**<br>3. On MCC-H GO: Depending on HR priority, attempt to install 180 out or a different HR at this location |
| | **On-Orbit Installed WIF** | |
| | A. WIF fails to soft dock | 1. Check for FOD and structural interference, cycle soft dock pins; reattempt installation<br>2. Verify WIF is co-planar<br>3. Install a different WIF at this location<br>4. On MCC-H GO: Attempt installation of WIF in a different location<br>5. Return WIF inside |
| | **PAD** | |
| | A. Release knob fails to rotate open | 1. Verify knob in release position (J-hook not locked)<br>2. Attempt to rotate knob using ratchet on knob's 7/16 in hex stud<br>3. Release contingency release bar captive bolts (2)<br>**PGT: [A6 (8.3), CCW2, 30.5], 7/16 - 6 ext**<br>5 turns<br>(Verify hook released from striker bar) |
| | **PGT** | |
| | A. No LEDs | 1. Perform LED test<br>2. Use display torque |
| | B. LEDs and torque messages do not agree | Use torque message and notify MCC-H |
| | C. Mode switch breaks | Retrieve spare PGT |
| | **LCD Messages** | |
| | A. BATTRY HITEMP | 1. Power off PGT<br>2. If alternate battery available; change battery<br>3. Retrieve spare PGT<br>4. Switch to ratchet mode |

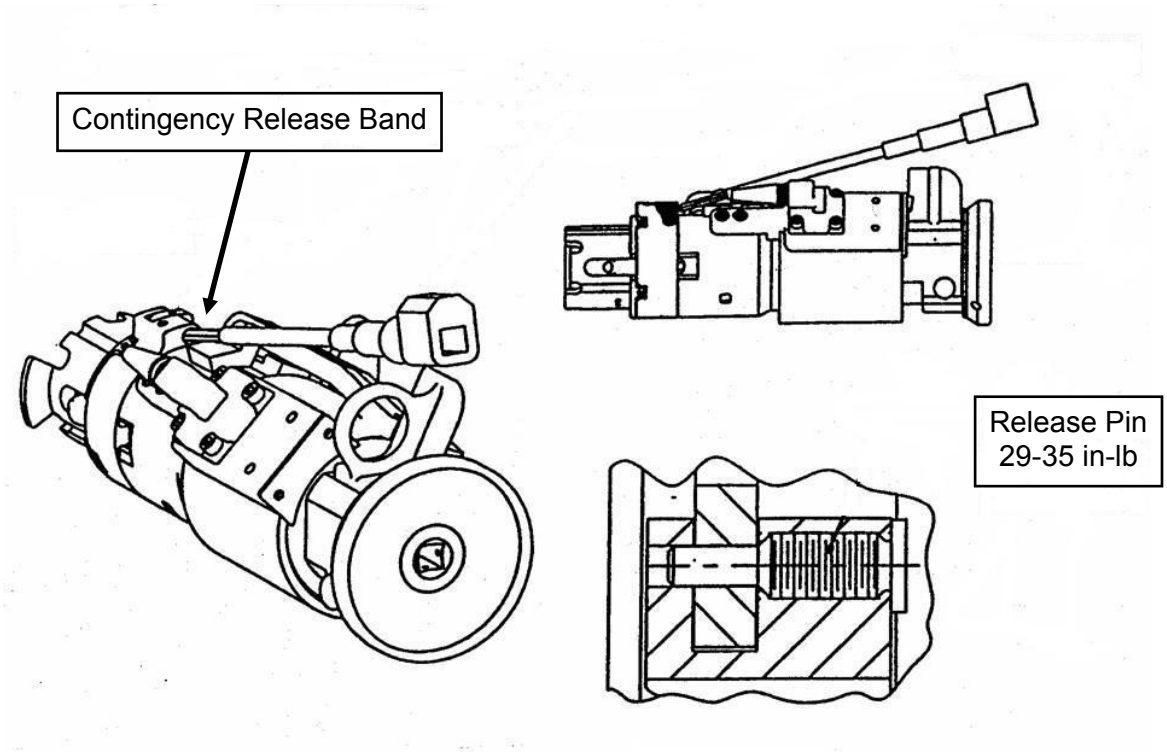
| TASK | FAILURE | ACTION |
|---|---|---|
| | B. BATTRY LOTEMP (blinking) | 1. Drive tool with no load to increase battery temperature<br>2. If alternate battery available; power off and change battery<br>3. Retrieve spare PGT<br>4. Power off and switch to ratchet mode |
| | C. BATTRY LOVOLT (blinking) | 1. Continue using tool until unable to deliver sufficient torque<br>2. Retrieve spare PGT<br>3. Power off and switch to ratchet mode |
| | D. CAL FAILED | 1. Press, release trigger to repeat calibration<br>2. Power cycle and calibrate<br>3. Retrieve spare PGT<br>4. Power off and switch to ratchet mode |
| | E. COLLAR ERROR | 1. Cycle torque and speed collars to clear error<br>2. Power cycle and calibrate<br>3. Retrieve spare PGT<br>4. Power off and switch to ratchet mode |
| | F. COMPAR ERROR | 1. Cycle torque collar and A/B mode switch<br>2. Power cycle and calibrate<br>3. Retrieve spare PGT<br>4. Power off and switch to ratchet mode |
| | G. EEPROM WR ERR (blinking)<br>HYBRID HITEMP<br>OVER CURR<br>SLFTST FAIL X | 1. Power cycle and calibrate<br>2. Retrieve spare PGT<br>3. Power off and switch to ratchet mode |
| | H. HI TORQ | 1. Contact MCC-H and report torque (Real time engineering assessment required)<br>2. On MCC-H GO: Power cycle and calibrate<br>3. Retrieve spare PGT<br>4. Power off and switch to ratchet mode |
| | I. HICURR | 1. Reattempt operation<br>– Can be caused by excessive rotation of the PGT body while torquing<br>2. Power cycle and calibrate<br>3. Retrieve spare PGT<br>4. Power off and switch to ratchet mode |
| | J. LO TORQ (Expected during bolt release) | 1. Reattempt operation until desired torque is reached<br>2. Power cycle and calibrate<br>3. Retrieve spare PGT<br>4. Power off and switch to ratchet mode |
| | K. LOCURR | 1. Reattempt operation<br>2. Power cycle and calibrate<br>3. Retrieve spare PGT<br>4. Power off and switch to ratchet mode |
| | L. LOG IS FULL (blinking) | 1. Cycle torque and speed collars to clear message<br>2. Continue operation |
| | M. MOTOR HITEMP | 1. Power off PGT<br>2. Retrieve spare PGT<br>3. Switch to ratchet mode |

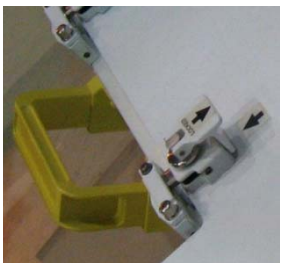
| TASK | FAILURE | ACTION |
|---|---|---|
| | **Safety Tether** | |
| | A. Safety tether fails to retract/tend | 1. Verify reel is unlocked<br>2. Verify tether reel and/or cable guide (for 85-ft tethers) is clear of FOD<br>3. Pull out small amount of cable and allow reel to retract while holding light tension on the cable<br>4. Tap side of reel housing during retraction<br>5. Report ID # of faulty tether to MCC-H and use alternate safety tether<br>6. Coil safety tether to bring inside<br>7. For 85-ft tether. On MCC-H GO: If coiling tether is not practical, release level wind mechanism bypass on back of safety tether. (Red indicator will show around edge of bypass once released)<br><br><u>NOTE</u><br>Once level wind has been released cable guide will likely be frozen in place. This will limit the amount of tether that can be successfully retracted into the tether housing and may require coiling of excess tether.<br><br>Level wind release will require safety tether be returned for ground servicing.<br><br>If tether fails to retract due to thermal issue normal tether function may return after tether brought IVA |
| | B. Safety tether red stripe showing (any length) | Safety tether cannot be used<br>– Report ID # of faulty tether to MCC-H<br>– Use alternate safety tether |
| | C. Crew hook fails | 1. On load alleviating end: Use waist tether to replace alleviating strap<br>– Report ID # of faulty tether to MCC-H<br>– Retrieve replacement safety tether<br>2. On anchor end: Report ID # of faulty tether to MCC-H and use an alternate safety tether |
| | **Scoops** | |
| | A. Scoop will not release from fitting | 1. If actuator will not pull back while in locked position, tap actuator with tool to release<br>2. On MCC-H GO: Leave scoop in place<br>3. On MCC-H GO: Remove non-captive contingency screws; 5 turns. Stow in trash bag<br>**PGT: [A1 (2.5), CCW2, 30.5], 5/32 allen drive**<br>– Square Scoop: 4 screws (figure 5)<br>– Round Scoop: 7 screws (figure 6) |

| TASK | FAILURE | ACTION |
|---|---|---|
| |  <br>Figure 5.- Square Scoop. | |
| |  <br>Figure 6.- Round Scoop. | |
| | **Socket Caddy** | |
| | A. Socket fails to release from socket caddy | 1. Verify PIP pin fully inserted into drop proof tether interface on socket<br>2. Reattempt using a different PIP pin |
| | **TA Clamp** | |
| | A. TA clamp fails to release | 1. With handle up, press down on top of rounded clamp<br>2. With handle up, use tether hook to pry drawhook from capture pin |

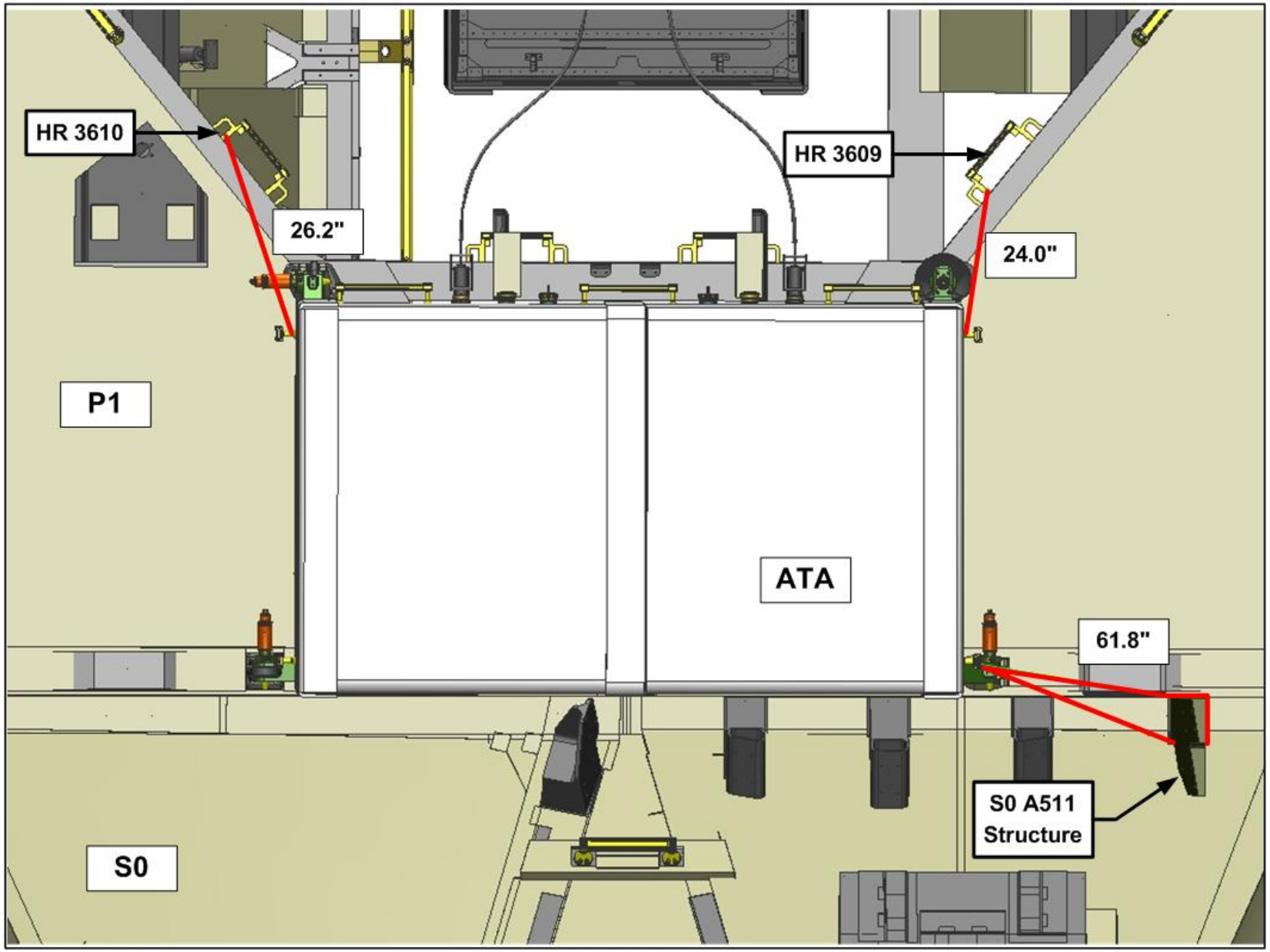
| TASK | FAILURE | ACTION |
|---|---|---|
| | **Tether Shuttle** | |
| | A. Tether shuttle will not release from CETA/MT rail | 1. Verify slider in unlock and no obstructions to paddle actuation<br>2. Verify safety tethered to structure and safety tether removed from tether shuttle anchor point<br>3. On MCC-H GO: Remove non-captive screws (2) at hingeline to release nadir section with slide lock (not captive) (figure 7). TBD turns. Stow screws in trash bag<br>**PGT: [A1 (2.5), CCW1, 30.5], 5/32 allen drive** |
| |  <br>Figure 7.- Tether Shuttle. | |
| | **Torque Multiplier** | |
| | A. TM will not release from fitting | 1. Place TM anti-backlash in neutral, if unable:<br>**PGT [RCW, 30.5]**<br>– Apply cw torque while pushing anti-backlash button to neutral. Reattempt removal<br>2. If able to lift TM off of bolt, attempt to rock off of fitting (Square TM only)<br>3. On MCC-H GO: Release TM contingency release band pin 20 turns (do not exceed 28 turns) (figure 8):<br>**PGT: [A1 (2.5), CCW2, 30.5], 5/32 ball end driver**<br>– When band springs open remove TM |

| TASK | FAILURE | ACTION |
|---|---|---|

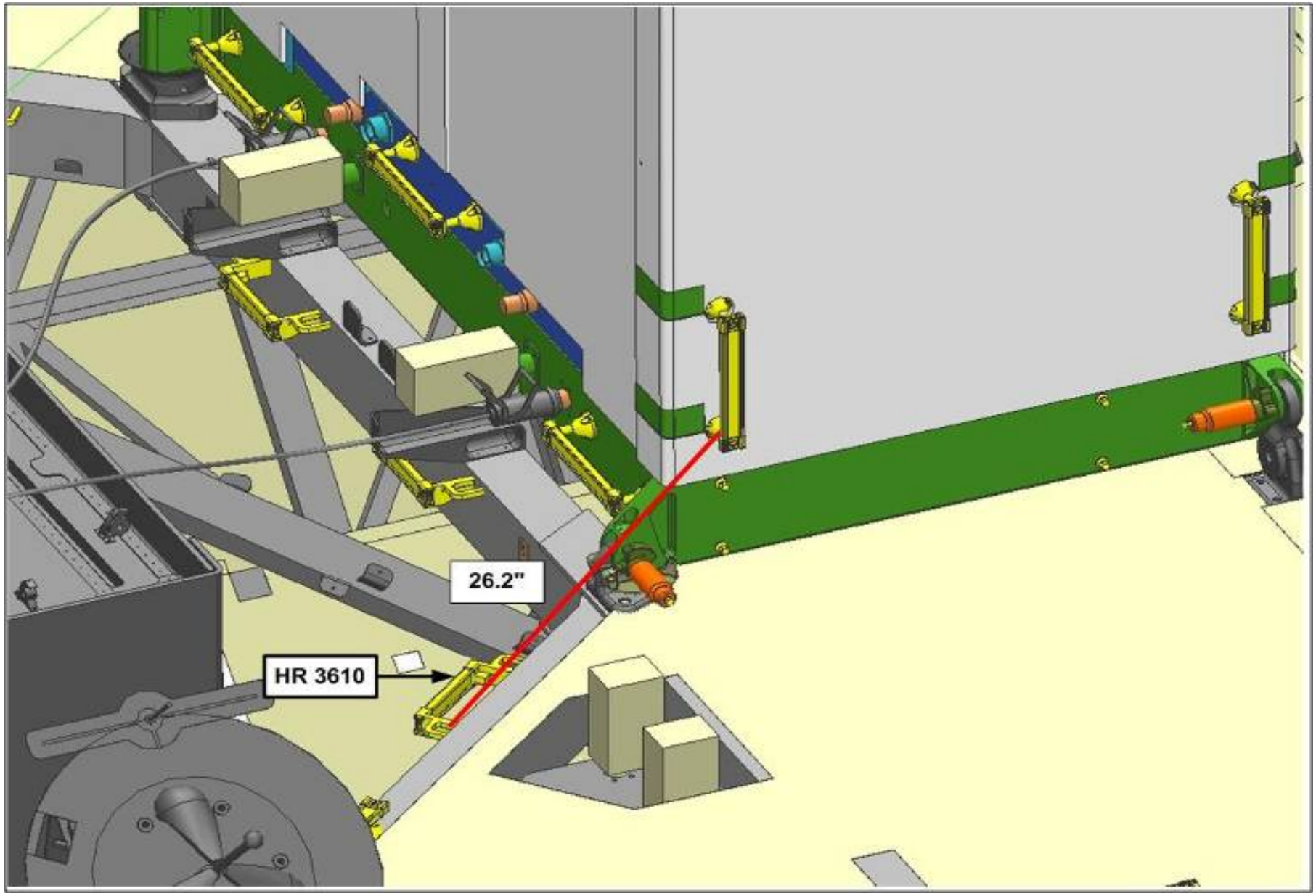



| TSA | |
|---|---|
| A. Latch fails to open | Release 7/16 EVA bolt on latch bracket; rotate bracket clear of latch<br>**PGT: [A2 (3.8), CCW2, 30.5], 7/16 - 6 ext 1-2 turns** |
| B. Latch fails to close<br>  | Close remaining latches (3 of 4 required for landing). Latch is closed arrow to arrow |

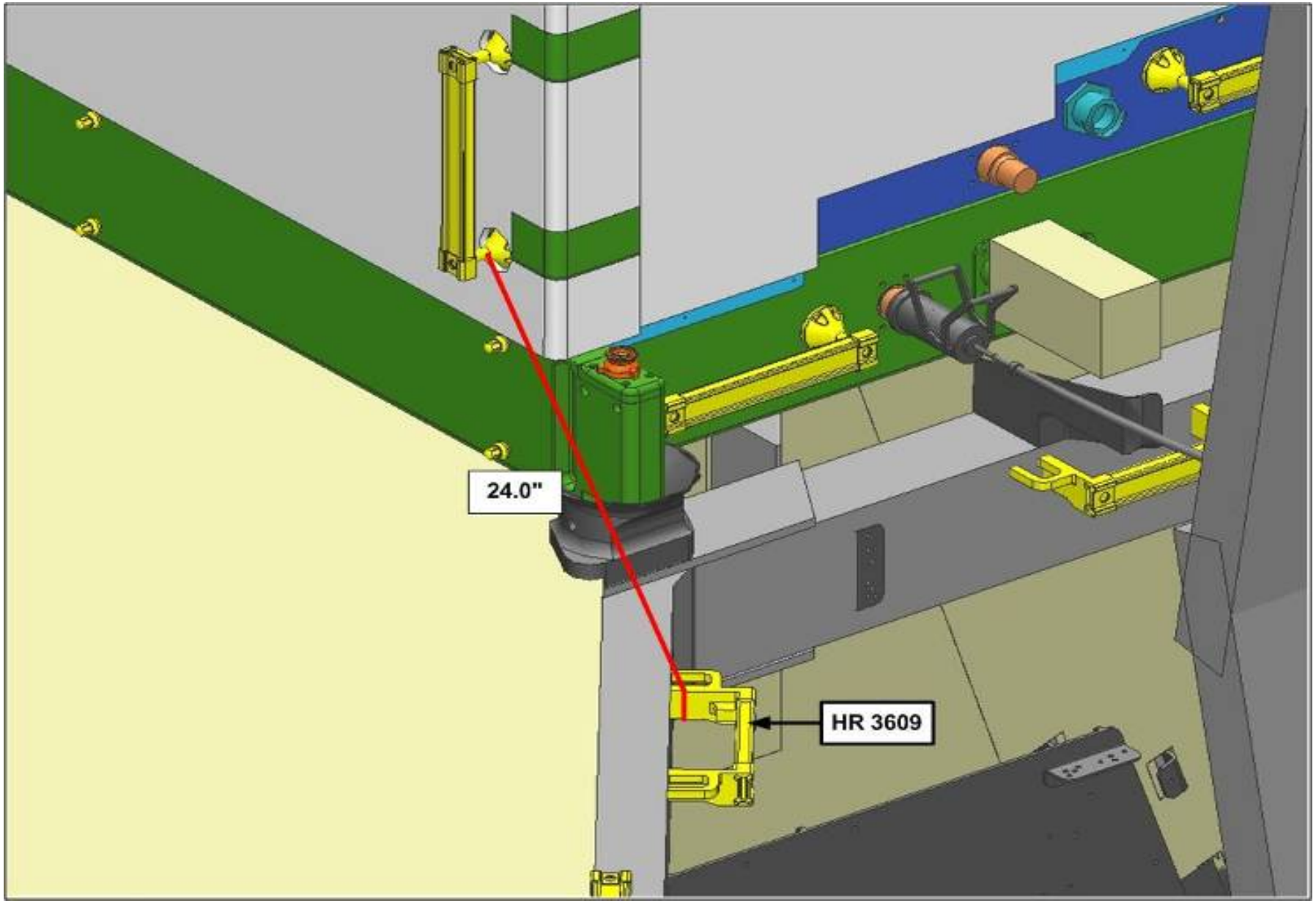
## P1 ATA TIE DOWN OVERVIEW



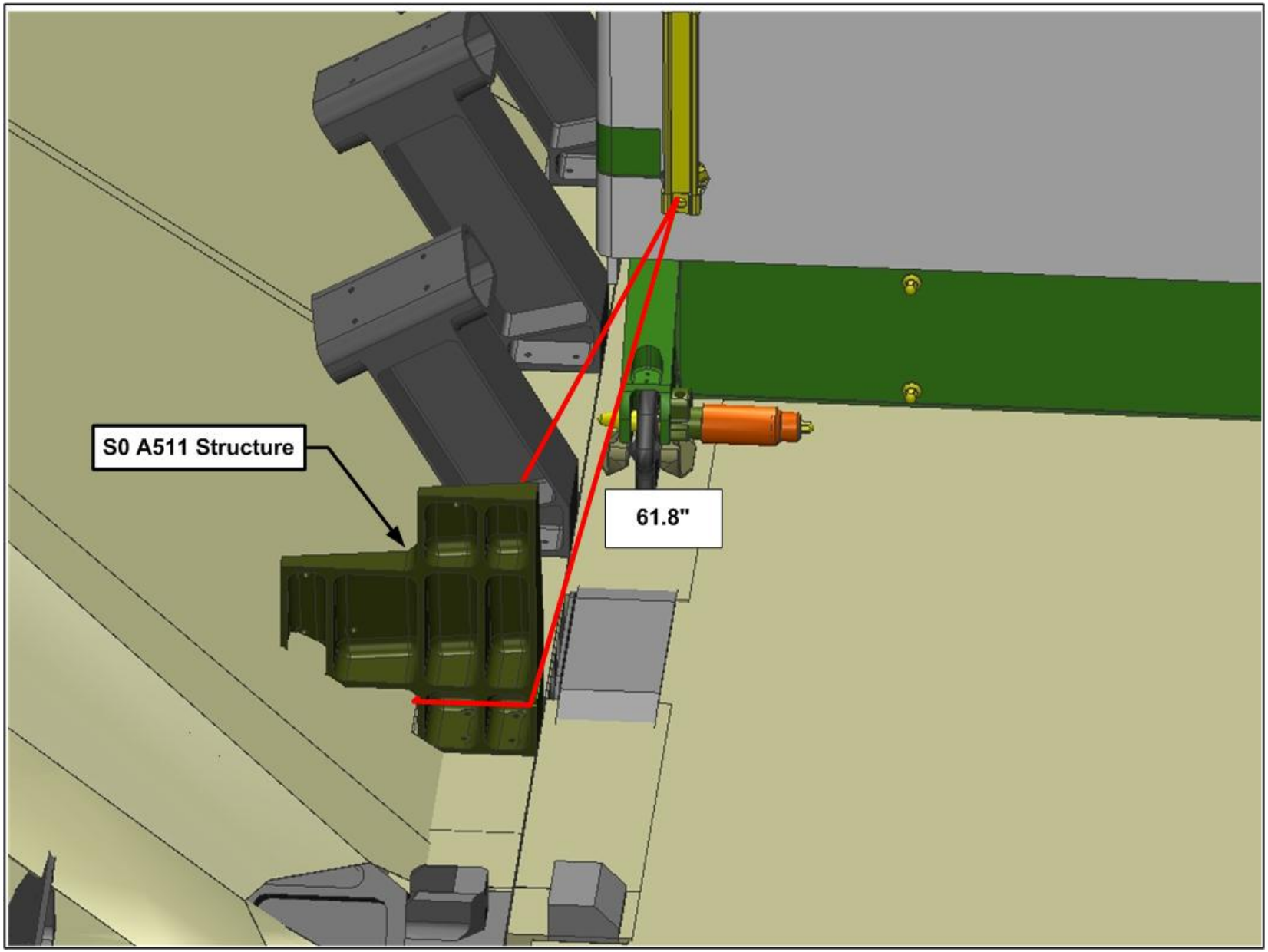
**P1 ATA TIE DOWN – BOLT 2**



**P1 ATA TIE DOWN – BOLT 3**



**P1 ATA TIE DOWN – BOLT 4**

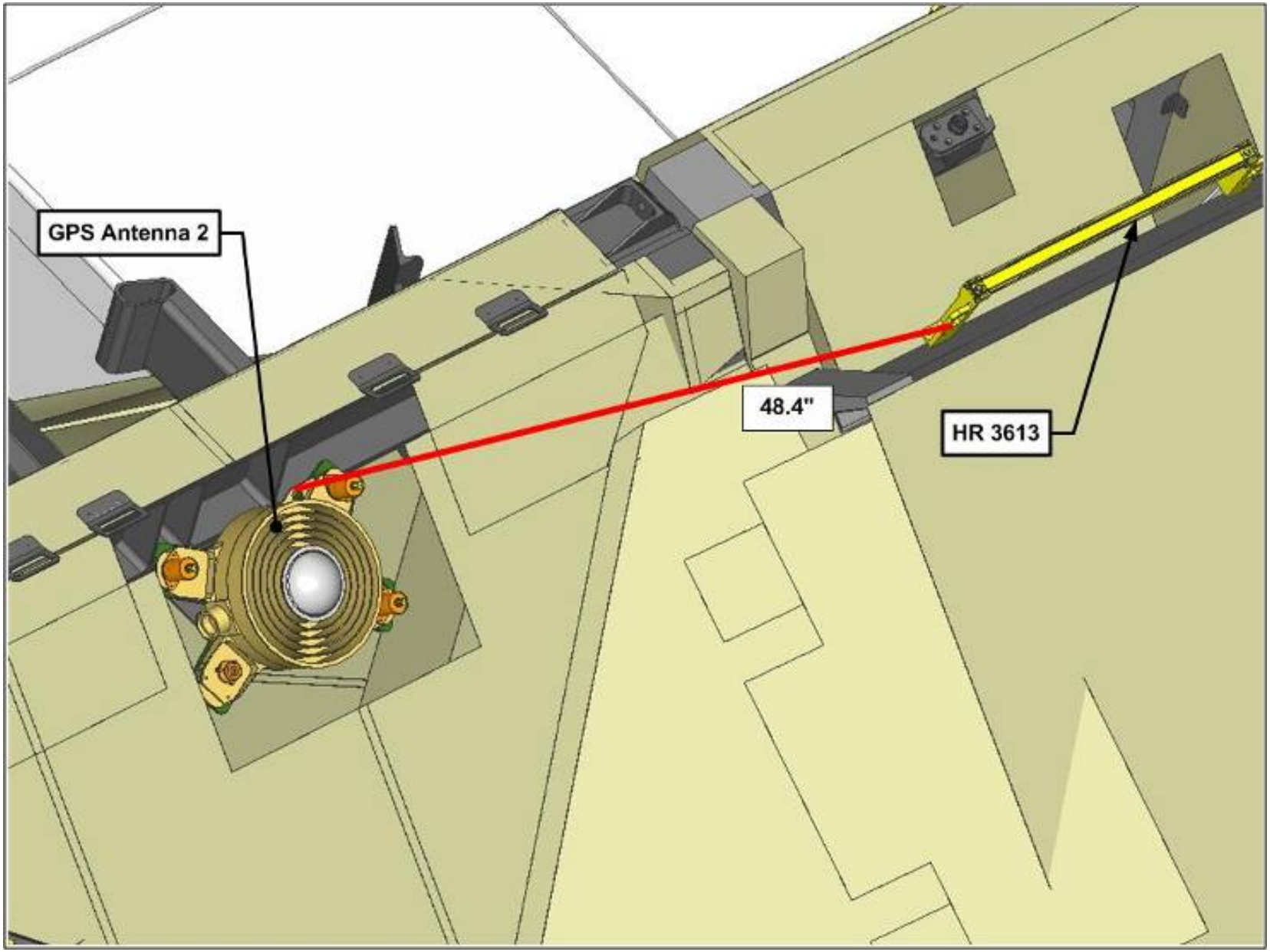


**P1 ATA TIE DOWN – BOLT 4** (Cont)

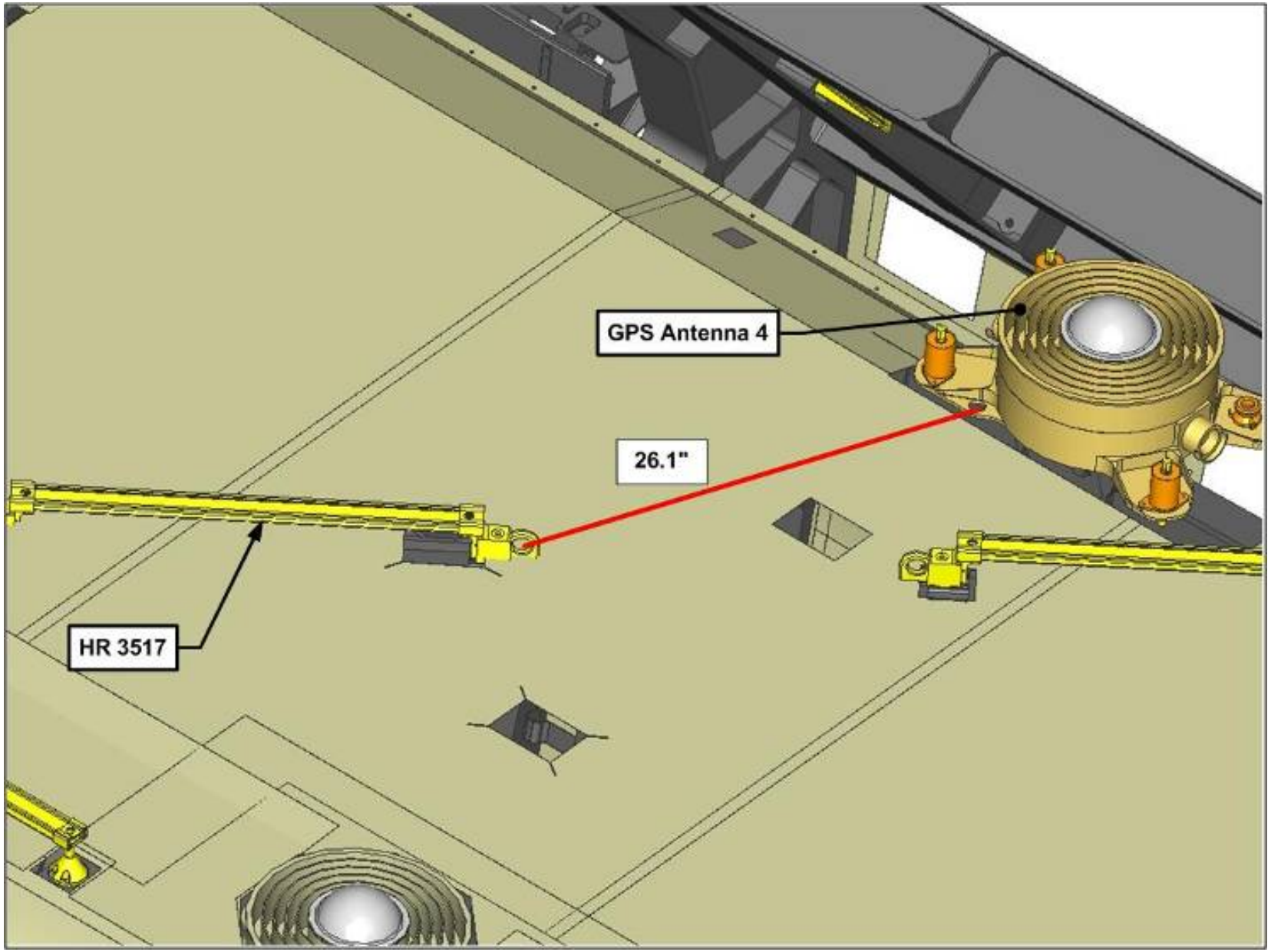
**Long Duration Tie Down Tether through this opening for Bolt 4 tie down**

**RGA 2 TIE DOWN**

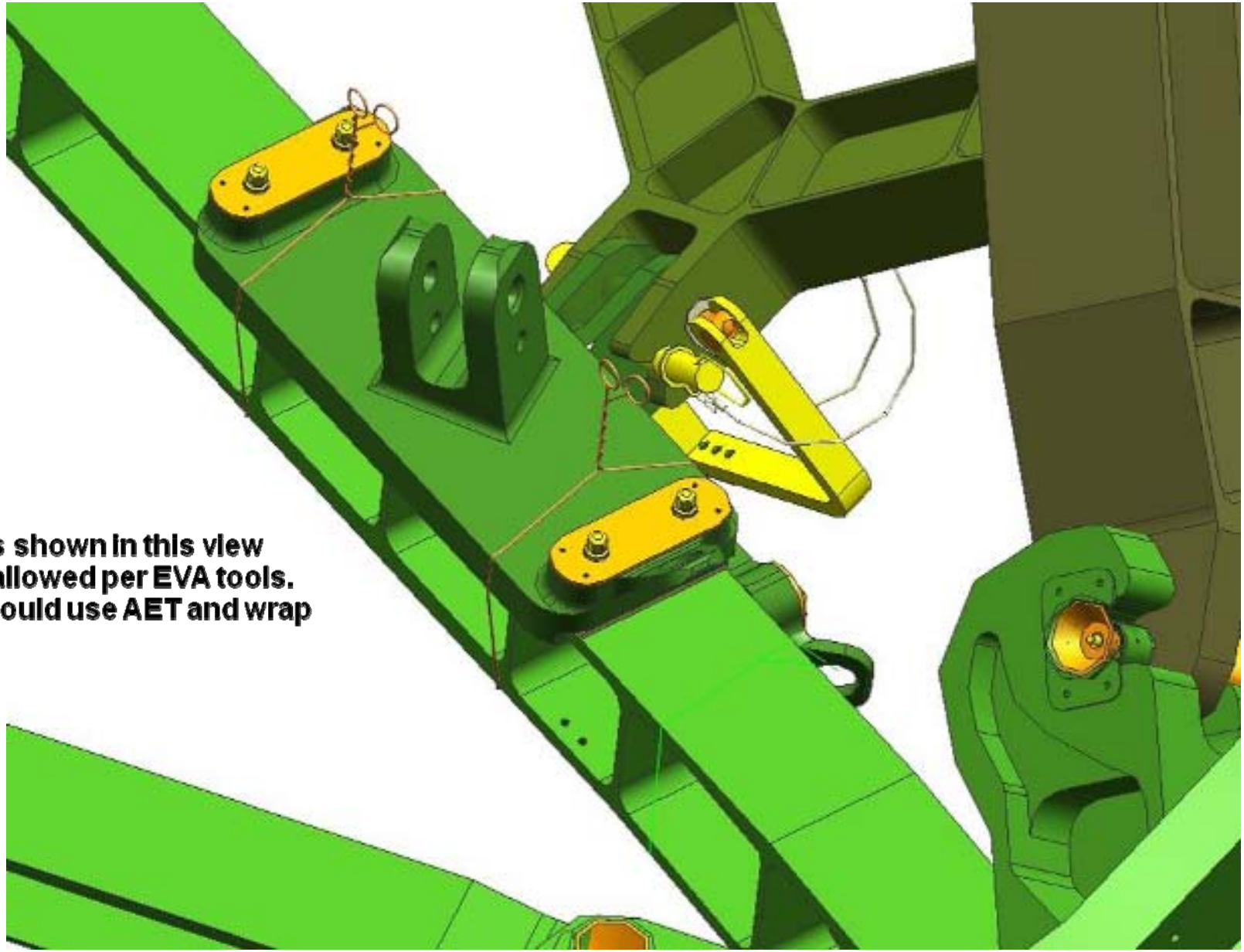
**GPS ANTENNA 2 TIE DOWN**



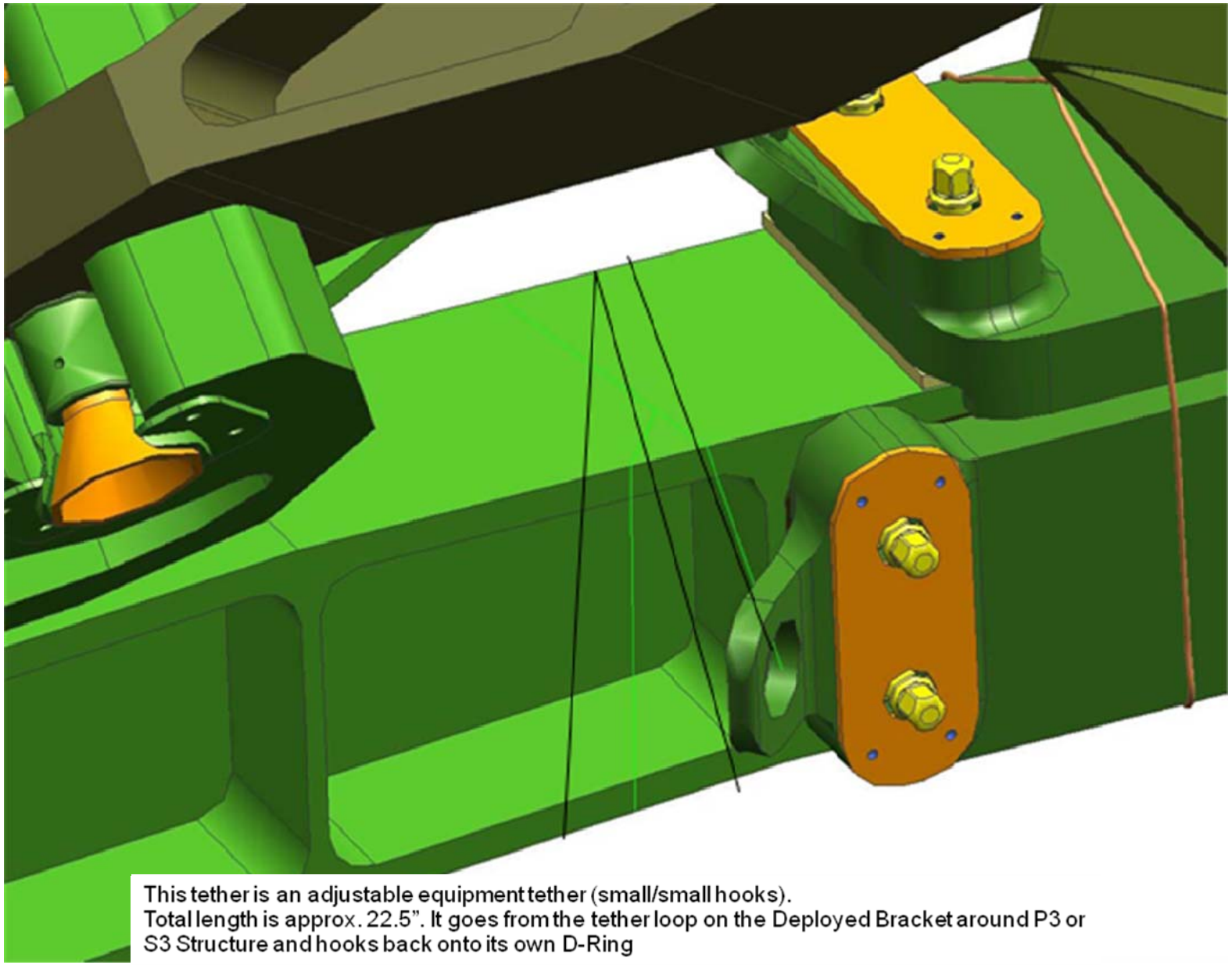
## GPS ANTENNA 4 TIE DOWN



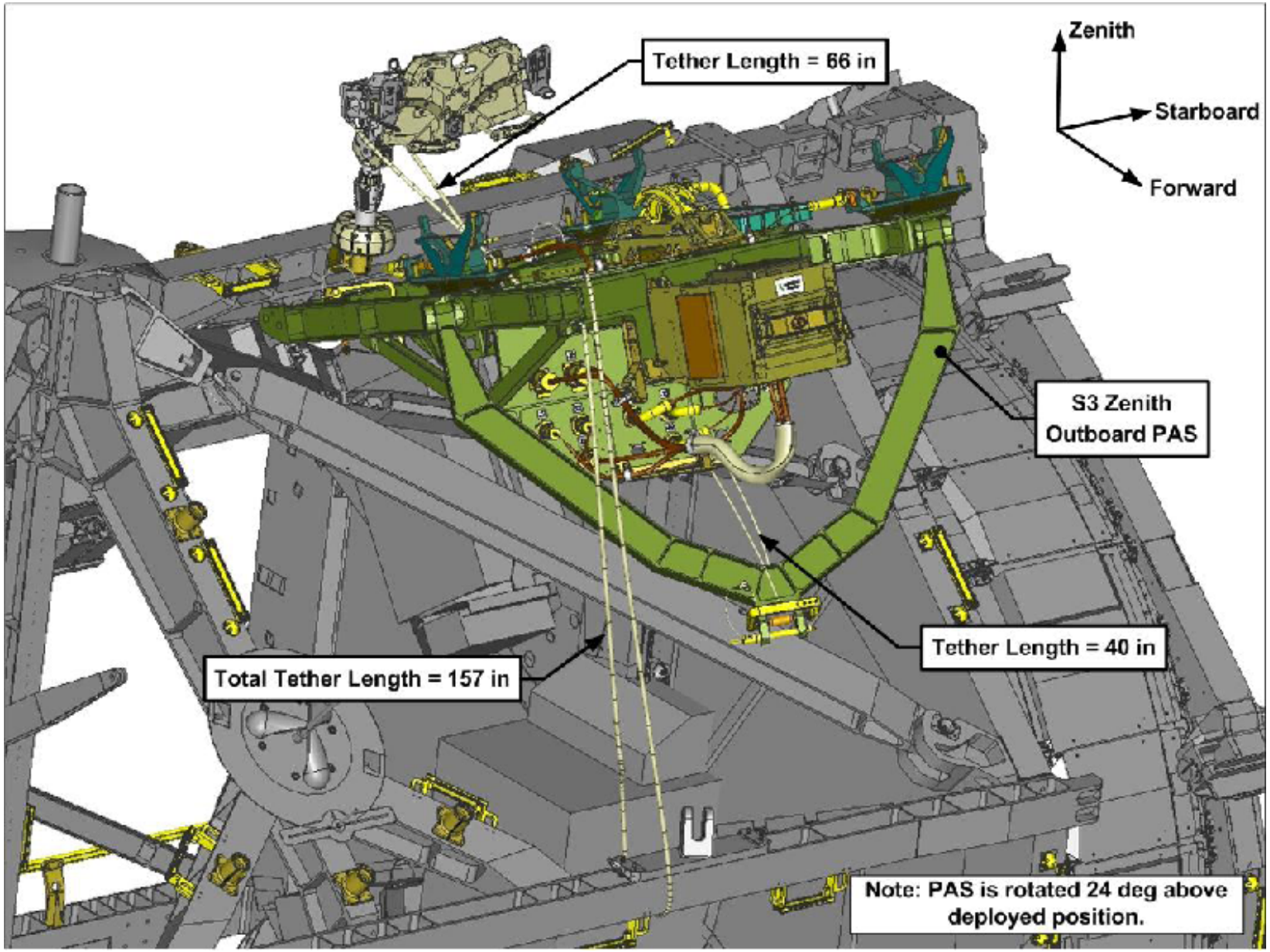
**S3 PAS TIE DOWN**



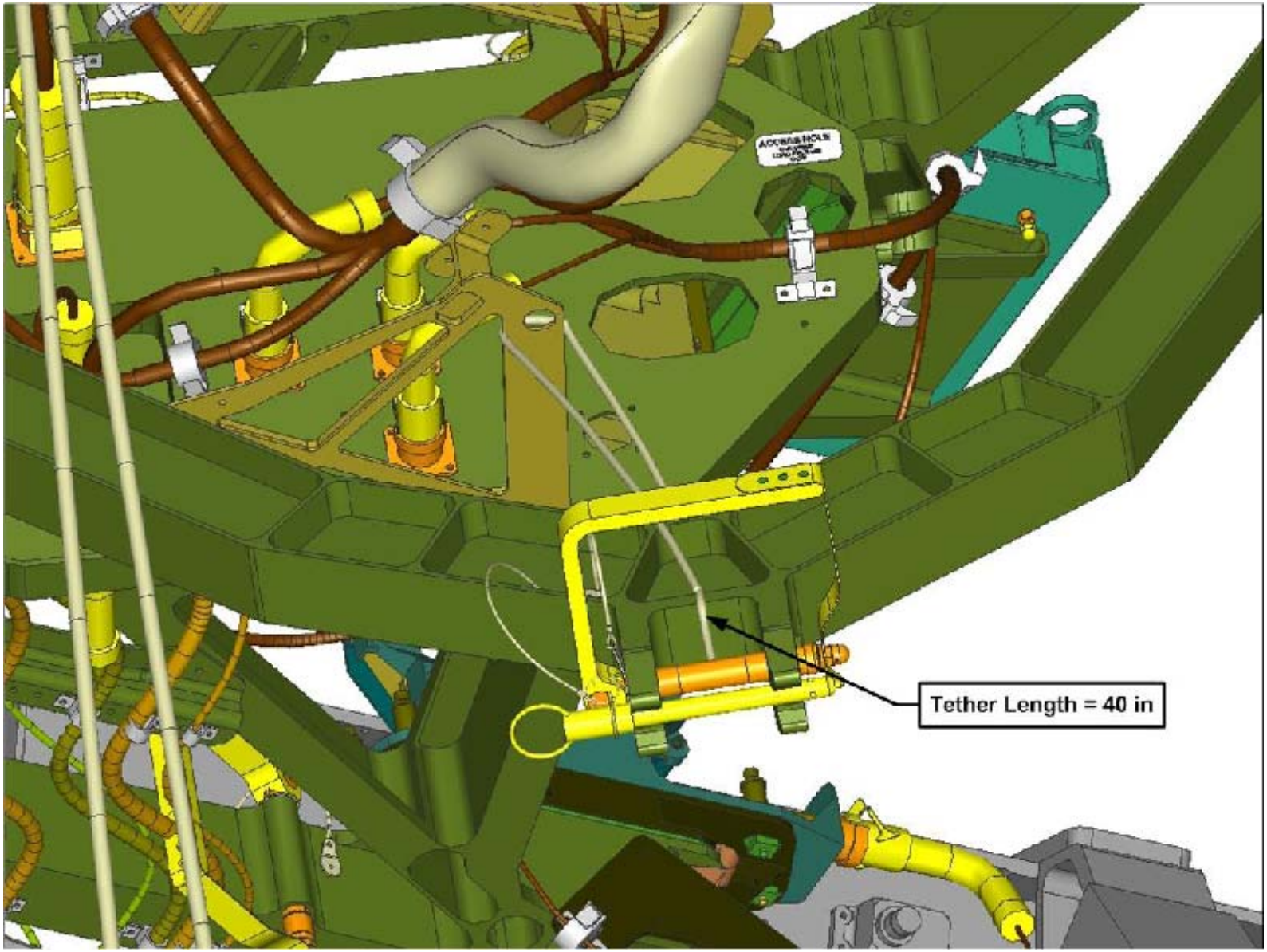
**S3 PAS TIE DOWN** (Cont)



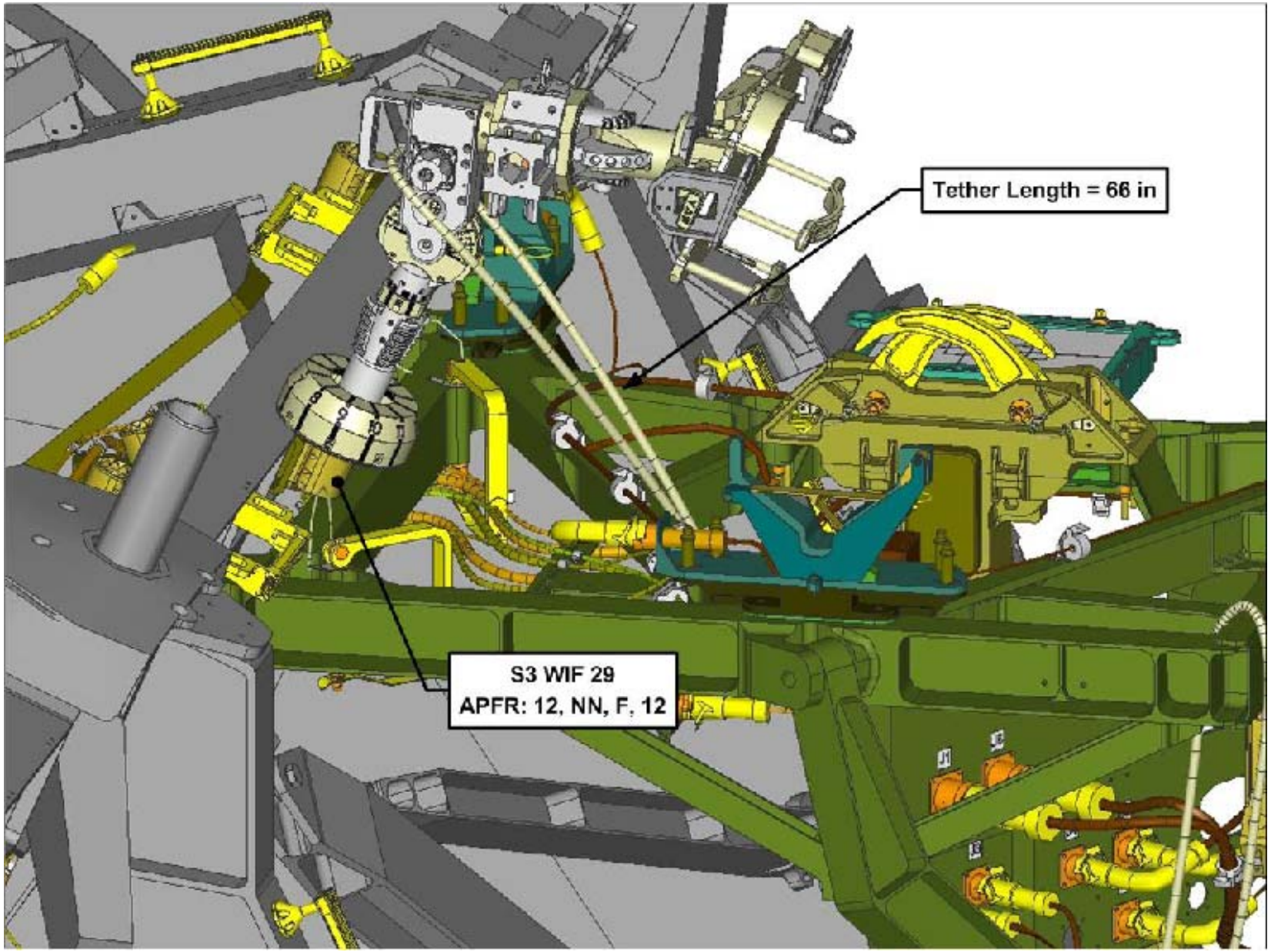
**S3 PAS TIE DOWN** (Cont)



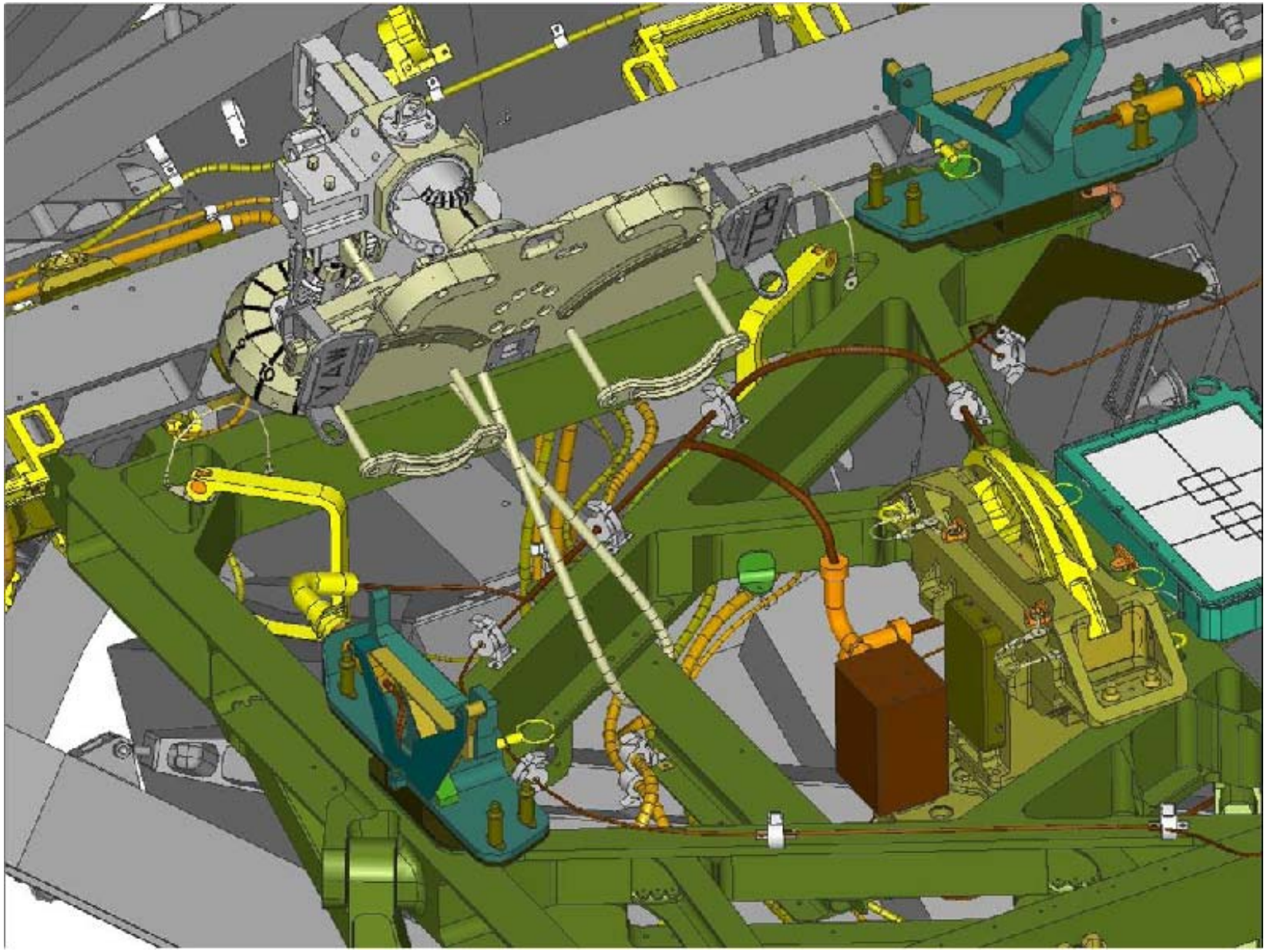
**S3 PAS TIE DOWN** (Cont)



**S3 PAS TIE DOWN** (Cont)



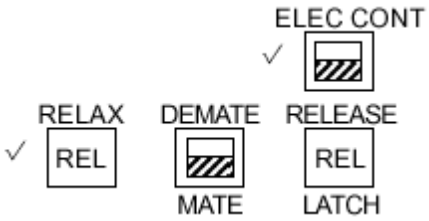
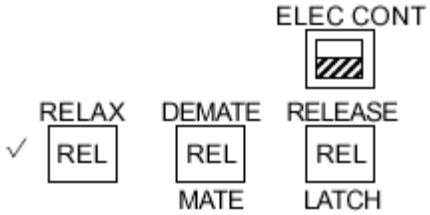
**S3 PAS TIE DOWN** (Cont)



## RELEASE ROEU LATCHES

| IV | EV |
|---|---|
| CAUTION<br>After step 1, 2 hr LCS Thermal Clock starts<br><br>1. DEADFACE ROEU<br>R1 √PRI PL MNC – OFF (tb-OFF)<br>SSP1 √MPLM CH 1,2 HTR PWR – OFF (tb-bp)<br>A15 APCU 2 CONV – OFF<br>√1 CONV, OUTPUT(two) – OFF<br><br>2. ROEU SAFING<br>R13L √PL BAY MECH PWR SYS 1,2 (two) – OFF<br>A6U √RETEN LOGIC PWR SYS 1,SYS 2 (two) – OFF<br>PL SEL – 1<br><br>Give EV GO to release ROEU | Tools reqd:<br>Ratchet with 3-in Ext (Airlock)<br><br>WARNING<br>For release, do not close access cover until ROEU stowed. Latches may not snap back to closed posn<br><br>1. On IV GO, open latch drive access cover:<br>Break safety cord, release access cover (3/4 turn ccw)<br>Open access cover (~120°)<br>Manual drive to RELEASE:<br>Rotate control lever to RELEASE<br>Rotate latch drive cw (~9 ft-lb) to hard stop (~3/4 turn)<br>Remove drive ratchet, clear worksite |

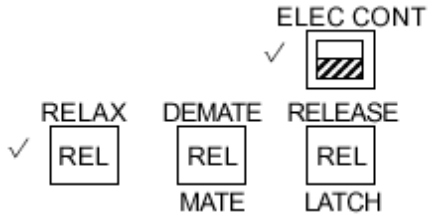
## RELEASE ROEU LATCHES (Cont)

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

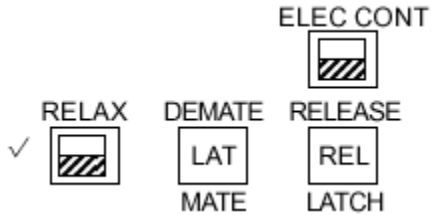
**RELEASE ROEU LATCHES** (Cont)

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

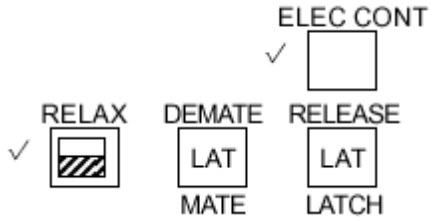
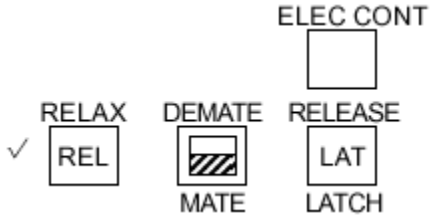
## LATCH ROEU LATCHES

| IV | EV |
|---|---|
| 1. CONFIGURE FOR ROEU MATE<br>A6U Install ROEU A6U PANEL OVERLAY<br><br>R13L √PL BAY MECH PWR SYS 1,2 (two) – OFF<br>A6U RETEN LOGIC PWR SYS 1, SYS 2 (two) – OFF<br>PL RETEN PL SEL – 2<br><br>SM 97 PL RETENTION<br><br>CRT √LAT 1,2,3 (six): 0<br><br>* If LATCH 2,3 LAT msw shows 1, drive latch for *<br>* single motor time *<br><br>A6U<br>  <br><br><br>R1 √PRI PL MNC – OFF (tb-OFF)<br>SSP1 √MPLM CH 1,2 HTR PWR – OFF (tb-bp)<br>A15 APCU 2 CONV – OFF<br>√1 CONV, OUTPUT(two) – OFF | Tools reqd:<br>Ratchet with 3-in Ext (Airlock) |

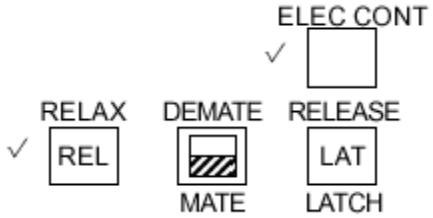
**LATCH ROEU LATCHES** (Cont)

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

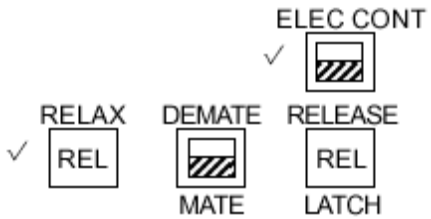
**LATCH ROEU LATCHES** (Cont)

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

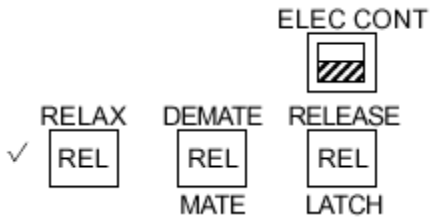
## STOW ROEU ARM

| IV | EV |
|---|---|
| CAUTION<br>After step 1, 2 hr LCS Thermal Clock starts<br><br>1. RELEASE ROEU LATCHES<br>R1 √PRI PL MNC – OFF (tb-OFF)<br>SSP1 √MPLM CH 1,2 HTR PWR – OFF (tb-bp)<br>A15 APCU 2 CONV – OFF<br>√1 CONV, OUTPUT(two) – OFF<br><br>A6U Install ROEU A6U PANEL OVERLAY<br><br>√PL RETEN LAT (five) – OFF<br>PL SEL – 2<br><br>SM 97 PL RETENTION<br>√REL 2,3 (four) – 0<br><br>* If LATCH 2,3 REL msw shows 1, drive latch for single motor time *<br><br>  <br> | Tools reqd:<br>Ratchet with 3-in Ext (Airlock) |

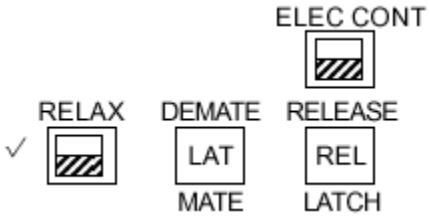
## **STOW ROEU ARM** (Cont)

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

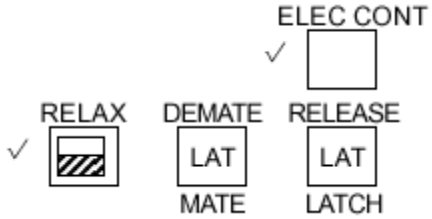
**STOW ROEU ARM** (Cont)

| IV | EV |
|---|---|
| A6U 4. <u>VERIFY TALKBACKS</u><br>PL RETEN PL SEL – 2<br>  <br><br>A15 5. <u>ENABLE POWER</u><br>√APCU 2 OUTPUT – ON<br>APCU 2 CONV – ON<br><br>6. End Thermal Clock ____:____ | 2. Reengage arm actuator:<br>Rotate control lever to neutral posn<br>Close, secure access cover (3/4 turn cw)<br>Clear worksite |

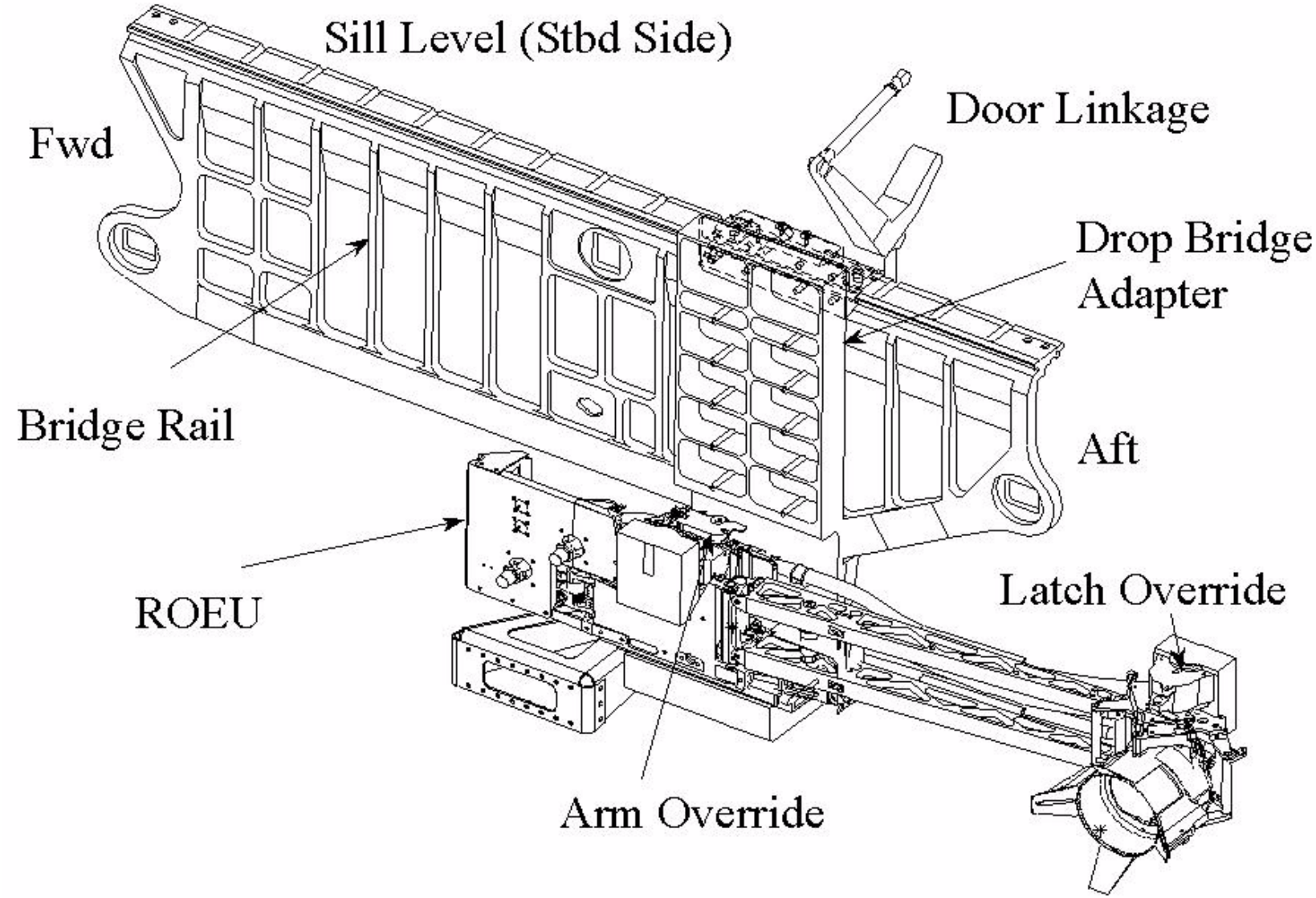
## MATE ROEU ARM

| IV | EV |
|---|---|
| 1. <u>CONFIGURE ROEU</u><br>A6U Install <u>ROEU A6U PANEL OVERLAY</u><br><br>2. <u>ROEU SAFING</u><br>R13L √PL BAY MECH PWR SYS 1,2 (two) – OFF<br>A6U √RETEN LOGIC PWR SYS 1,SYS 2 (two) – OFF<br>PL SEL – 1<br>SSP 1 √MPLM CH 1,2 HTR PWR – OFF (tb-bp)<br>A15 APCU 1,2 CONV (two) – OFF<br>√1 OUTPUT – OFF<br>R1 PRI PL MNC – OFF (tb-OFF)<br><br>Give EV GO to mate ROEU<br><br>3. <u>VERIFY TALKBACKS</u><br>A6U PL RETEN PL SEL – 2<br>  | Tools reqd:<br>Ratchet with 3-in Ext (Airlock)<br><br>1. On IV GO, open arm drive access cover:<br>Break safety cord, release access cover (3/4 turn ccw)<br>Open access cover (~120°)<br>Manual drive to MATE:<br>Rotate control lever to MATE<br>Ratchet arm drive cw (~25 ft-lb) until “READY TO LATCH” posn indicated on interface guide<br>Remove drive ratchet<br>Clear worksite (for latching) |

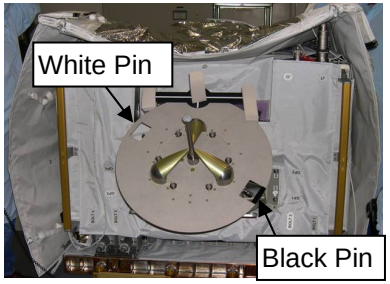
## **MATE ROEU ARM** (Cont)

| IV | EV |
|---|---|
| 4. <u>LATCH LATCHES</u><br>R13L PL BAY MECH PWR SYS 1,2 (two) – ON<br>A6U RETEN LOGIC PWR SYS 1,SYS 2 (two) – ON<br><br>Note single motor time (> 20 sec)<br><br>RELEASE/LATCH – LATCH (tb-LAT), 40 sec max<br>– OFF<br><br>  <br><br><br>PL RETEN LOGIC PWR SYS 1,SYS 2 (two) – OFF<br>R13L BAY MECH PWR SYS 1,2 (two) – OFF<br><br>5. <u>RELAX ROEU (EVA)</u><br>Monitor PL RETEN LAT 1 tb<br><br>Give EV GO to STOW arm, halt once RELAX tb – REL | 2. <u>RELAX ROEU (EVA)</u><br>On IV GO, rotate control lever to STOW:<br>Ratchet arm drive ccw until IV receives RELAX 1 tb – REL<br>Remove drive ratchet<br>3. Reengage arm actuator:<br>Rotate control lever to neutral posn<br>Close, secure access cover (3/4 turn cw)<br>Clear worksite |

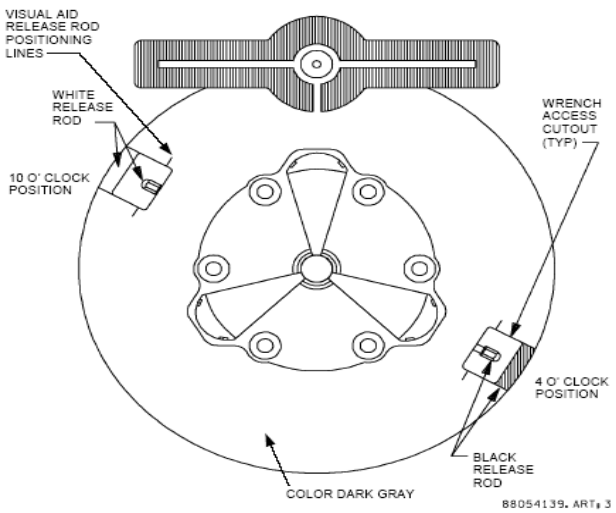
**MATE ROEU ARM** (Cont)

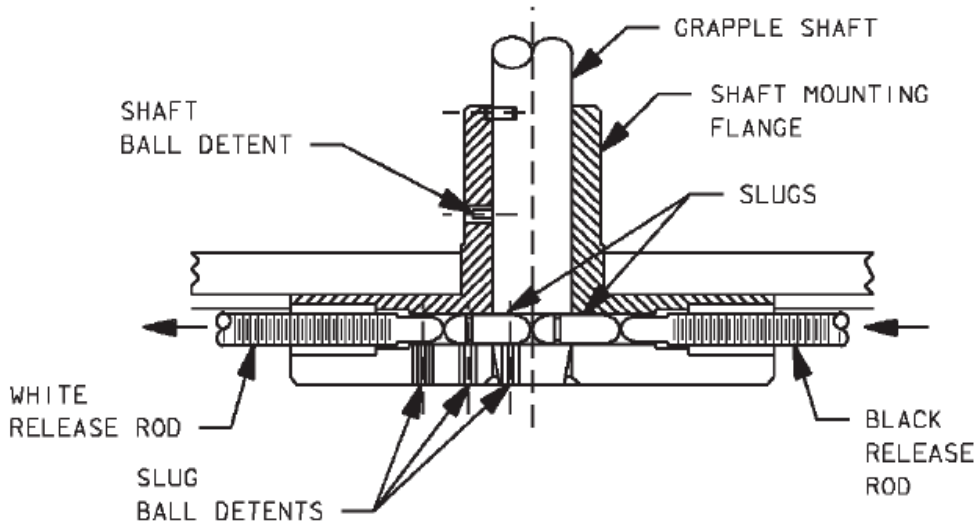


## FGB GRAPPLE SHAFT RELEASE

| IV | EV1 | EV2 |
|---|---|---|
| 1. Verify SSRMS in temp handoff position<br>Verify brakes on<br><br>2. SSRMS mnvr to ATA temp handoff position<br><br>  <br><br><br>3. SSRMS mnvr to ATA handoff position | <u>FGB GRAPPLE SHAFT REMOVAL</u> (00:45)<br>1. Release RET from ATA<br>2. Egress APFR<br>3. Translate to the A/L to retrieve ½" socket with 8" ext, Velcro Tape Caddy<br>4. Translate back to P1 ATA Handoff worksite<br>5. Hand off ½" socket with 8" ext, Velcro/Tape Caddy to EV2<br>6. Ingress APFR<br>7. Attach RET to ATA<br>8. When in two-handed positive control of ATA give EV2 a GO to release contingency pins<br><br>Return to ATA INSTALL ON P1 (P1 CLEANUP/ATA HANDOFF) step 49, FS 7-54 | <u>FGB GRAPPLE SHAFT REMOVAL</u> (00:45)<br>1. GCA SSRMS close to structure to retrieve contingency tools<br><br>2. Receive Box Ratchet and Velcro/Tape Caddy from EV1; stow tools on MWS<br>3. GCA SSRMS close to Temp Handoff position<br>4. Egress APFR in LEE<br>5. Translate to FGB contingency pins<br><br>6. On EV1 GO rotate white release rod ccw to hardstop (32 strokes of 90 deg)<br>7. Verify EV1 has positive control of ATA<br>8. Rotate black release rod cw to hardstop (32 strokes of 90 deg), shaft will release from grapple fixture<br>9. Tape end of shaft to restrain slug within shaft<br>10. Translate to APFR in LEE<br>11. Ingress<br>12. GCA SSRMS to ATA Handoff position<br><br>Return to ATA INSTALL ON P1 (CONNECT ELECTRICAL & ZENITH FLUID CONNECTORS) step 15, FS 7-53 |

# FGB GRAPPLE SHAFT RELEASE – TASK DATA




**Estimated Task Duration:**

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

**Tools:**

| EV1 | EV2 |
|---|---|
| | 1/2" socket with 8" ext,<br>Velcro Tape Caddy |

**Fasteners:**

| Contingency Fastener | Tool | Qty | Turns | Position on grapple fixture |
|---|---|---|---|---|
| White | 1/2" socket with 8" ext | 1 | 32 ccw | 10 o'clock |
| Black | 1/2" socket with 8" ext | 1 | 32 cw | 4 o'clock |

**Notes:**

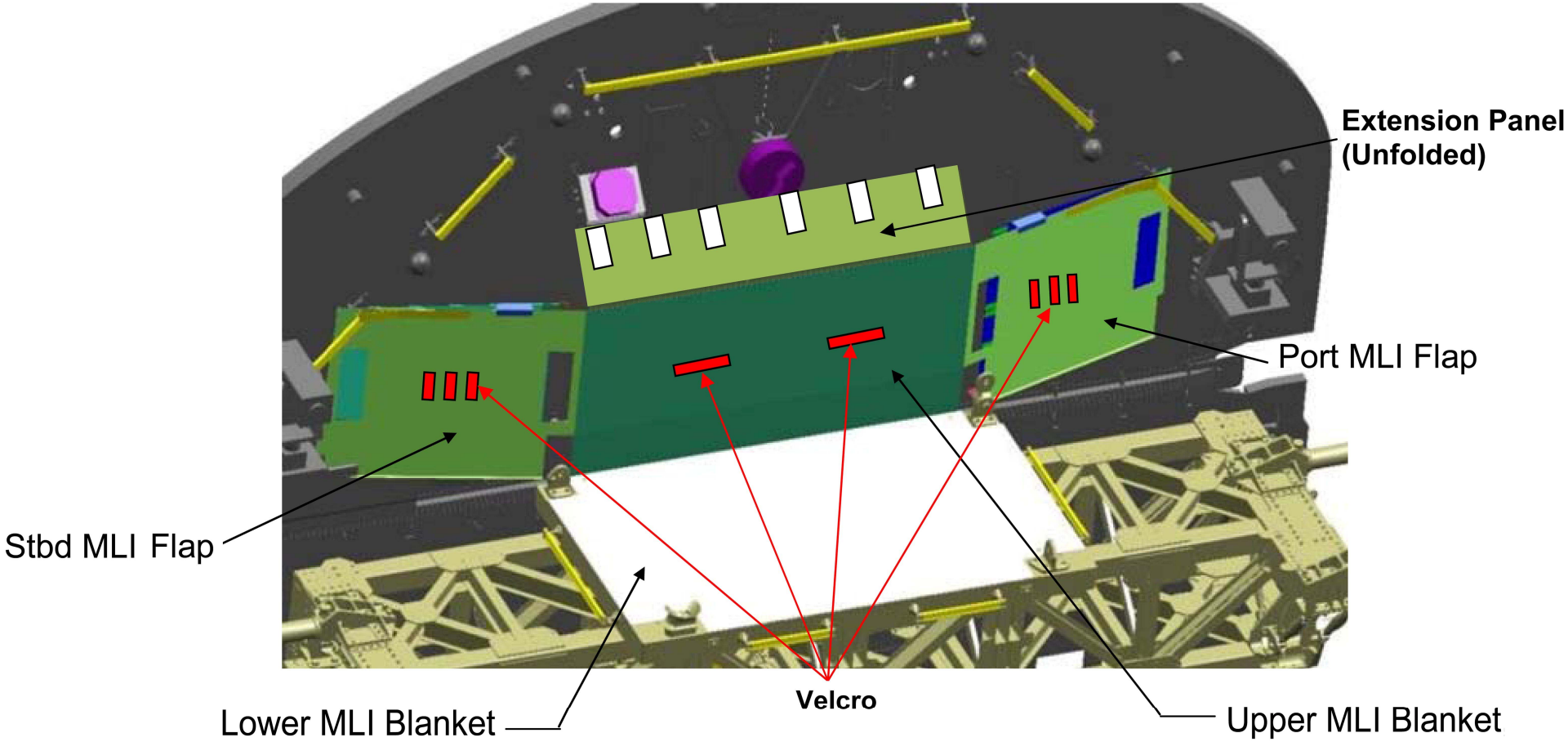
**Cautions:**

**Warnings:**

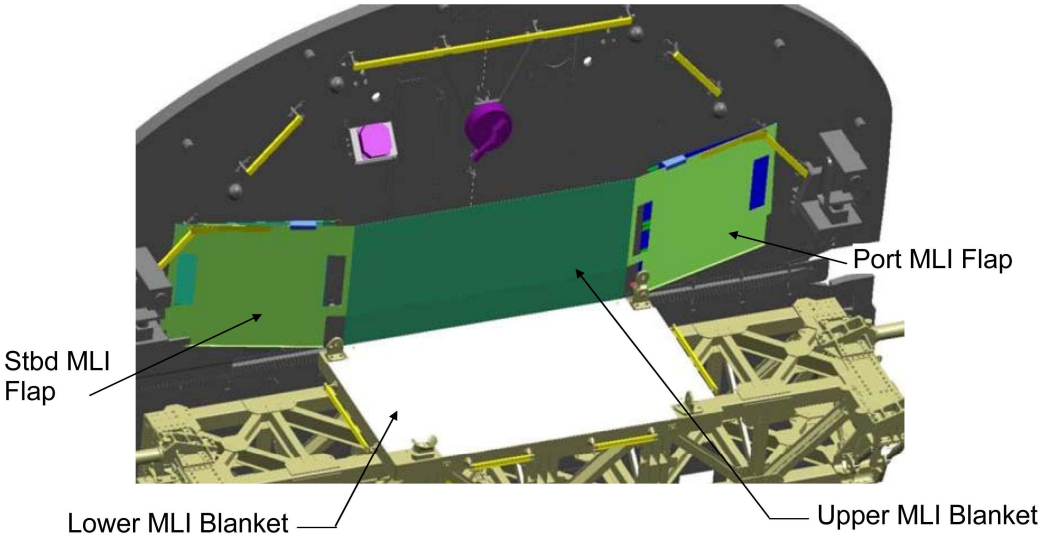
## ATA MLI STOW WITHOUT ATA ON LMC (00:10)

| IV (SSRMS) | EV1 | EV2 |
|---|---|---|
| | ATA MLI STOW WITHOUT ATA (00:10)<br>1. Cut tacks inside extension flap with EVA scissors; stow in trash bag<br>2. Unstow extension flap<br>3. Release stbd. integrated strap from bulkhead handrail<br>4. Restrain stbd MLI flap with velcro to upper MLI blanket<br>5. Fold upper MLI blanket and extension flap flat against ATA FSE<br>6. Restrain MLI with stbd MLI straps around stbd ATA FSE HRs (2)<br>7. Restrain extension flap with forward/stbd MLI straps around forward/stbd FSE HR (2)<br>8. Closeout photos of ATA MLI on LMC<br>9. Glove Inspection | ATA MLI STOW WITHOUT ATA (00:10)<br>1. Assist EV1 with unstow of extension flaps<br>2. Release port integrated strap from bulkhead handrail<br>3. Restrain port MLI flap with velcro to upper MLI blanket<br>4. Fold upper MLI blanket and extension flap flat against ATA FSE<br>5. Restrain MLI with port MLI straps around port ATA FSE HRs (2)<br>6. Restrain extension flap with forward/port MLI straps around forward/port FSE HR (2)<br>7. Glove Inspection |

**ATA MLI STOW WITHOUT ATA ON LMC – TASK DATA**



## ATA MLI STOW WITHOUT ATA ON LMC – TASK DATA (Cont)



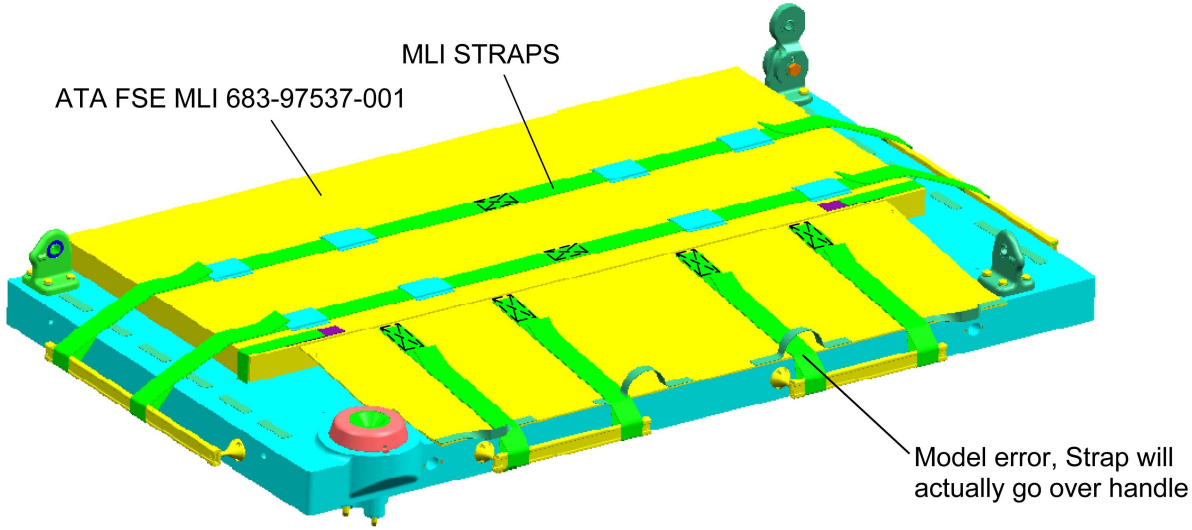

| ORU | Part Number | Serial Number | Dimensions (in) |
|---|---|---|---|
| ATA FSE MLI | 638-97537-001 | TBD | |

**Estimated Task Duration**

| | Without SSRMS | With SSRMS |
|---|---|---|
| **One EV Crew** | TBD | **N/A** |
| **Two EV Crew** | TBD | **N/A** |

**Tools**

| EV1 | EV2 |
|---|---|
| BRT | BRT |



## MANUAL GN2 VENT

| IV | EV1 | EV2 |
|---|---|---|
| | EVA SETUP<br>1. Retrieve 1/4" $NH_3/N_2$ vent tool from Fluid QD bag and place in crewlock bag<br>2. Perform P1 ATA RELEASE FROM TRUSS (P1 ATA WORKSITE SETUP), all steps (EVA 1, FS 7-16)<br>3. Perform P1 ATA RELEASE FROM TRUSS (ATA RELEASE FROM TRUSS), steps 1-8 (EVA 1, FS 7-16)<br>4. Retrieve and route vent tool with nozzle aimed away from structure and crew | EVA SETUP<br>1. Perform P1 ATA RELEASE FROM TRUSS (P1 ATA WORKSITE SETUP), all steps (EVA 1, FS 7-16)<br>2. Perform P1 ATA RELEASE FROM TRUSS, steps 1-7 (EVA 1, FS 7-16)<br>3. Clear venting region |
| | WARNING<br>Do not open vent tool valve until nozzle is routed and EV crew is clear of vent region | |
| 1. Verify with MCC-H GO to perform GN2 vent of M2; duration per MCC<br>2. Verify with MCC-H GO to perform GN2 vent of M1; duration per MCC | 5. Mate vent tool per **BLOCK D** to M2<br>6. When EV2 clear of vent region, open valve per **BLOCK E**. Vent duration per MCC expect ~10 min<br>7. When venting is complete, close valve per **BLOCK B**<br>8. Demate per **BLOCK C**<br>9. Mate vent tool per **BLOCK D** to M1<br>10. Open valve per **BLOCK E**. Vent duration per MCC expect ~10 min<br>11. When venting is complete, close valve per **BLOCK B**<br>12. Demate vent tool per **BLOCK C** and place in crewlock bag<br>13. Return to perform P1 ATA RELEASE FROM TRUSS (ATA RELEASE FROM TRUSS), step 9 (EVA 1, FS 7-16) | 4. Return to perform P1 ATA RELEASE FROM TRUSS (ATA RELEASE FROM TRUSS), step 8 (EVA 1, FS 7-16) |

## ADJUSTABLE GRAPPLE BAR (AGB) REMOVE/INSTALL

| IV | EV1 (FF) | EV2 (FF) |
|---|---|---|
| | CAUTION<br>Avoid contact with AGB target pin and grapple shaft<br><br>REMOVE AGB FROM FHRC<br>1. Translate to single pin end of AGB stowed on FHRC<br>2. Transfer crewlock bag to EV2 as reqd<br><br>3. **PGT: A2/CCW2/30.5**<br>(3.8 ft-lb, 30 RPM)<br>6-in ext<br>4. Drive ABG bolt, 2-4 turns (preps it for release)<br><br>5. Attach tether to AGB tether point<br>6. Pull T-handle out to unlock (two white lines visible)<br>7. Slide single pin end out of receptacle on ORU<br>8. Remove AGB 2-pin end out of receptacles on ORU<br><br>9. Fully retract AGB<br>10. Push T-handle into lock (no lines visible)<br><br>11. Attach AGB to BRT<br><br>12. Translate to AGB install location | CAUTION<br>Avoid contact with AGB target pin and grapple shaft<br><br>REMOVE AGB FROM FHRC<br>1. Translate to 2-pin end of AGB stowed on FHRC<br><br>2. Receive crewlock bag from EV1 as reqd; stow on BRT<br><br>3. Remove AGB 2-pin end out of receptacles on ORU<br><br>4. Secure AGB receptacle flaps (three) (Velcro holds them closed)<br><br>5. Translate to AGB install location |

## **ADJUSTABLE GRAPPLE BAR (AGB) REMOVE/INSTALL** (Cont)

| IV | EV1 (FF) | EV2 (FF) |
|---|---|---|
| | <u>INSTALL AGB ONTO ATA</u><br>13. GCA SSRMS into position for AGB installation<br>14. Translate to single pin receptacle end of ATA<br><br>15. Remove AGB from BRT and orient it to align AGB pins with receptacles on ORU<br>16. Pull T-handle out to unlock (two white lines visible)<br>17. Extend AGB out to position wider than ATA<br><br>18. Slide single pin end into receptacle until aligned with specific ORU position indicator line<br><br>19. Push T-handle into lock (no lines visible)<br>20. Release tether<br><br>21. **PGT: A2/CCW2/30.5**<br>(3.8 ft-lb, 30 RPM)<br>6-in ext<br><br>22. Drive AGB bolt, two to four turns (hard stop) (Preps it for grapple) | <u>INSTALL AGB ONTO ATA</u><br><br>6. Translate to 2-pin receptacle end of ORU<br><br>7. Install AGB 2-pin side into receptacles on ORU (soft dock); react EV1 loads<br><br>8. Take digital stills of AGB from various angles, specifically the RMS target pin |

# ADJUSTABLE GRAPPLE BAR (AGB) REMOVE/INSTALL – TASK DATA

Table 1. Tools

| EV1 | EV2 |
|---|---|
| PGT with 2 x 7/16 | |
| BRT | |

**Foot Restraints:** N/A

Table 2. EVA Fasteners

| Fastener Name | Label | Head Size (in) | Qty | Install Torque (ft-lbs) | Failure Torque (ft-lbs) | Turns | RPM |
|---|---|---|---|---|---|---|---|
| Center Drive Pin | 4 | 7/16 | 1 | 3.8 | 5.7 (overload fwd leg pin and retainer) | ~2 to 4 | 30 CW |

**AGB Mass:** 34 kg (75 lbs)

**Notes:**

1. The AGB is designed to be used with the Nitrogen Tank Assembly (NTA), Ammonia Tank Assembly (ATA), Flex Hose Rotary Coupler (FHRC), and Pump Module (PM). To make installation easier, there exists a line marking the required AGB length for each ORU
2. A RAD with 2-inch socket may be needed to access AGB bolt because of tight clearances
3. The NTA, ATA, and PM must each be released from the FRAM or truss to install the AGB
4. FHRC must be released from truss to install the AGB
5. The flight AGB retracted length (NTA setting) is: ~38.4". The NBL AGB retracted length (NTA setting) is: ~37.3"

**Cautions:**

1. Avoid contact with AGB target pin and grapple shaft

**Warnings:**

1. None

## ADJUSTABLE GRAPPLE BAR (AGB) REMOVE/INSTALL – TASK DATA (Cont)

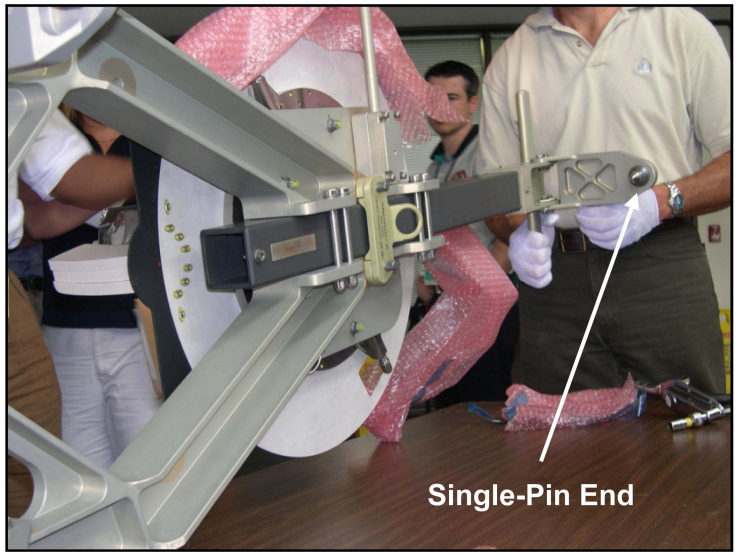



Figure 1.- Adjustable Grapple Bar.

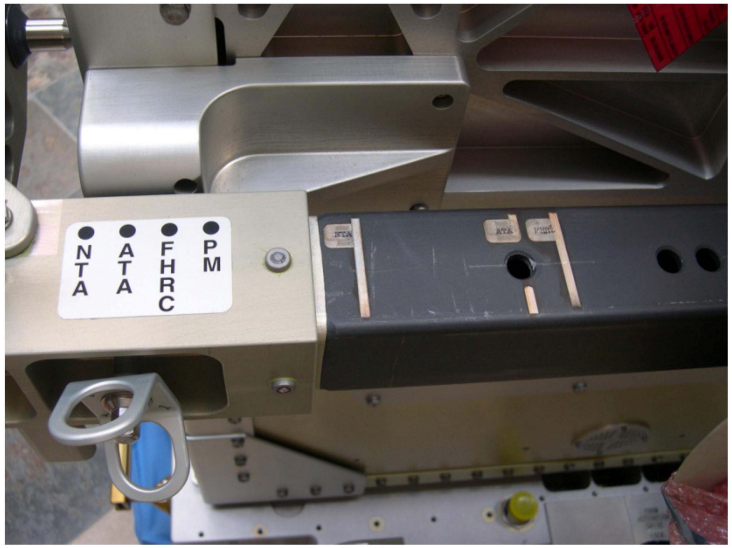



Figure 2.- ORU Sizing Indication Lines.

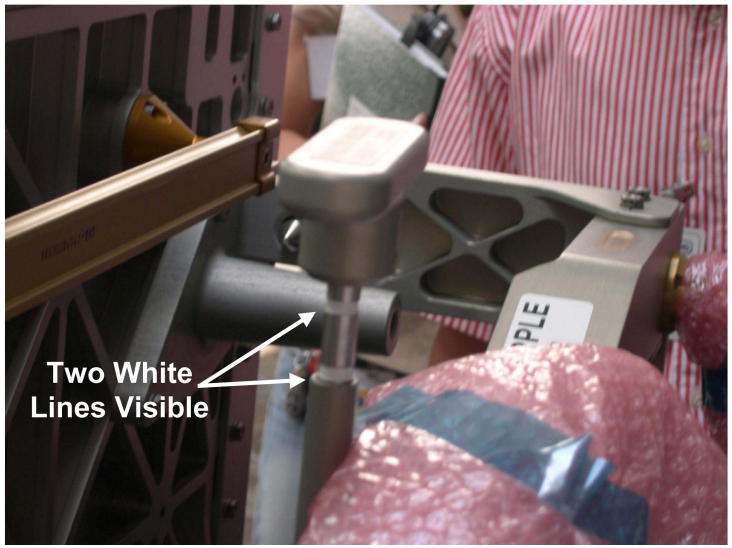



Figure 3.- T-Handle in Unlock Position.

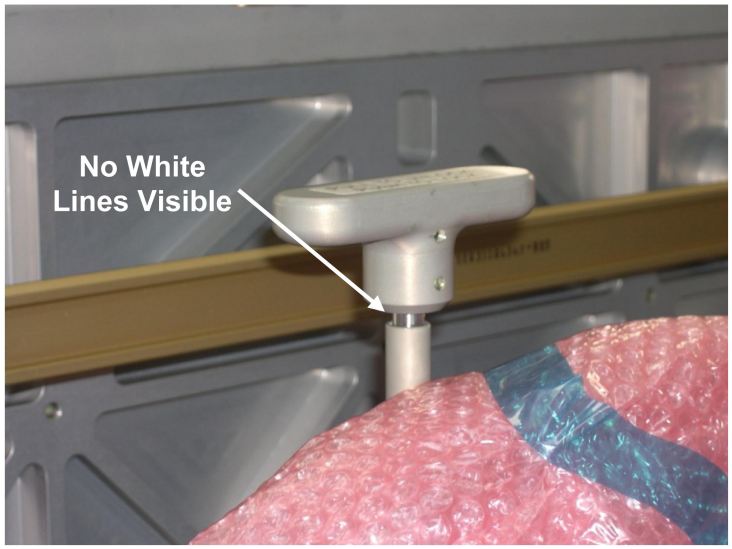



Figure 4.- T-Handle in Lock Position.

Figure 5.- Ammonia Tank Assembly – AGB Pin Interfaces.

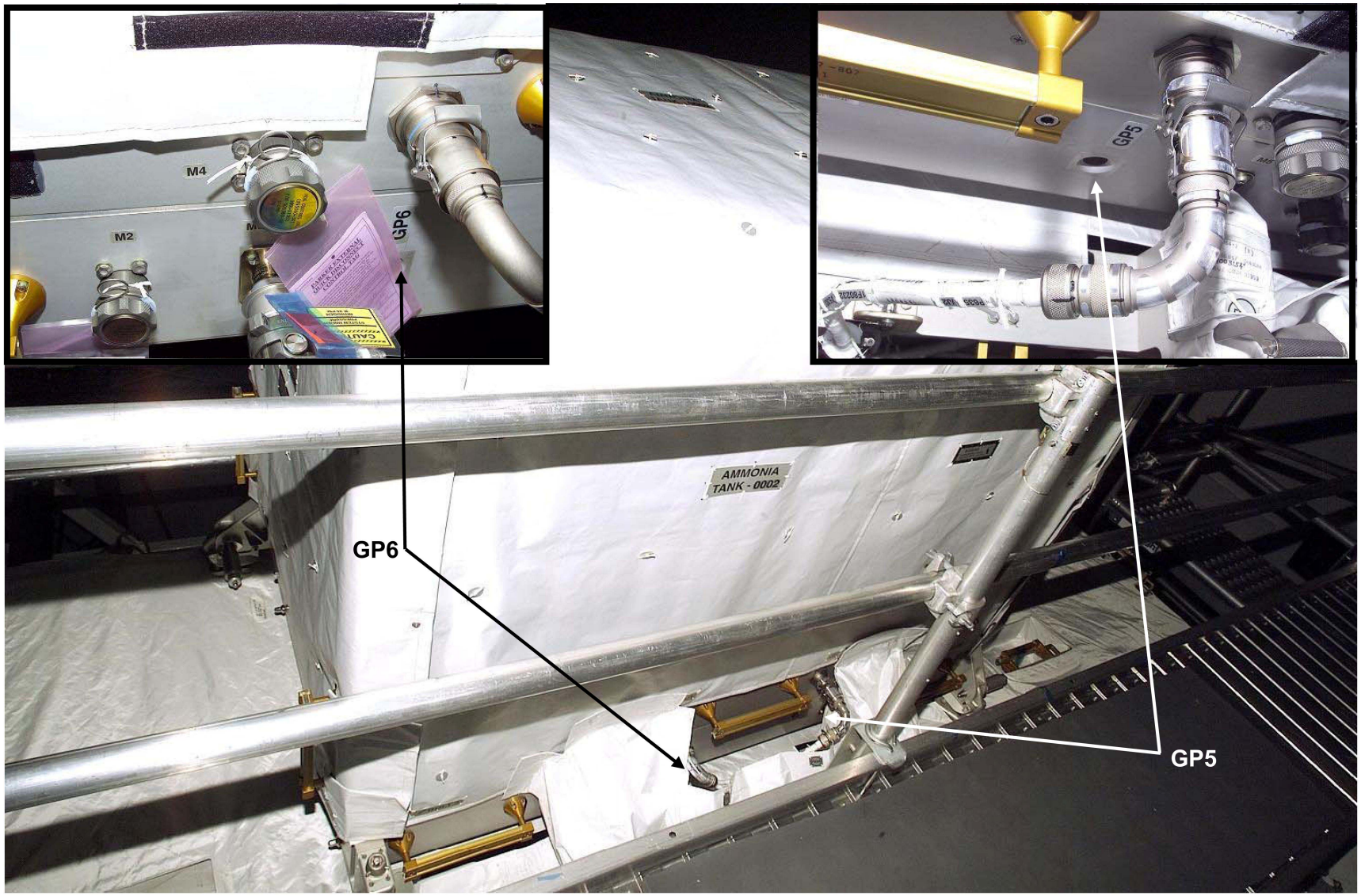



Figure 6.- Ammonia Tank Assembly – 2-Pin Interface (Labeled GP5 and GP6).

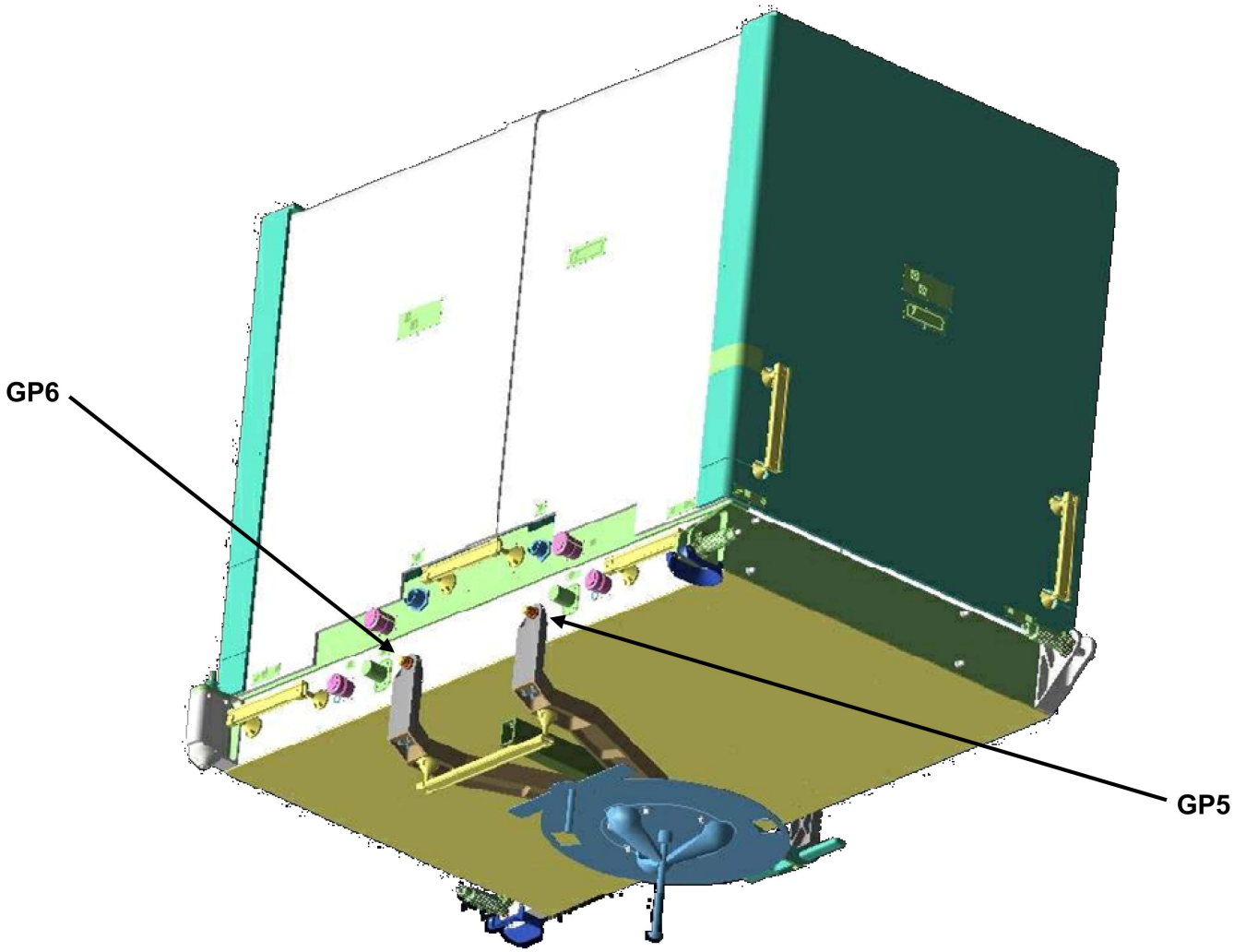
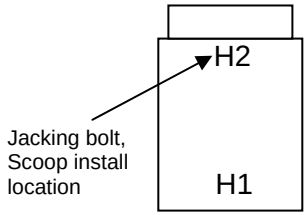



Figure 7.- Ammonia Tank Assembly – AGB Installed.

## MBSU 4A4B REMOVE AND REPLACE (NO SSRMS)

| IV | EV1 | EV2 |
|---|---|---|
| 1. IV: Verify with MCC S0 inhibits in place<br>– MBSU 4 RBI 7 Op (Cl Inh)<br>– MBSU 4 RBI 6 Op (Cl Inh)<br>– MBSU 4 RBI 14 Op (Cl Inh)<br>2. IV: Verify w/MCC ESP2 inhibits in place<br>– RPCM N1RS2-B RPC10 (open and close inhibited)<br>– RPCM S04B F RPC 12 (open and close inhibited)<br><br>3. IV: Record S/N of failed MBSU<br>_____ | S0 MBSU R&R SETUP<br>1. Retrieve APFR per MCC direction<br>2. Translate to failed MBSU 4A4B, (S0, Bay 00, Face 2)<br>3. Install APFR in S0 WIF 18 [1,NN,F,12]<br>❑ Verify Black on Black<br>❑ Perform pull test<br>4. Ingress APFR<br><br>5. Verify failed MBSU P/N and S/N to IV<br>6. Install Sq TM on H1 fitting; √anti-backlash neutral | S0 MBSU R&R SETUP<br>1. Retrieve APFR per MCC direction<br>2. Translate to A/L Toolbox #1 WIF<br>3. Set WIF Pitch/Yaw fitting [1,KK]<br>4. Install APFR [10,QQ,G,5]<br>❑ Verify Black on Black<br>❑ Perform pull test<br>5. Translate to ESP-2; attach BRT to ESP-2 HR 8003 (aft face, stbd side)<br>6. Remove MLI from spare MBSU (hinge is FWD)<br>❑ Release velcro tabs on front, side, and back corners of ORU base<br>❑ Release integral strap from underside of fwd flap<br>❑ Fold or roll cover toward back of MBSU, attach strap to Velcro mating swatch on back side of MLI<br>❑ Using side straps from front of MLI, secure rest of MLI as reqd<br>7. Install MUT EE/Ballstack on ESP-2 HR 8005<br>8. Translate to failed MBSU 4A4B (S0, Bay 00, Face 2) |
|  | S0 MBSU 4A4B REMOVAL<br><br>CAUTION<br>Acme screws unfastened/fastened out of sequence could lead to jamming of MBSU<br><br>On MCC GO:<br>7. **PGT: B1/CCW1/30.5**<br>(12.0 ft-lb, 10 RPM)<br>Sq TM-7/16" Rec<br>8. Drive PGT 5 turns (1 turn at bolt) on H1<br>9. Remove Sq TM and install on H2 fitting; √anti-backlash neutral | S0 MBSU 4A4B REMOVAL |

## MBSU 4A4B REMOVE AND REPLACE (NO SSRMS) (Cont)

| IV | EV1 | EV2 |
|---|---|---|
| | 10. **PGT: B1/CCW2/30.5**<br>(12.0 ft-lb,30 RPM)<br>6" Ext 7/16"<br>11. Drive H1 ~8 turns<br>12. √Status indicator – UNLOCK | |
| | 13. **PGT: B1/CCW1/30.5**<br>(12.0 ft-lb, 10 RPM)<br>Sq TM-7/16" Rec<br>14. Drive PGT 5 turns (1 turn at bolt) on H2<br>15. Remove TM from H2 and transfer to EV2 | 9. Pass PGT w/no socket to EV1 for all TM ops, to avoid socket swaps<br><br>10. Receive Sq TM from EV1; stow on MWS<br>11. Transfer Sq Scoop to EV1 |
| | 16. Receive Sq Scoop from EV2; install on H2<br>17. **PGT: B1/CCW2/30.5**<br>(12.0 ft-lb,30 RPM)<br>6" Ext 7/16"<br>18. Drive H2 ~18 turns<br>19. √Status indicator – UNLOCK<br>20. Stow PGT | |
| | WARNING<br>Avoid contact with intermeshing fins of the MBSU and coldplate | |
| | 21. Remove MBSU from coldplate (soft dock on H2 15-20 lb); stow in BRT | |
| | RETRIEVE SPARE MBSU/STOW FAILED MBSU<br>22. Egress APFR and translate to ESP-2 | RETRIEVE SPARE MBSU/STOW FAILED MBSU<br>12. Translate to ESP-2; assist with tending MBSU |
| | 23. Temp stow failed MBSU on ESP-2 HR 8005 using MUT EE/Ballstack (fins facing away from structure)<br>24. Ingress APFR [10,QQ,G,5] in A/L Toolbox #1 WIF [1,KK] | 13. Temp stow failed MBSU on ESP-2 HR 8005 using MUT EE/Ballstack (fins facing away from structure)<br>14. Install Sq TM on Spare MBSU H1 fitting; √anti-backlash neutral |

## MBSU 4A4B REMOVE AND REPLACE (NO SSRMS) (Cont)

<table>
<tr><th>IV</th><th>EV1</th><th>EV2</th></tr>
<tr>
<td>4. IV: Record failed MBSU installation turns and torque
<table>
<tr><th>Bolt</th><th>Turns</th><th>Torque</th></tr>
<tr><td>H2</td><td></td><td></td></tr>
<tr><td>H1</td><td></td><td></td></tr>
</table></td>
<td>25. PGT: B1/CCW1/30.5<br>(12.0 ft-lb, 10 RPM)<br>Sq TM-7/16" Rec<br>26. Drive PGT 5 turns on H1<br>27. Remove Sq TM and install on H2 fitting; √anti-backlash neutral<br><br>28. PGT: B1/CCW2/30.5<br>(12.0 ft-lb,30 RPM)<br>6" Ext 7/16"<br>29. Drive H1 ~8 turns<br>30. √Status indicator – UNLOCK<br><br>31. PGT: B1/CCW1/30.5<br>(12.0 ft-lb, 10 RPM)<br>Sq TM-7/16" Rec<br>32. Drive PGT 5 turns on H2<br>33. Transfer Sq TM to EV2<br><br>34. Retrieve Sq Scoop from MWS; install on H2<br>35. PGT: B1/CCW2/30.5<br>(12.0 ft-lb,30 RPM)<br>6" Ext 7/16"<br>36. Drive H2 ~18 turns<br>37. √Status indicator – UNLOCK<br>38. Stow PGT<br><br>39. Remove MBSU (soft dock on H2 15-20 lb); transfer to EV2<br><br>40. Remove failed MBSU from Ballstack; install on FRAM (soft dock on H2 15-20 lb)<br>41. √Status indicator on H1and H2 are in UNLOCK</td>
<td>15. Receive Sq TM from EV1; stow on MWS<br><br>16. Receive spare MBSU; stow on BRT</td>
</tr>
</table>

## MBSU 4A4B REMOVE AND REPLACE (NO SSRMS) (Cont)

| IV | EV1 | EV2 |
|---|---|---|
| | 42. **PGT: B2/CW2/30.5**<br>(16.0 ft-lb,30 RPM)<br>6" Ext 7/16"<br>43. Drive H2, expect 17 turns<br>44. √H2 status indicator – LOCK<br><br>45. **PGT: B2/CW2/30.5**<br>(16.0 ft-lb,30 RPM)<br>6" Ext 7/16"<br>46. Drive H1, expect 5-7 turns<br>47. √H1 status indicator – LOCK<br>48. Remove Sq Scoop; stow on MWS<br>49. Egress APFR<br>50. Install thermal cover on failed unit | 17. Transfer spare MBSU to EV1<br>18. Install thermal cover on failed unit |
| 5. IV: Record spare MBSU installation turns and torque<br><br>Bolt / Turns / Torque<br>H2 / / /<br>H1 / / / | 51. Translate to S0 worksite; assist with tending MBSU<br><br><u>INSTALL SPARE MBSU</u><br>52. Ingress APFR<br>53. Receive MBSU from EV2<br><br><u>CAUTION</u><br>There is a TBD thermal dwell time between the MBSU & coldplate. Wait TBD time prior to driving bolt<br><br>54. Install spare MBSU (soft dock on H2 15-20 lb)<br>55. √Status indicator on H1 and H2 are in UNLOCK<br>56. **PGT: A3/CW2/30.5**<br>(14.8 ft-lb,30 RPM)<br>6" Ext 7/16"<br>57. Drive H2, expect 17 turns<br>58. √H2 status indicator – LOCK | 19. Translate to S0 worksite<br><br><u>INSTALL SPARE MBSU</u><br>20. Transfer MBSU to EV1<br>21. Inspect guide rails and connectors for debris/damage<br><br>22. Assist EV1 with MBSU install |

## **MBSU 4A4B REMOVE AND REPLACE (NO SSRMS)** (Cont)

| IV | EV1 | EV2 |
|---|---|---|
| | 59. **PGT: A3/CW2/30.5**<br>(14.8 ft-lb,30 RPM)<br>6" Ext 7/16"<br>60. Drive H1, expect 5-7 turns<br>61. √H1 status indicator – LOCK<br>62. Give MCC-H GO to restore power to MBSU<br><br><u>CLEANUP</u><br>63. Remove APFR; stow per MCC direction | <u>CLEANUP</u><br>23. Remove Sq scoop from MBSU<br>24. Translate to ESP-2; retrieve MUT EE/Ballstack<br>25. Translate to A/L Toolbox #1 WIF; remove/reconfigure APFR per MCC instruction |

# MBSU REMOVE/REPLACE (NO SSRMS) – TASK DATA

**Estimated Task Duration:**

| | Without SSRMS |
|---|---|
| One EV Crew | N/A |
| Two EV Crew | 03:30 |

**Tools:**

| EV1 | EV2 |
|---|---|
| Square scoop | EVA Crewlock bag (optional) |
| PGT – 6" Ext 7/16" | Square Scoop |
| Sq TM 7/16 rec | PGT – no socket |
| | 6 Ext 7/16 (backup) – stowed in small trash bag |
| | MUT EE |
| | Ballstack |

**EVA Fasteners:**

| Fastener Name | Label | Size | Qty | Install Torque (ft-lb) | Release Torque (ft-lb) | Failure Torque (ft-lb) | Turns | RPM |
|---|---|---|---|---|---|---|---|---|
| H1 (Secondary Bolt) | H1 | 7/16 | 1 | 4.8 (S0)<br>16.0 (esp2) | 60 | 190.3 (R)<br>22.8 (I) | 9 (R)<br>5.7 (I) | 30 |
| H2 (Primary Bolt) | H2 | 7/16 | 1 | 4.8 (S0)<br>16.0 (esp2) | 60 | 188.4 (R)<br>27.8 (I) | 19 (R)<br>17 (I) | 30 |

**Foot Restraints:**

| Task | WIF | APFR Setting |
|---|---|---|
| MBSU 1A1B | S0-22 | 1,NN,J,11 |
| MBSU 2A2B | S0-19 | 9,PP,E,11 |
| MBSU 3A3B | S0-19 | 3,PP,F,1 |
| MBSU 4A4B | S0-18 | 1,NN,F,12 |
| Spare MBSU (ESP-2, site #4) | AL Toolbox #1 (1, KK) | 10,QQ,G,5 |

**ORU DATA:**

| ORU | Part number | Serial Number | Mass | Dimensions |
|---|---|---|---|---|
| MBSU 1A1B | R072591-41 | X700385 | 236 lb | 40" x 28" x 12" |
| MBSU 2A2B | R072591-41 | X700386 | 236 lb | 40" x 28" x 12" |
| MBSU 3A3B | R072591-41 | C250636 | 236 lb | 40" x 28" x 12" |
| MBSU 4A4B | R072591-41 | C250637 | 236 lb | 40" x 28" x 12" |
| Spare MBSU | R072591-41 | X652064 | 236 lb | 40" x 28" x 12" |
| Spare MBSU | R072591-41 | TBD | 236 lb | 40" x 28" x 12" |

**Notes:**

1. H1 is secondary bolt, H2 is primary bolt
2. NO ACTION is required when Acme screw torque and appropriate number of turns has been met and the status indicator is not at the LOCKED position. Report anomaly
3. Removing MBSU from coldplate causes H1 status indicator to move from UNLOCK to LOCK
4. There is no hard stop when releasing H1 and H2 bolts; upon release, they will free spin
5. Primary stanchion (H2) has ~15-20 lb soft dock force to overcome during MBSU removal and installation from/to FSE & coldplate
6. H1 and H2 status indicators are not identical, see drawing below

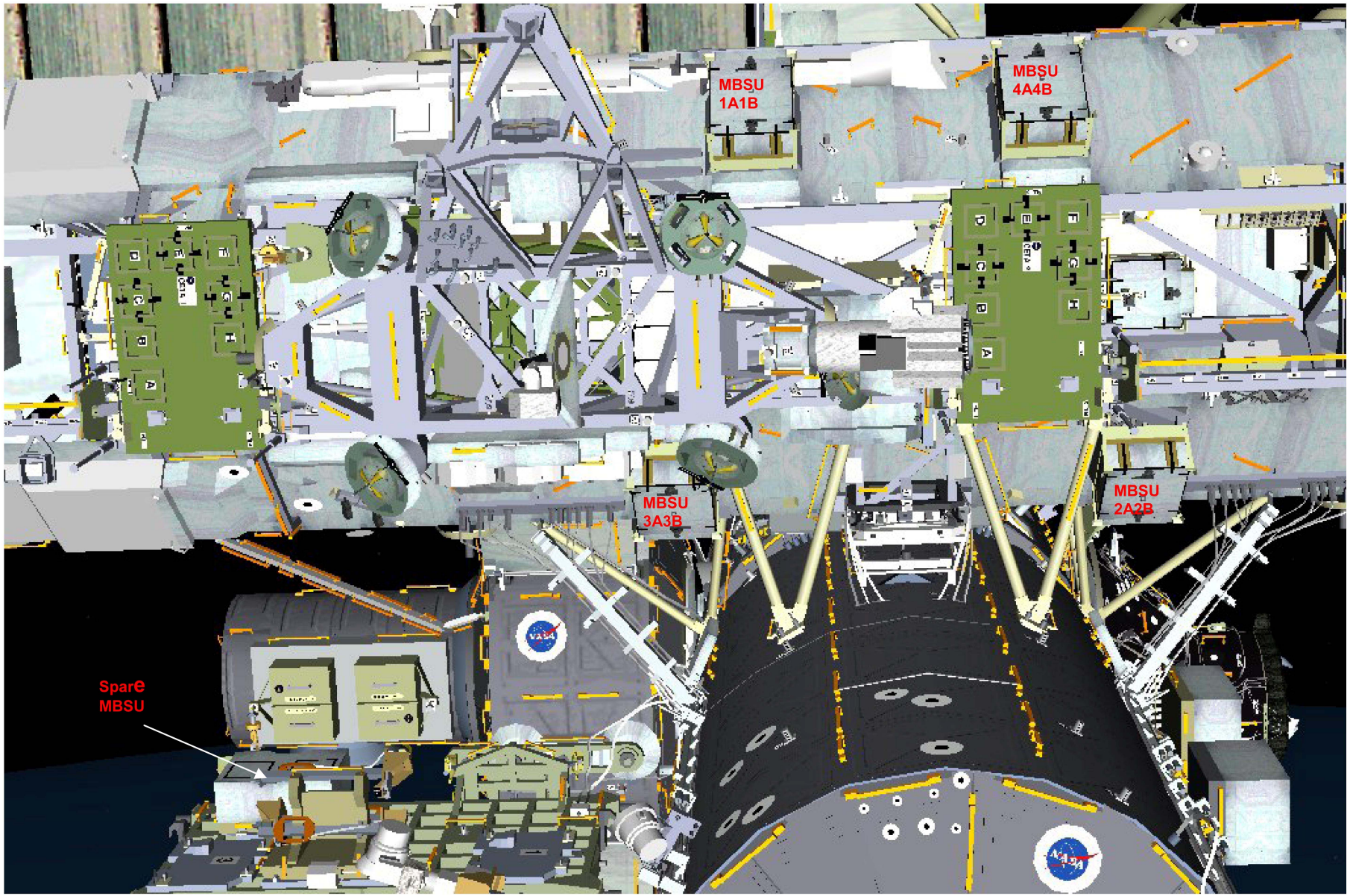
**Cautions:**

1. Acme screws unfastened/fastened out of sequence could lead to jamming of MBSU during removal. When unfastening Acme screws, H1 must be unfastened before H2
2. H1 bolt must always be released first and H2 bolt (jack screw) must always be installed first or damage to ORU and underlying structure may occur
3. Ensure ORU is maintained level and perpendicular to the tiedown stanchions during installation. Failure to comply may damage H-2 status indicator probe
4. Minimize force applied to H1 microfixture. It is not rated to withstand excessive loads
5. There is a TBD thermal dwell time between the MBSU and coldplate. Wait TBD time, prior to driving bolts

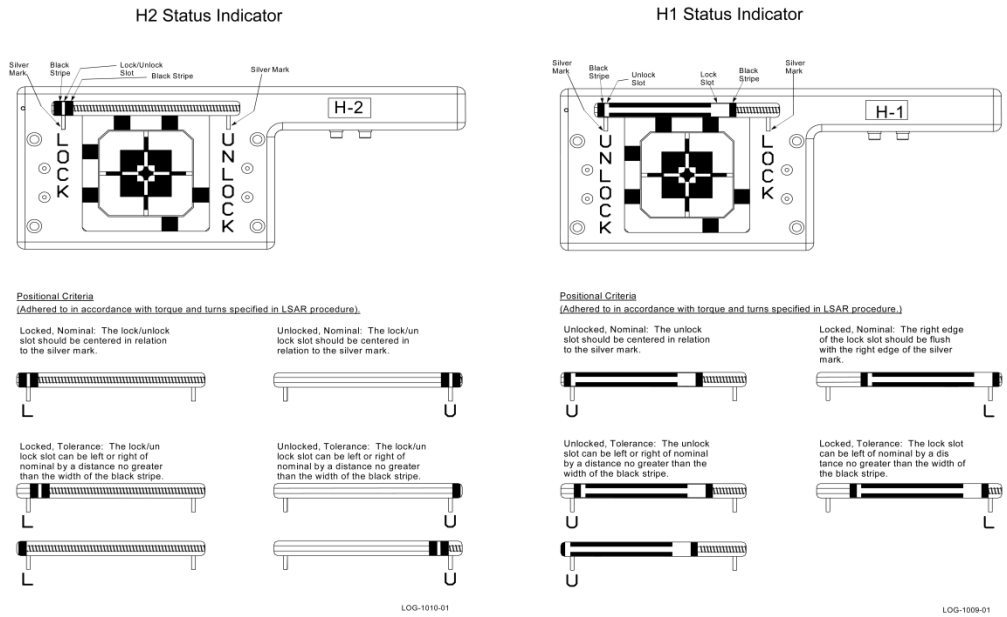
**Warnings:**

1. Hazard voltage exists at the connectors of the MBSU. MBSU must be safed before removal
2. Avoid contact with intermeshing fins of the MBSU and coldplate due to sharp edge concerns

# MBSU locations



# MBSU REMOVE/REPLACE (NO SSRMS) – TASK DATA (Cont)



**Spare MBSU w/MLI attached to FRAM on ESP-2**

**MBSU at worksite**

## P1-2 MDM REMOVE AND REPLACE

| IV | EV |
|---|---|
| **MCC-H** 1. Verify electrical power inhibits complete (Refer to Task Data) | 1. Translate to MDM worksite<br>2. Temporarily stow spare MDM<br>3. Inspect failed MDM and 1553 cables, which mate to back of MDM for possible damage<br>NOTE: Viewing may not be possible due to limited access |
| IV 2. Record failed MDM EVA label number: _____ | REMOVE FAILED MDM<br>1. If required, remove thermal cover<br>2. Report failed MDM EVA label number<br>3. Attach tether to MDM<br><br>CAUTION<br>During removal, ensure that left and right captive fasteners are unfastened before loosening center jackscrew<br>Avoid contacting MDM Cho-Therm and electrical mating surfaces |
| **MCC-H** 3. Give EV GO for MDM removal | **On MCC-H GO**, perform MDM removal<br>4. **PGT[A5 7.0 ft-lb, CCW2 30 RPM, MTL 10.5]-6 ext 7/16:** Release secondary bolts (two), expect ~16 turns for MDM sizes 4 and 10 and ~7 to 14 turns for MDM size ESS<br>5. **PGT[A5 7.0 ft-lb, CCW2 30 RPM, MTL 10.5]-6 ext 7/16:** Release primary jack bolt (one), expect ~33 turns for MDM sizes 4 and 10 and ~25 to 32 turns for MDM size ESS<br>6. Install Round Scoop on MDM<br>7. Slide failed MDM along guide rails to remove<br>8. Inspect failed MDM Cho-Therm and blindmate connections and report condition to **MCC-H**<br>9. Temporarily stow failed MDM |
| IV 4. When MDM is removed from cover (ORU bag), record thermal clock start time: _____:_____:_____ | INSTALL SPARE MDM<br>1. Remove spare MDM from cover (ORU bag)<br>2. Inspect spare MDM Cho-Therm, truss coldplate, and blindmate connections for debris/damage<br>3. Align guide pins (two) to bracket; slide spare MDM into soft-dock position<br>4. Once MDM is soft-docked, remove and stow round scoop<br><br>NOTE<br>To insure proper torque, verify PGT is straight on bolt and no side load is applied. To reset turn count, cycle PGT collar between each bolt |

## IV

IV 5. Record MDM bolt data, Initial Torquing:

| **Bolt** | **Turns** | **Torque** (ft-lb) |
|---|---|---|
| Primary Jack Bolt | | |
| Secondary Bolt (Port) | | |
| Secondary Bolt (Stbd) | | |

IV 6. Record MDM bolt data, Second Torquing:

| **Bolt** | **Turns** | **Torque** (ft-lb) |
|---|---|---|
| Primary Jack Bolt | | |
| Secondary Bolt (Port) | | |
| Secondary Bolt (Stbd) | | |

IV 7. Record MDM bolt data, Final Torquing:

| **Bolt** | **Turns** | **Torque** (ft-lb) |
|---|---|---|
| Primary Jack Bolt | | |

IV 8. When ORU is installed, record thermal clock time: _____:_____:_____

IV 9. Give **MCC-H** GO to perform MDM power up and initial checkout

IV 10. When power-up confirmed, record time: _____:____:_____

## EV

CAUTION

Blind mate connectors are subject to damage as spare unit is secured to structure. Ensure that the center jack bolt is tightened fully to properly engage blind mate connectors

Center jack bolt must first be installed minimum turns, at torque setting, for proper installation of outer bolts

DRIVE MDM BOLTS – INITIAL TORQUING

NOTE

The three different MDM sizes have slightly different turn counts; refer to Task Data for the exact turn count range per MDM size

1. **PGT[A4 6.3 ft-lb, CW2 30 RPM, MTL 10.5]-6 ext 7/16:** Drive primary jack bolt (one) to torque, minimum ~25 turns expected
2. If torque and/or minimum turns not achieved, notify **MCC-H** before driving secondary bolts
3. **PGT[A4 6.3 ft-lb, CW2 30 RPM, MTL 10.5]-6 ext 7/16:** Drive secondary bolts (two) to torque, minimum ~7 turns expected

DRIVE MDM BOLTS - SECOND TORQUING

1. **PGT[A4 6.3 ft-lb, CW2 30 RPM, MTL 10.5]-6 ext 7/16:** Drive primary jack bolt (one) to torque, for expected 25 to 32 total turn count
2. **PGT[A4 6.3 ft-lb, CW2 30 RPM, MTL 10.5]-6 ext 7/16:** Drive secondary bolts (two) to torque, for expected 7 to 14 total turn count

DRIVE CENTER BOLT – FINAL TORQUING

1. **PGT[A4 6.3 ft-lb, CW2 30 RPM, MTL 10.5]-6 ext 7/16:** Drive primary jack bolt (one) to torque, for expected 25 to 32 total turn count

2. Clean up worksite
3. Give **MCC-H** GO for MDM power up
4. Perform WVS survey
5. Stow failed MDM on cover (in ORU bag)

# P1-2 MDM REMOVE AND REPLACE – TASK DATA

**Tools**

| EV | |
|---|---|
| PGT | MDM Cover (if required) |
| 6 Ext 7/16 | ORU Bag (if required) |
| Round Scoop | 3" Scraper (if required) |

**EVA Fasteners**

| Fastener Name | Label | Head Size (in) | Qty | Install Torque (ft-lb) | Max Break Away Torque (ft-lb) | Failure Torque (ft-lb) | Turns | RPM |
|---|---|---|---|---|---|---|---|---|
| Primary Jack Bolt (Center) | N/A | 7/16 | 1 | 6.3 | 6.5 | 9.2 (Install)<br>14.7 (Release) | Refer to EVA Fastener Turn Count | 30 |
| Secondary Bolts (Outer) | N/A | 7/16 | 2 | 6.3 | 6.5 | 9.2 (Install)<br>14.7 (Release) | Refer to EVA Fastener Turn Count | 30 |

**EVA Fastener Turn Count**

| Fastener Name | MDM Size | Turns to Remove | Turns to Install |
|---|---|---|---|
| Primary Jack Bolt (Center) | ESS | 24.5 to 31.5 | 24.5 to 31.5 |
| | 4 | 33 | 25.4 to 31.5 |
| | 10 | 33 | 25.5 to 31.5 |
| Secondary Bolts (Outer) | ESS | 7 to 14 | 7 to 14 |
| | 4 | 16 | 7.5 to 14 |
| | 10 | 16 | 7.5 to 14 |

**ORU Identification**

| Spare MDM | Part number | Serial Number | EVA Label Number |
|---|---|---|---|
| ESS (EXT) | 8259065-910 | 98070105 | MDM 16-1015 |
| 10E | 8259056-927 | 97010101 | |
| 4E Type 12 | 8260500-927 | 98080113 | |
| 4E Type 13 | 8260500-929 | 98070112 | |

**ORU Characteristics**

| ORU | Height | Length | Width | Weight |
|---|---|---|---|---|
| ESS (EXT1,2) | 10.5 inches | 14.9 inches | 16.4 inches | 50.8 lb |
| 10E MDM | 9 inches | 14 inches | 15 inches | 43.1 lb |
| 4E MDM | 10.5 inches | 14.9 inches | 8 inches | 18.4 lb |

## P1-2 MDM REMOVE AND REPLACE – TASK DATA (Cont)

**ORU Power Inhibits**

| ORU (Size) | Location | Cover/Bag | Power Inhibits |
|---|---|---|---|
| EXT-1 (ESS) | S0 Bay 1 (Zenith) | MDM Cover | S01A_C RPC 01 (pwr)<br>S02B_C RPC 02 (htr) |
| EXT-2 (ESS) | S0 Bay 1 (Nadir) | MDM Cover | S02B_C RPC 01 (pwr)<br>S01A_C RPC 02 (htr) |
| N1-1 (10) | PMA1 (Zenith) | MDM Cover | N1RS1_A RPC 11 (pwr)<br>N1RS1_A RPC 05, 06 (SDO)<br>N1RS2_C RPC 15 (htr) |
| N1-2 (10) | PMA1 (Nadir) | MDM Cover | N1RS2_C RPC 13 (pwr)<br>N1RS2_C RPC 03, 04 (SDO)<br>N1RS1_C RPC 2 (htr) |
| P1-1 (4) | P1 Bay 14 (Zenith) | Small ORU Bag | P11A_B RPC 05 (pwr)<br>P13A_G RPC 16 (htr) |
| P1-2 (10) | P1 Bay 14 (Nadir) | MDM Cover | P12B_C RPC 16 (pwr)<br>P12B_C RPC 10 to 13 (SDO)<br>P14B_G RPC 16 (htr) |
| PTR (4) | P1 Radiator Beam Zenith | Small ORU Bag | P12B_C RPC 03 (pwr)<br>P12B_C RPC 04 to 06 (SDO)<br>P14B_G RPC 11 (htr and thermostat) |
| S0-1 (10) | S0 Bay 0 (Zenith) | MDM Cover | S01A_C RPC 16 (pwr)<br>S01A_D RPC 02 to 05 (SDO)<br>S03A_E RPC 05 (htr) |
| S0-2 (10) | S0 Bay 0 (Nadir) | MDM Cover | S02B_C RPC 16 (pwr)<br>S02B_D RPC 02 to 05 (SDO) |
| S1-1 (10) | S1 Bay 13 (Zenith) | MDM Cover | S11A_C RPC 16 (pwr)<br>S11A_D RPC 10 to 13 (SDO)<br>S13A_G RPC 16 (htr) |
| S1-2 (4) | S0 Bay 0 (Nadir) | Small ORU Bag | S12B_B RPC 05 (pwr)<br>S14B_G RPC 16 (htr) |
| STR (4) | S1 Radiator Beam Nadir | Small ORU Bag | S11A_C RPC 03 (pwr)<br>S11A_C RPC 04 to 06 (SDO)<br>S13A_G RPC 11 (htr and thermostat) |
| P3-1 (12) | P3 Bay 18, Face 1, Zenith (Stbd) | TBD | P31A_A RPC 01 (pwr)<br>P33A_C RPC 16 (htr) |
| P3-2 (16) | P3 Bay 18, Face 1, Zenith (Port) | TBD | P32B_A RPC 01 (pwr)<br>P34B_C RPC 16 (htr) |
| S3-1 (16) | S3 Bay 17, Face 1, Nadir (Port) | TBD | S31A_A RPC 01 (pwr)<br>S33A_C RPC 16 (htr) |
| S3-2 (12) | S3 Bay 17, Face 1, Nadir (Stbd) | TBD | S32B_A RPC 01 (pwr)<br>S34B_C RPC 16 (htr) |

Figure 1.- MDM Receptacle on P3.

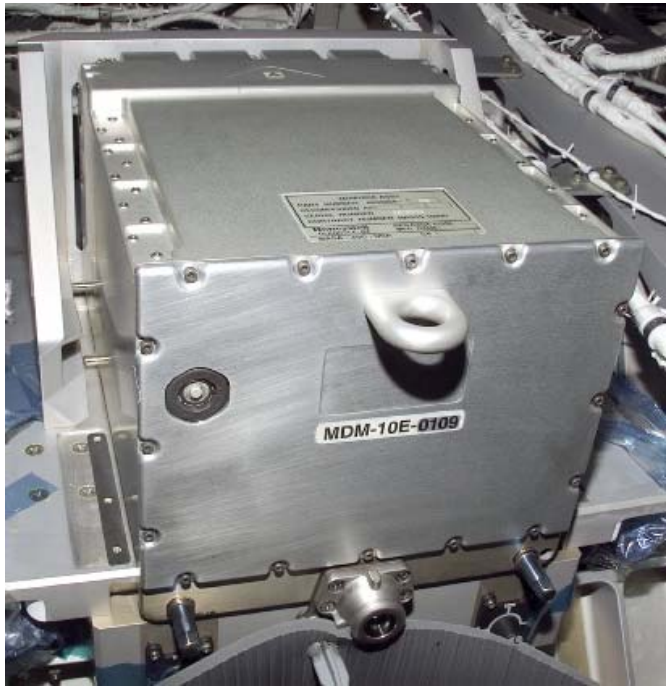



Figure 2.- MDM Installed in Receptacle.

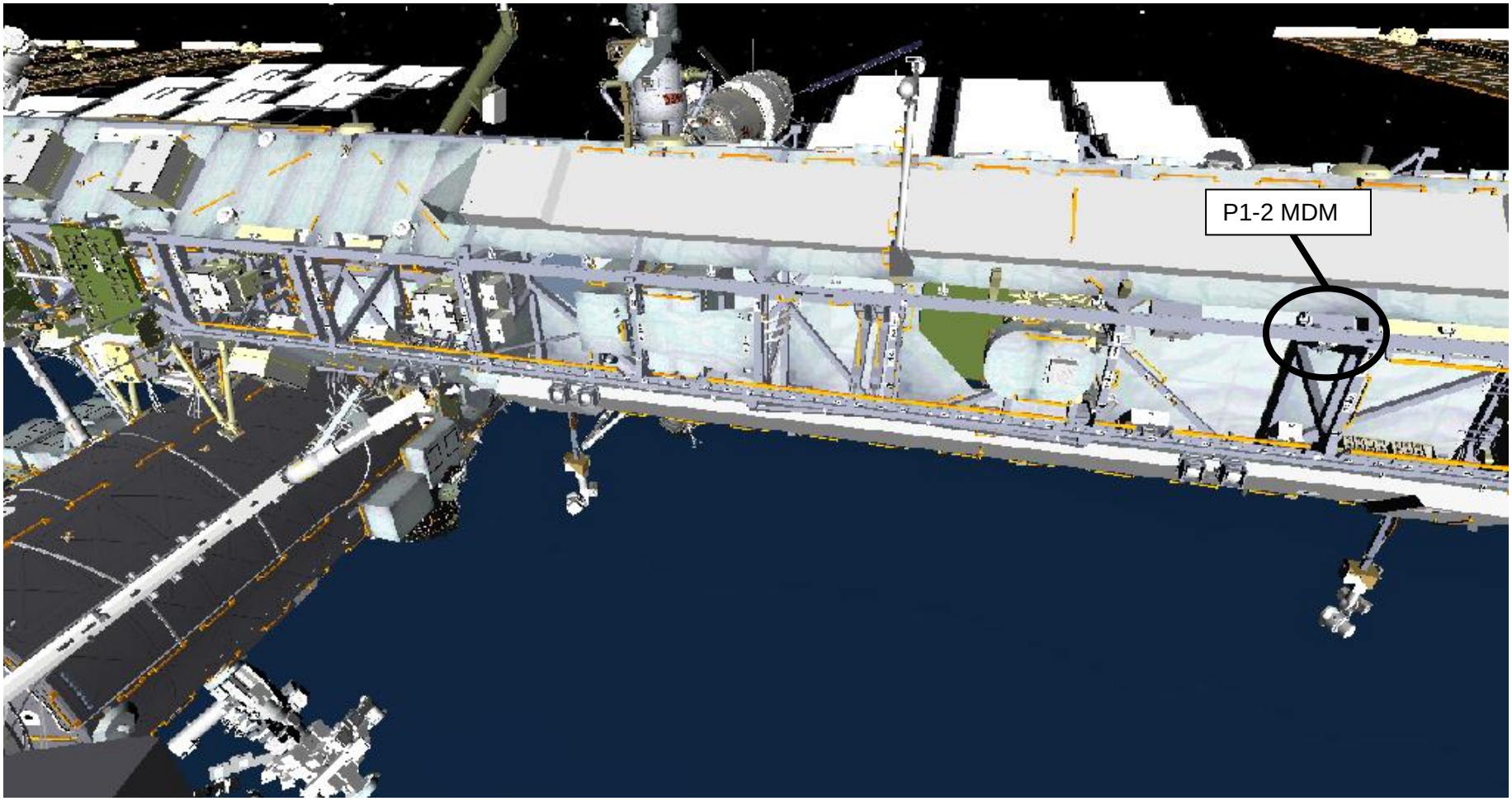



Figure 3.- P1-2 MDM Worksite Location.

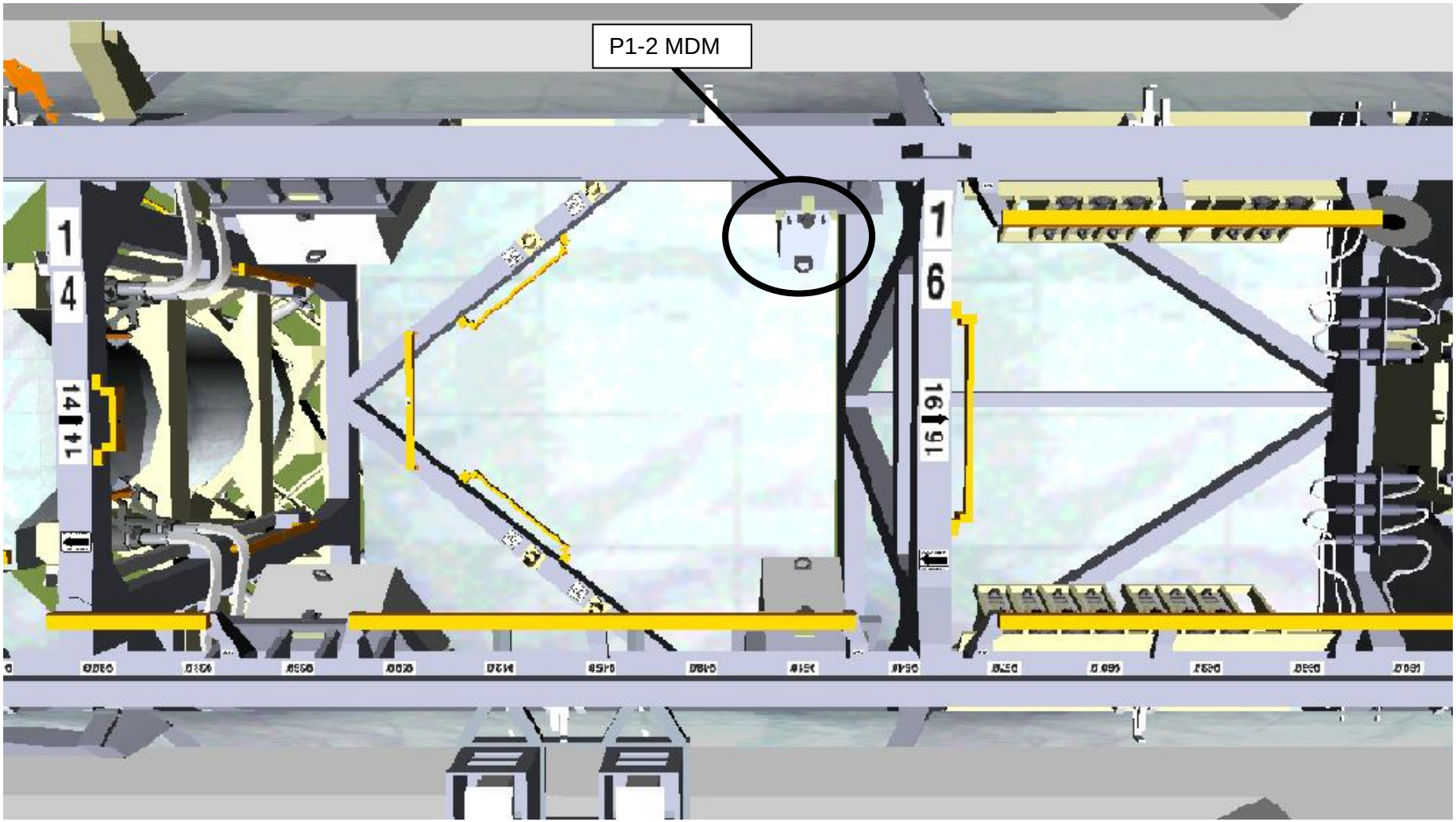



Figure 4.- P1-2 MDM Worksite Location (Closeup View).

## P1_2B_C RPCM

| IV or RMS | EV1(FF) |
|---|---|
| IV<br>1. Verify part number of failed ORU and record serial number on task data sheet. Report P/N and S/N of failed unit to **MCC-H**<br><br>2. Verify power inhibits complete Give EV GO for RPCM removal | WARNING<br>Edges of RPCM housing may be sharp, use caution while handling<br><br>CAUTION<br>Failure to use wobble socket, or socket with equivalent outer diameter, to release lock springs can result in damage to the RPCM Drive Screw Assembly<br>Do not operate drive screw with scoop attached to micro-conical. The wobble socket feature will not extend thru the round scoop<br>Failure to align and fully seat socket until lock springs have released can result in damage to RPCM Drive Screw Assembly<br>Combined linear and rotational motion on the socket while inserting, can result in damage to RPCM Drive Screw Assembly<br><br>REMOVING FAILED RPCM<br>1. Verify failed RPCM P1_2B_C s/n; report to IV<br>2. On IV/MCC GO: Tether to failed RPCM using crewlock bag RET (w/hook pointed away from RPCM)<br>3. **PGT: A6/CCW2/30.5**<br>(8.3 ft-lb, 30 RPM)<br>6" -Ext-7/16"<br>4. Release drive screw,~8 turns (push in while turning to release locking tabs)<br>5. √Status Indicator – UNLOCK<br>6. Remove failed RPCM, slide off guide rail<br><br>INSTALLING SPARE RPCM<br>7. Inspect guide rail for debris/damage<br>8. Retrieve spare RPCM; stow failed unit in crewlock bag<br>9. Verify spare RPCM s/n, report to IV<br>10. Inspect spare RPCM connector interface for debris/damage<br>11. Install spare RPCM on guide rail and slide into soft dock<br>12. √Status Indicator – not below UNLOCK<br>13. **PGT: A2/CW2/30.5**<br>(3.8 ft-lb, 30 RPM)<br>6" -Ext-7/16"<br>14. Engage drive screw, ~6.5 turns to a hardstop (push in while turning to release locking tabs)<br>15. √Status Indicator – LOCK<br>16. Perform WVS survey |

# P1_2B_C RPCM – TASK DATA

**Tools**

| EV1 | EV2 |
|---|---|
| PGT | |
| 7/16 (wobble) Socket-6 ext | |
| Crewlock Bag | |

**EVA Fasteners**

| Fastener Name | Label | Head Size | Qty | Install Torque (ft-lb) | Release Torque (ft-lb) | Failure Torque (ft-lb) | Turns | RPM |
|---|---|---|---|---|---|---|---|---|
| RPCM Drive Screw | | 7/16 | 1 | 5.5 (grnd)<br>3.8 (orbit) | 4.5 | 18.6 (remove)<br>8.5 (install) | 8 (remove)<br>6-7 (install) | 30 |

* Fastener torque data is derived from INC-9 S0 RPCM R&R task
It will be necessary to reverify data prior to performing this task

**ORU Identification**

| | Part Number | Serial Number |
|---|---|---|
| Spare RPCM | | |
| Failed RPCM | | |

**P1_2B_C RPCM – TASK DATA** (Cont)

Figure 1.- P1_2B_C RPCM Worksite Location.

**P1_2B_C RPCM – TASK DATA** (Cont)

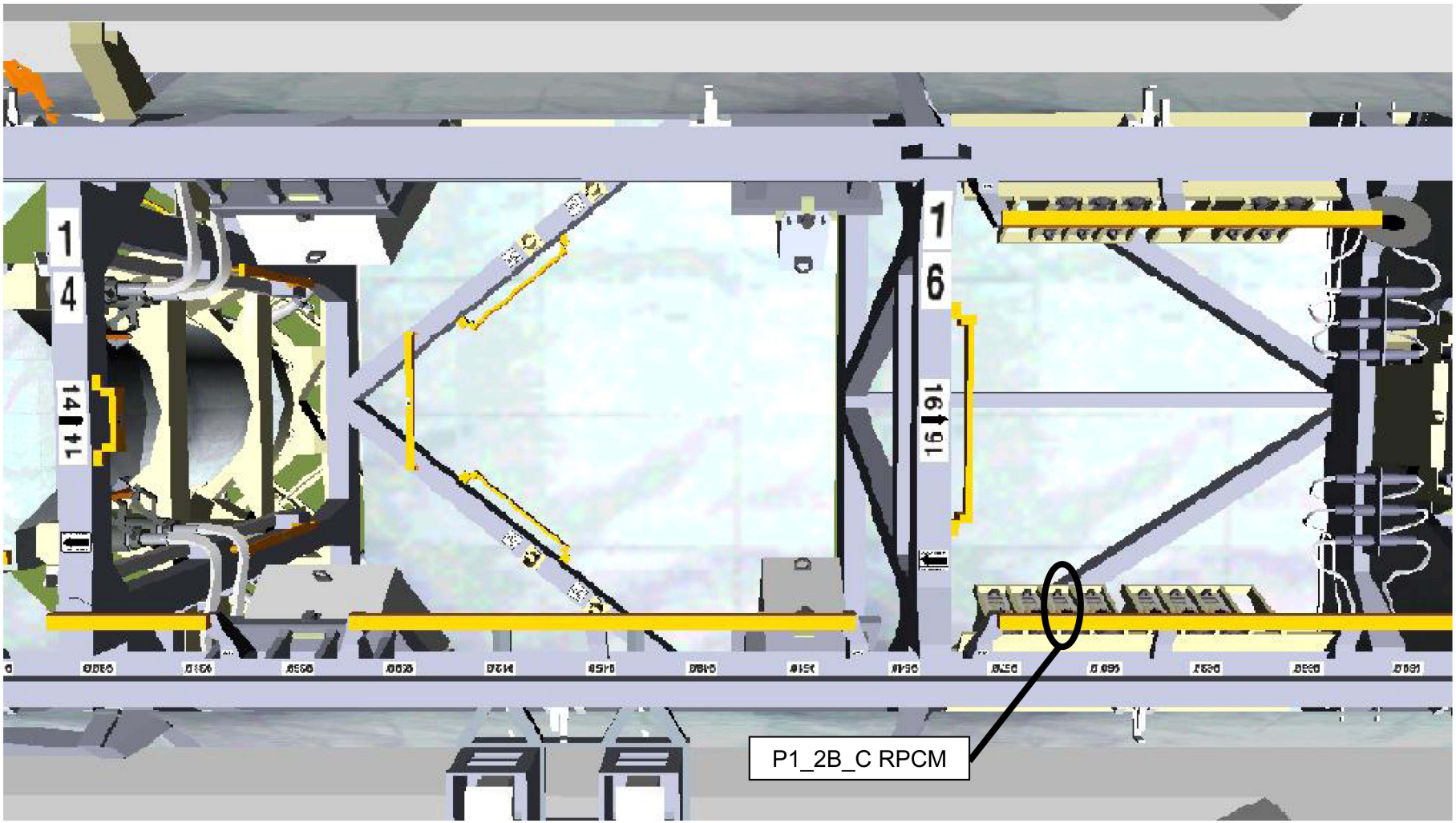



Figure 2.- P1_2B_C RPCM Worksite Location (Closeup View).

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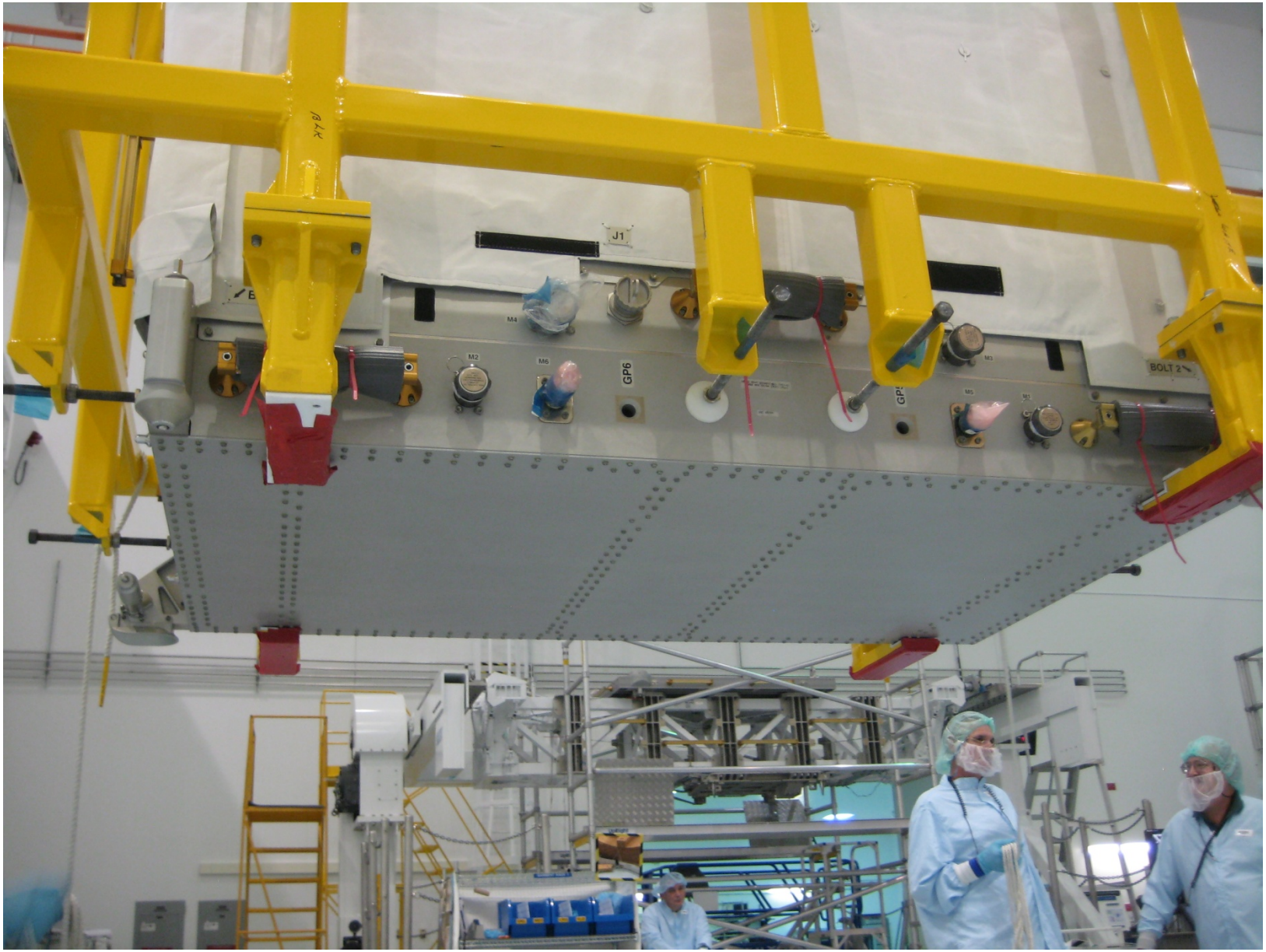
# FLIGHT SPECIFIC EVA REFERENCE


SPARE ATA OVERVIEW ..... FS 18-2
SPARE ATA BOLT 1 AND FSE ..... FS 18-6
SPARE ATA BOLT 2 AND FSE ..... FS 18-10
SPARE ATA BOLT 3 AND FSE ..... FS 18-12
SPARE ATA BOLT 4 AND FSE ..... FS 18-15
P1 ATA OVERVIEW ..... FS 18-18
P1 ATA BOLTS ..... FS 18-20
P1 ATA CONNECTORS ..... FS 18-23
ATA CONTINGENCIES ..... FS 18-29
EUTEF ..... FS 18-33
FRAM CONTINGENCY PIN KIT ..... FS 18-36
MISSE 6 ..... FS 18-42
RGA 2 ..... FS 18-50
GPS ANTENNA #2 AND #4 ..... FS 18-54
PMA3 HEATER CABLE ..... FS 18-56
CLA/CLPA COVER ..... FS 18-57
S3 PAS ..... FS 18-60
UCCAS DETENT TOOL ..... FS 18-61
PMA1 APFR 5/TOOL STANCHION ..... FS 18-63
MISC FIXED GRAPPLE BAR ..... FS 18-64
MISC FIXED GRAPPLE BAR – ON P1 ATA ..... FS 18-66
MISC FRAM ..... FS 18-67
ROEU ..... FS 18-71
PRLA ..... FS 18-76

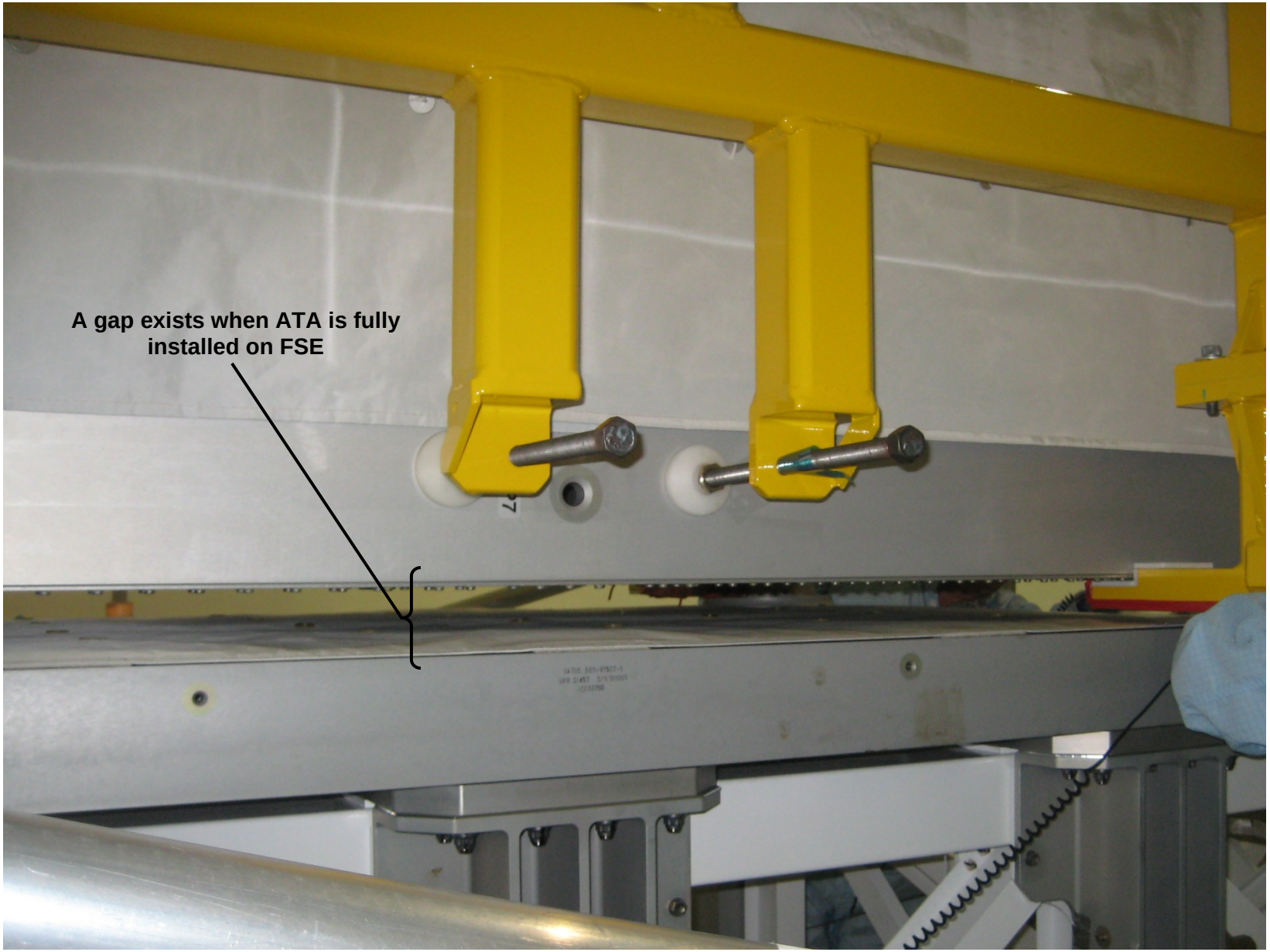
## SPARE ATA OVERVIEW

**SPARE ATA OVERVIEW** (Cont)

**SPARE ATA OVERVIEW** (Cont)

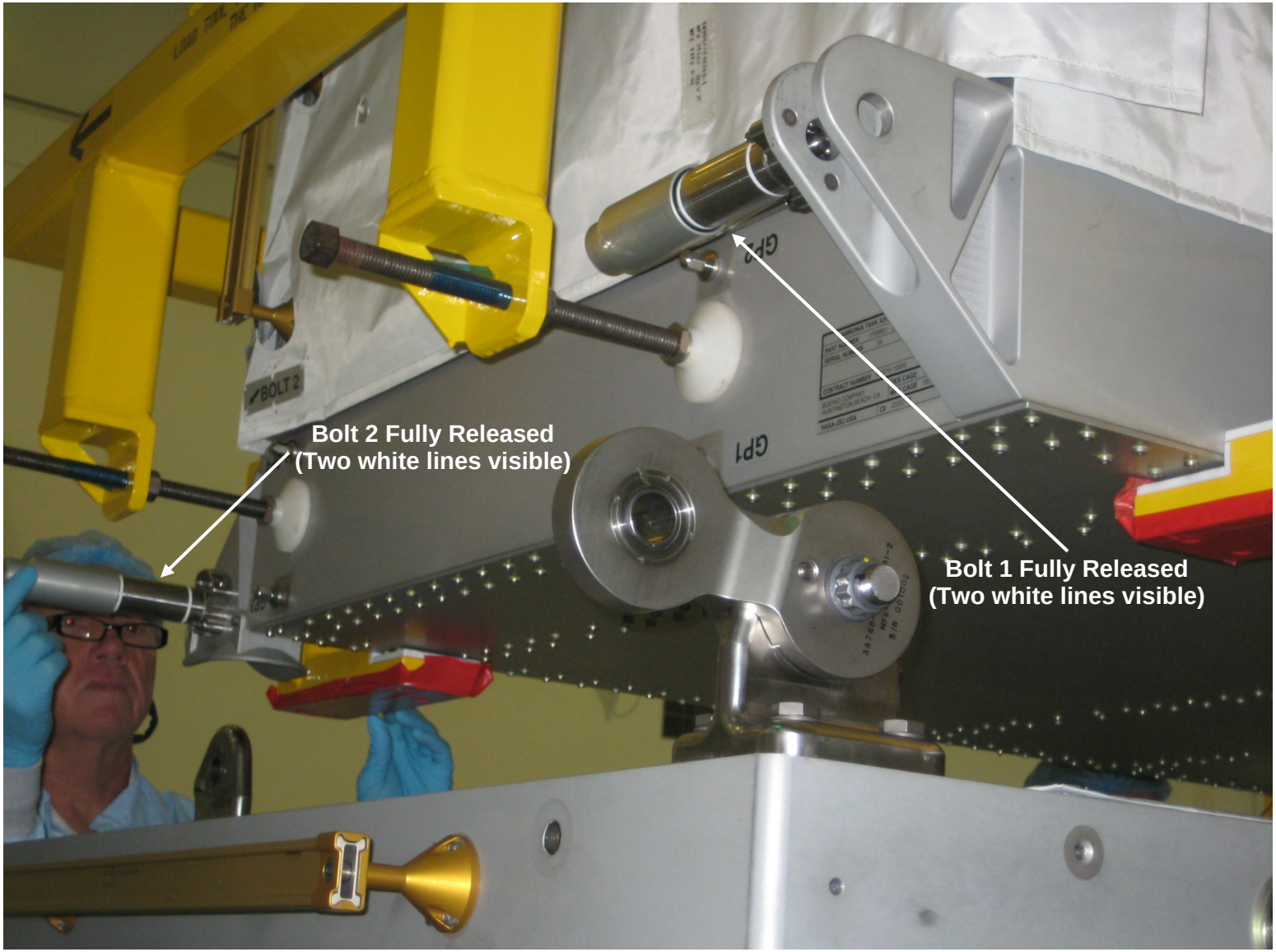


**SPARE ATA OVERVIEW** (Cont)

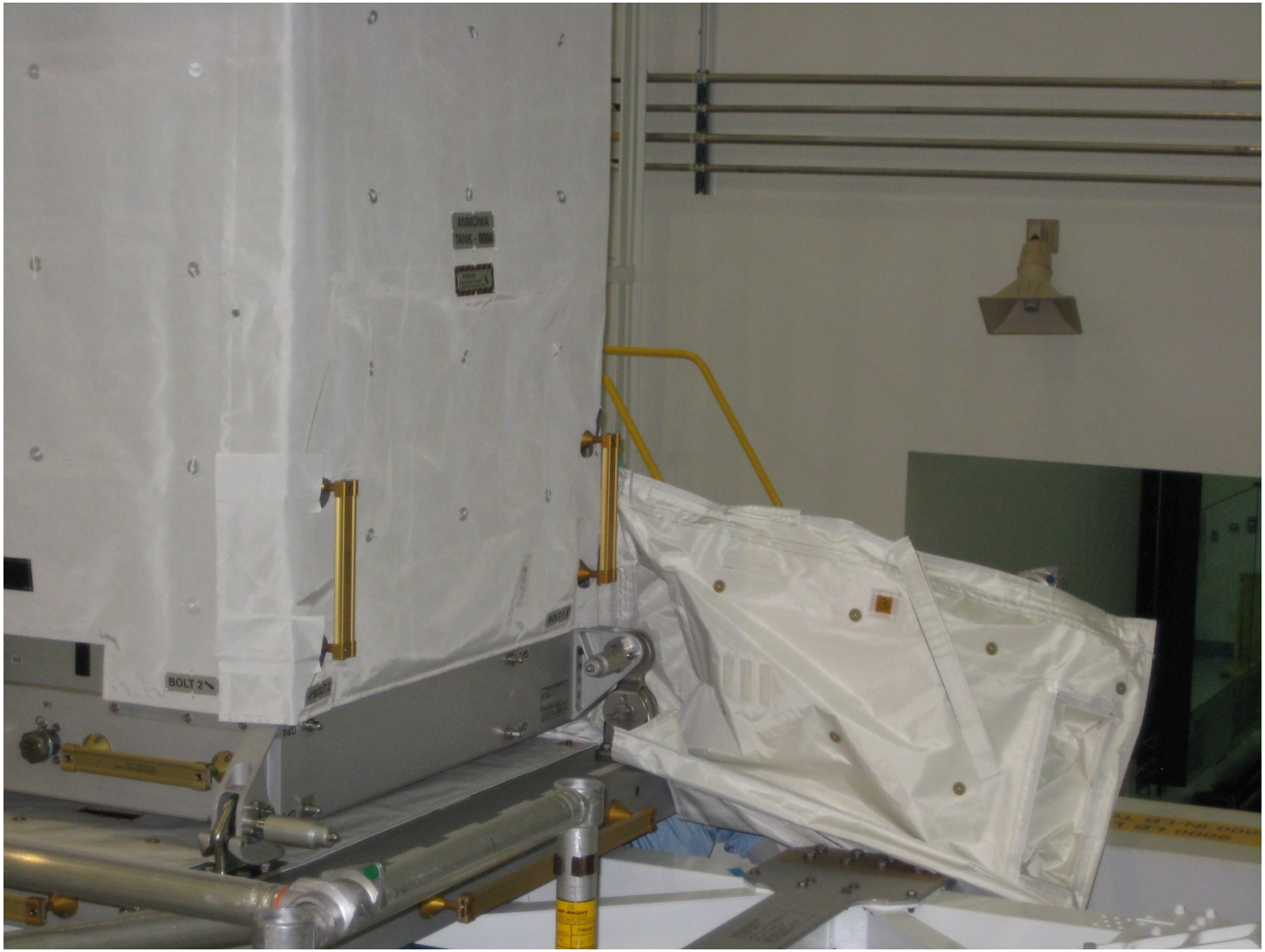


**SPARE ATA BOLT 1 AND FSE**

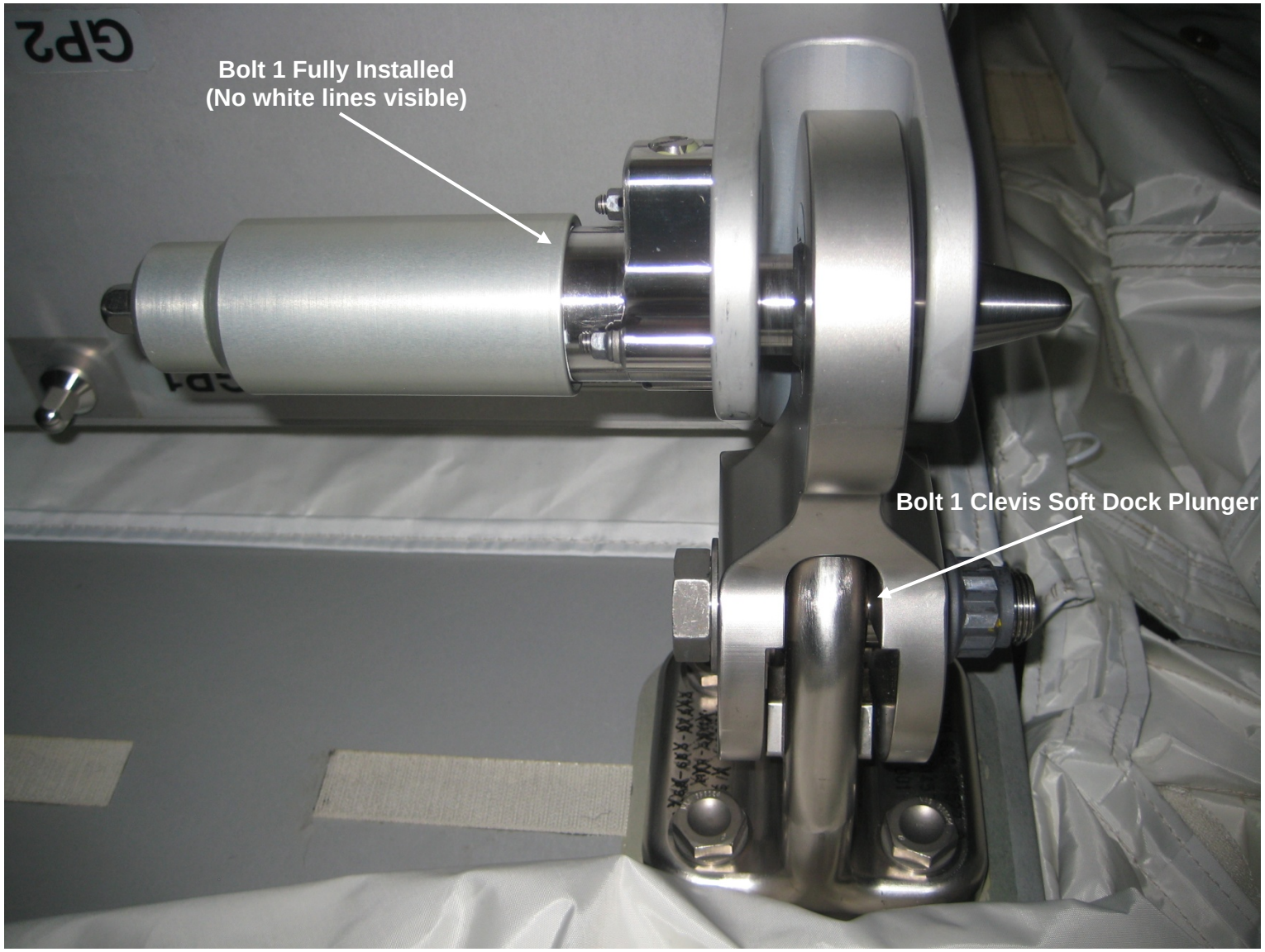
**SPARE ATA BOLT 1 AND FSE** (Cont)



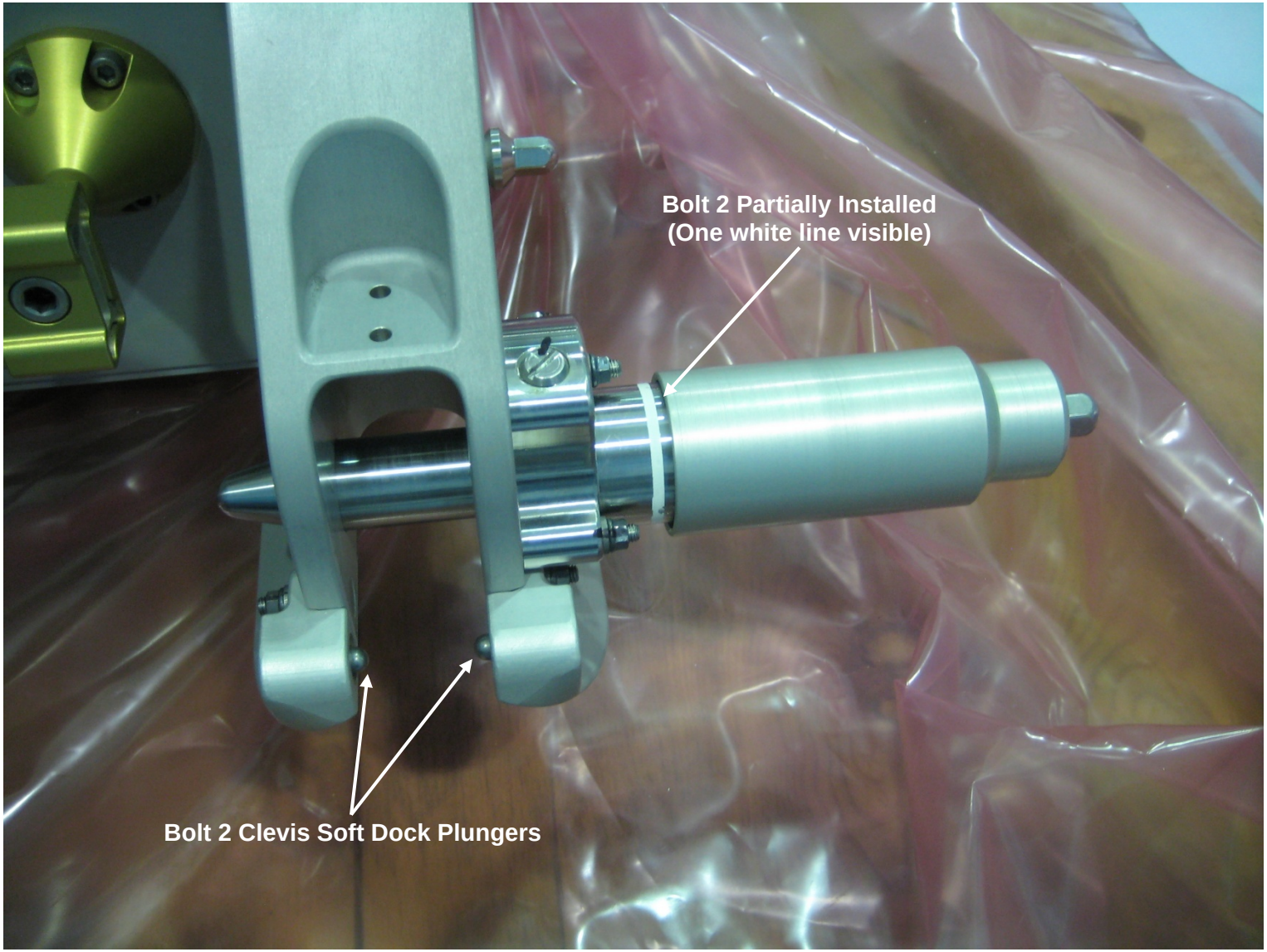
**SPARE ATA BOLT 1 AND FSE** (Cont)



**SPARE ATA BOLT 1 AND FSE** (Cont)



## SPARE ATA BOLT 2 AND FSE



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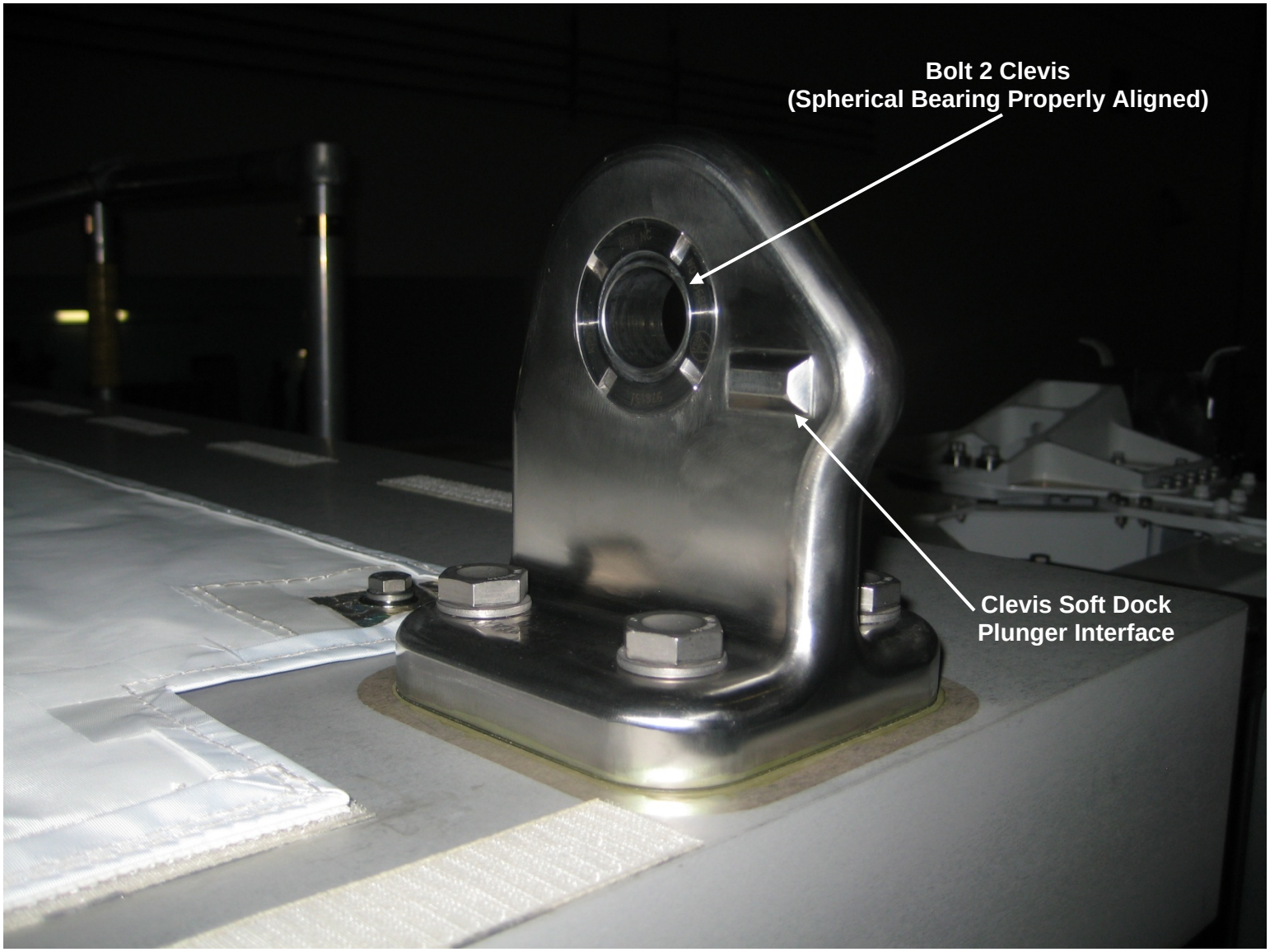
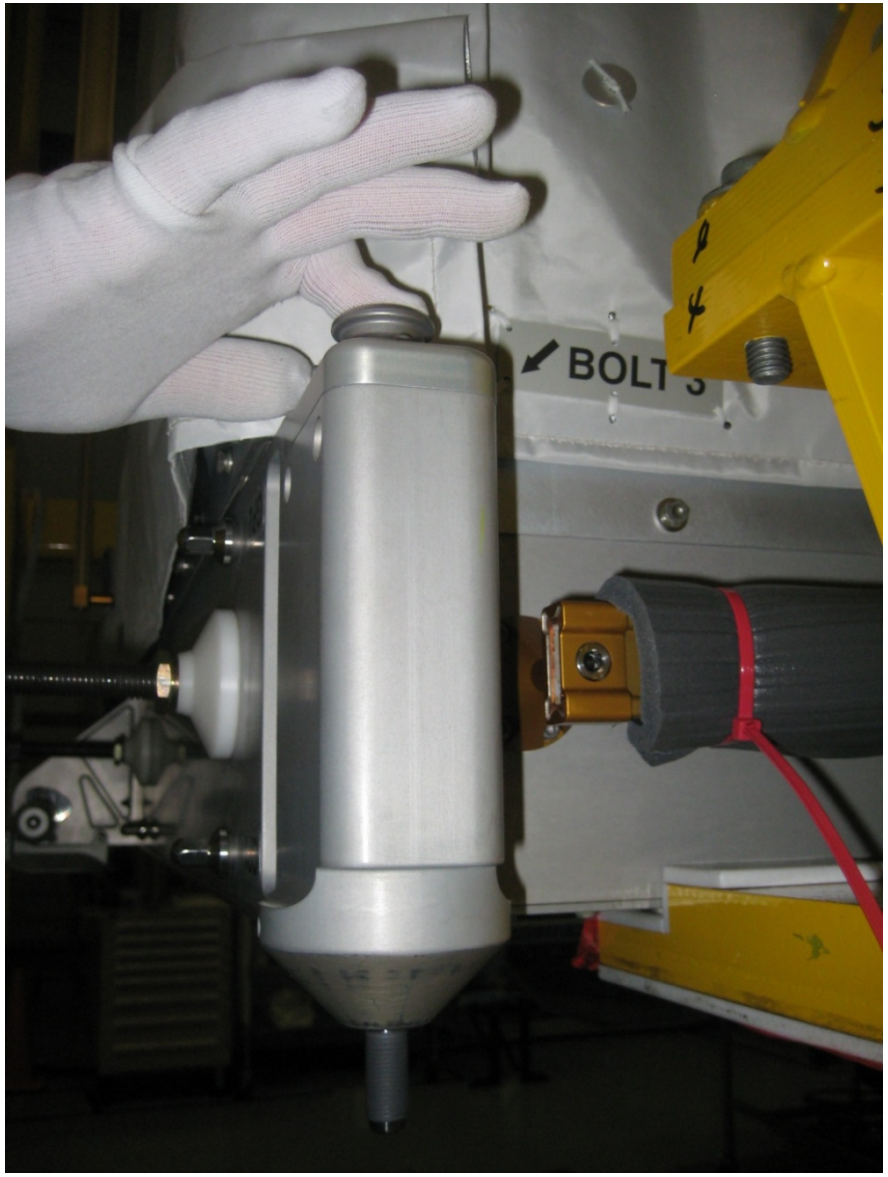
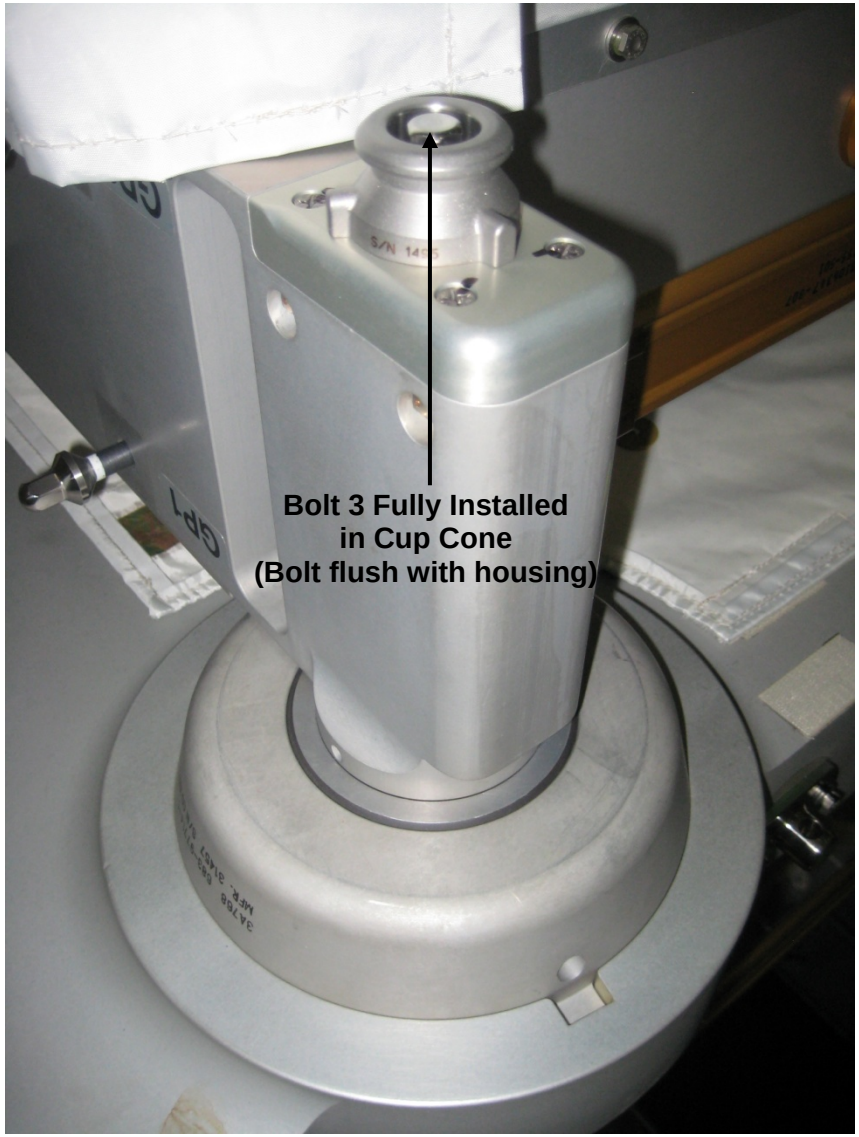


## SPARE ATA BOLT 3 AND FSE

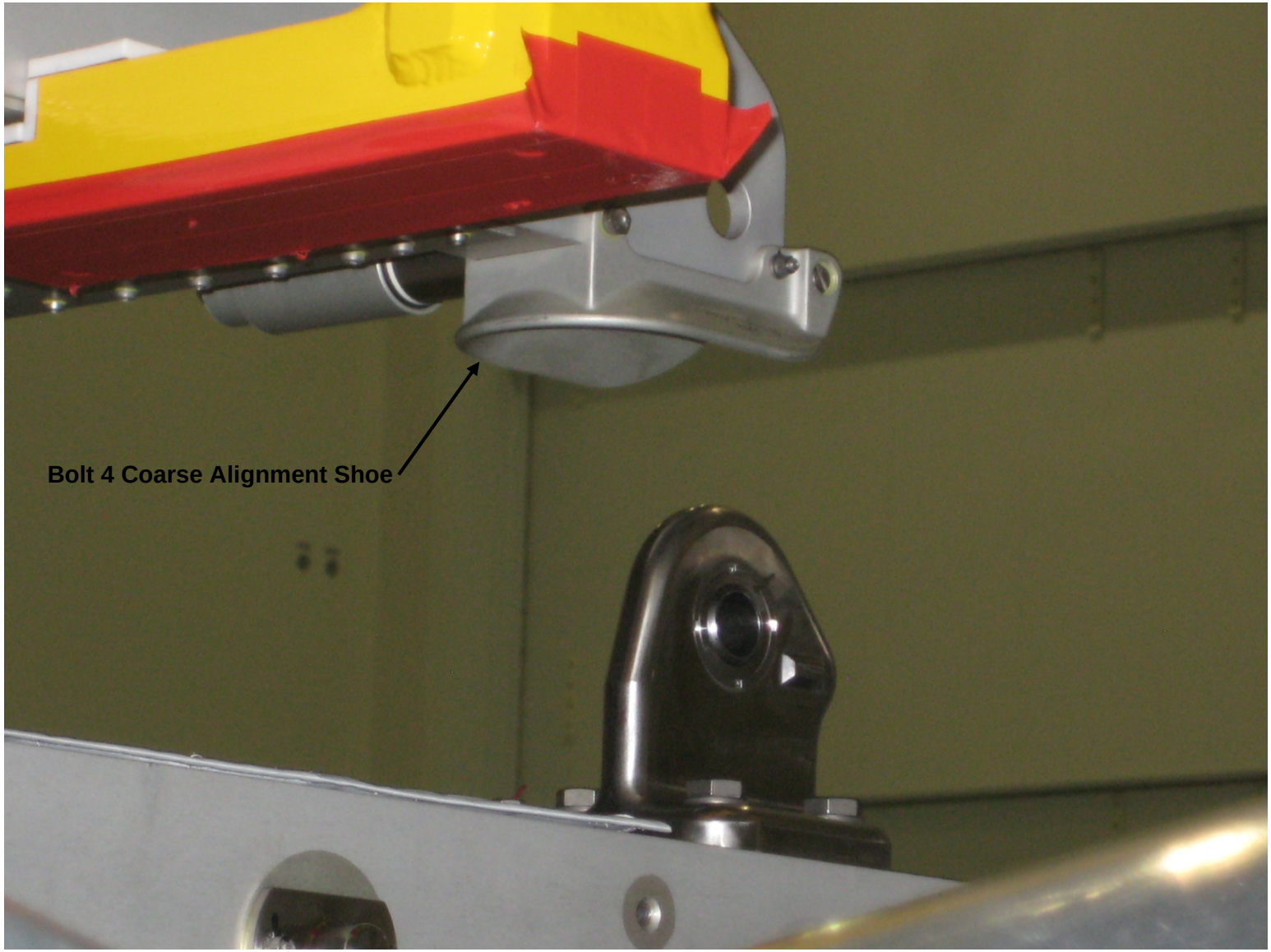


**SPARE ATA BOLT 3 AND FSE** (Cont)

**SPARE ATA BOLT 3 AND FSE** (Cont)



**SPARE ATA BOLT 4 AND FSE**



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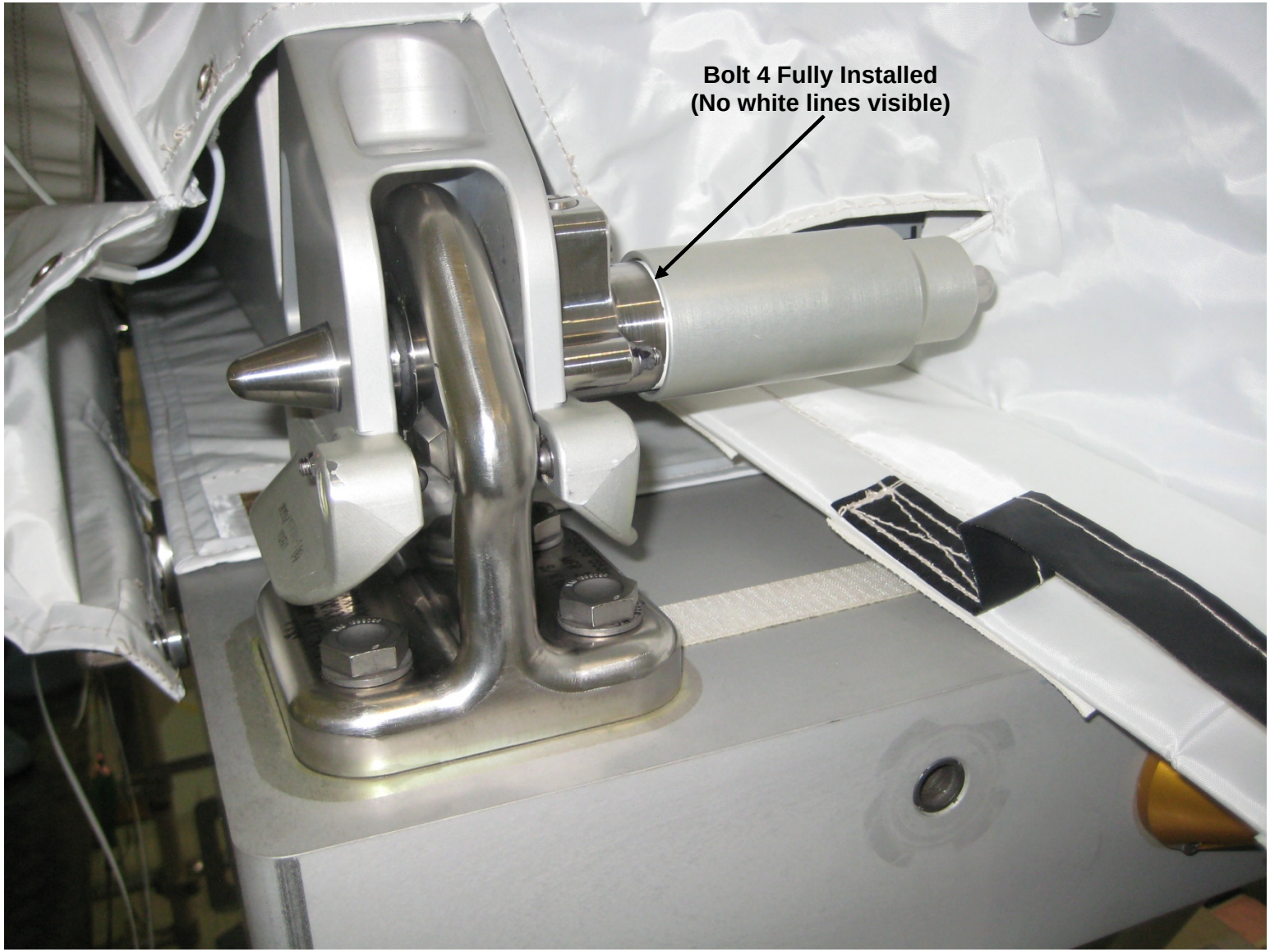
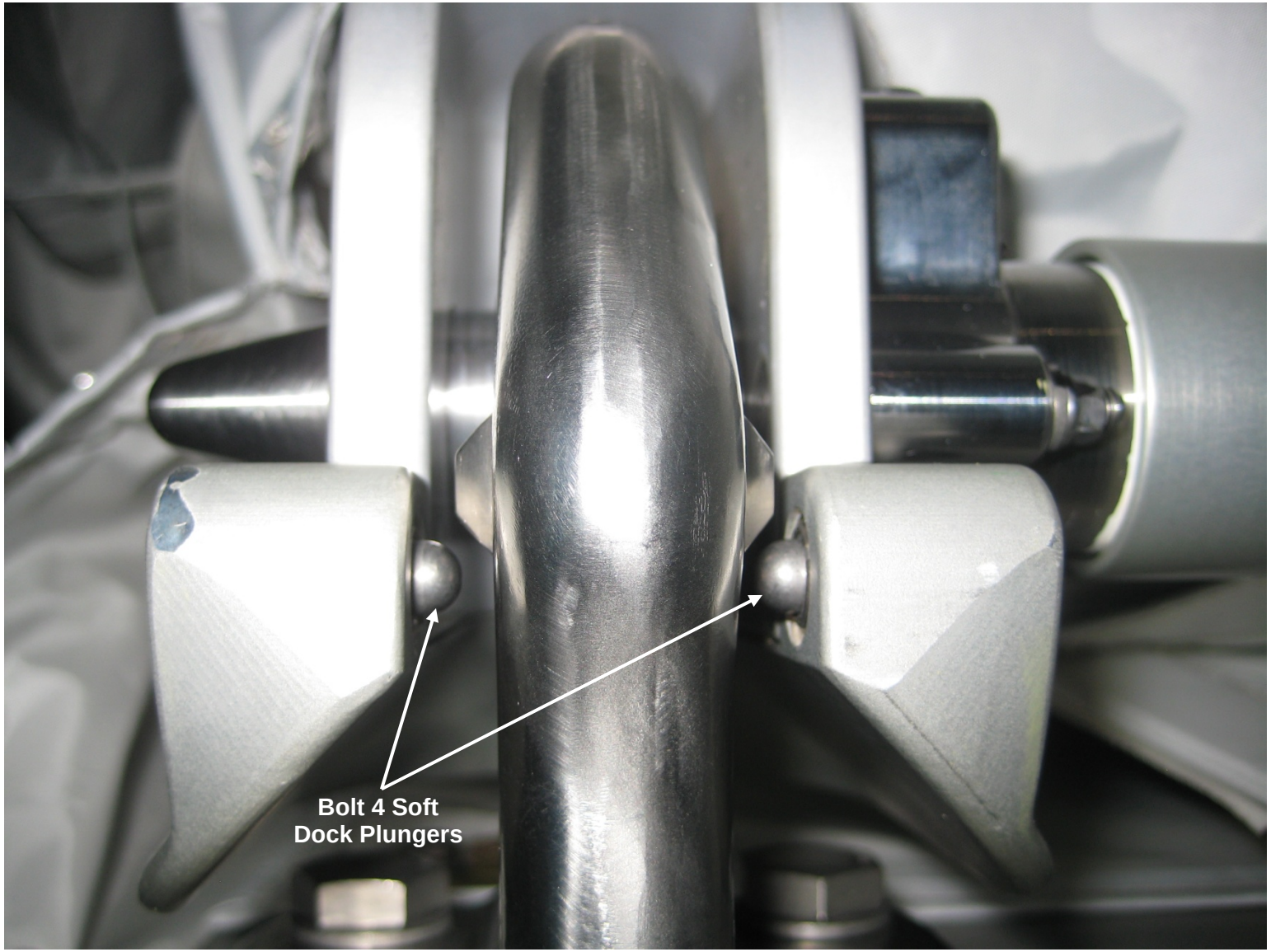
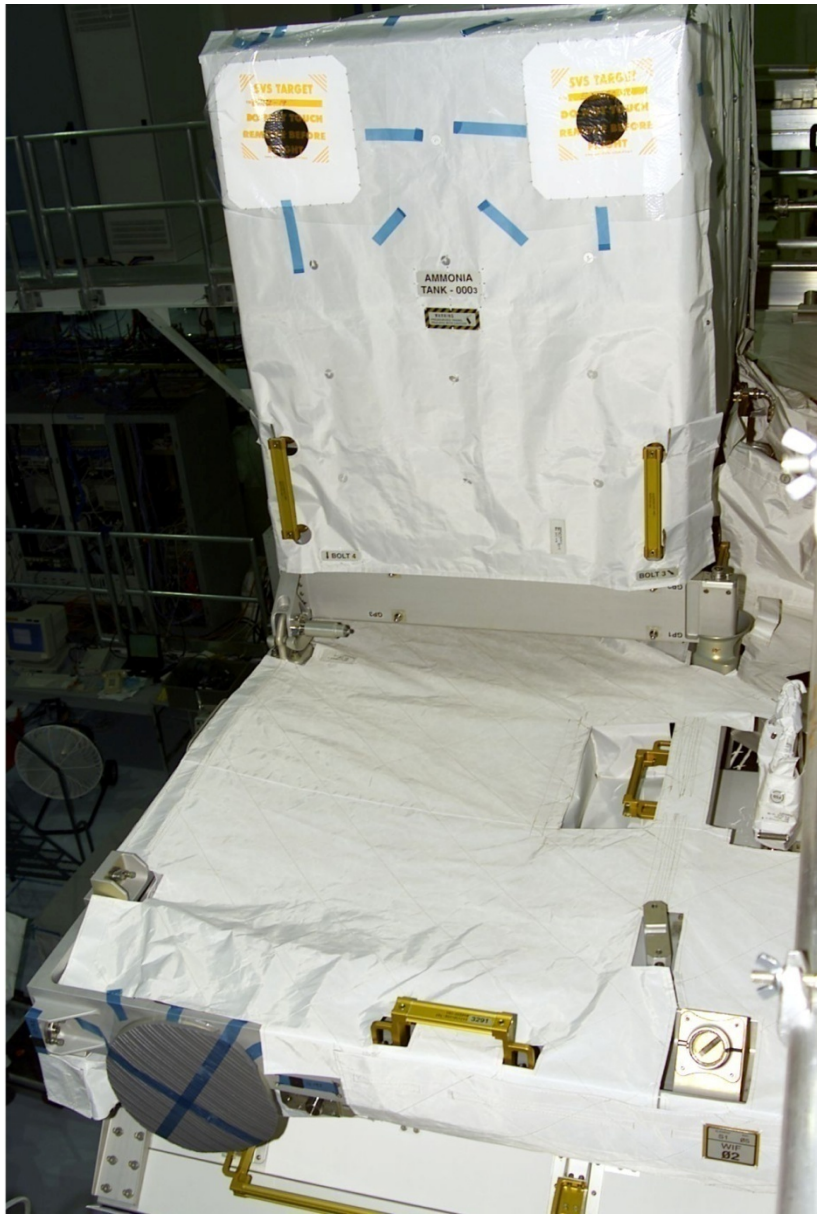


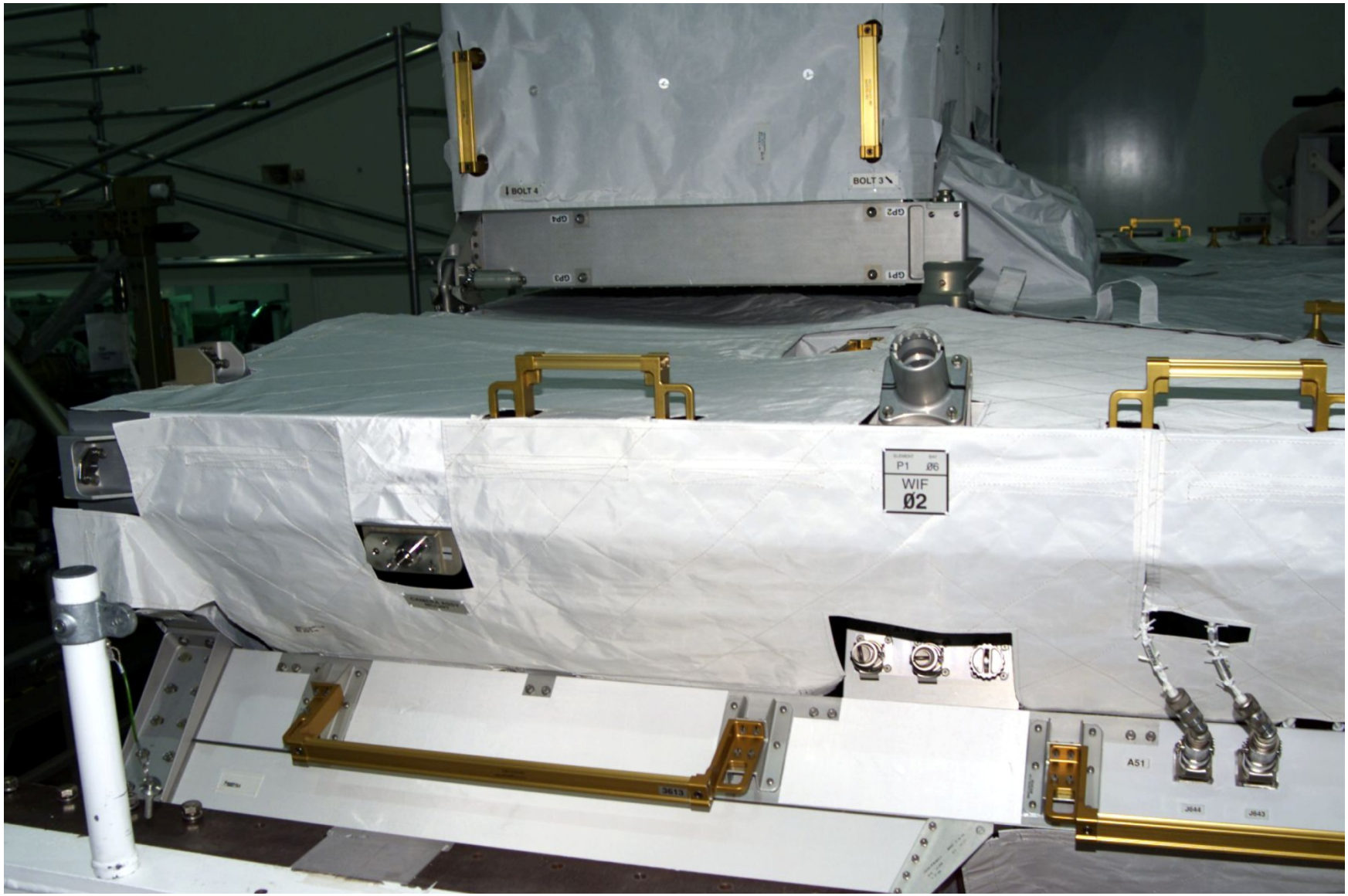
**SPARE ATA BOLT 4 AND FSE** (Cont)



## P1 ATA OVERVIEW



**P1 ATA OVERVIEW** (Cont)



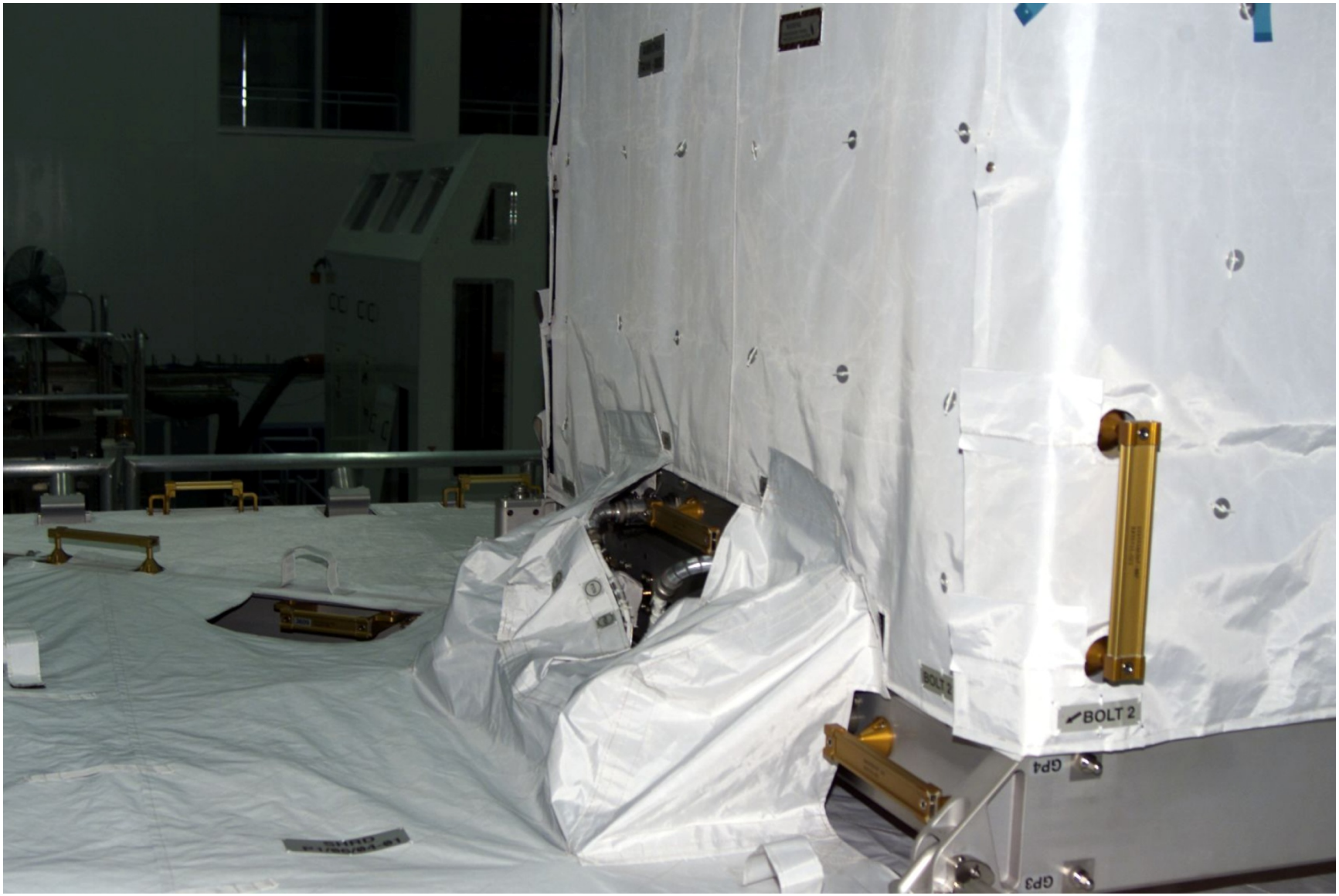
**P1 ATA BOLTS**

BOLT 1
AMMONIA TANK ASSEMBLY - ORU
PART NUMBER 1F28801 - 501
SERIAL NUMBER 03
CONTRACT NUMBER
BOEING COMPANY
HUNTINGTON BEACH, CA
NASA-JSC-USA
GP1

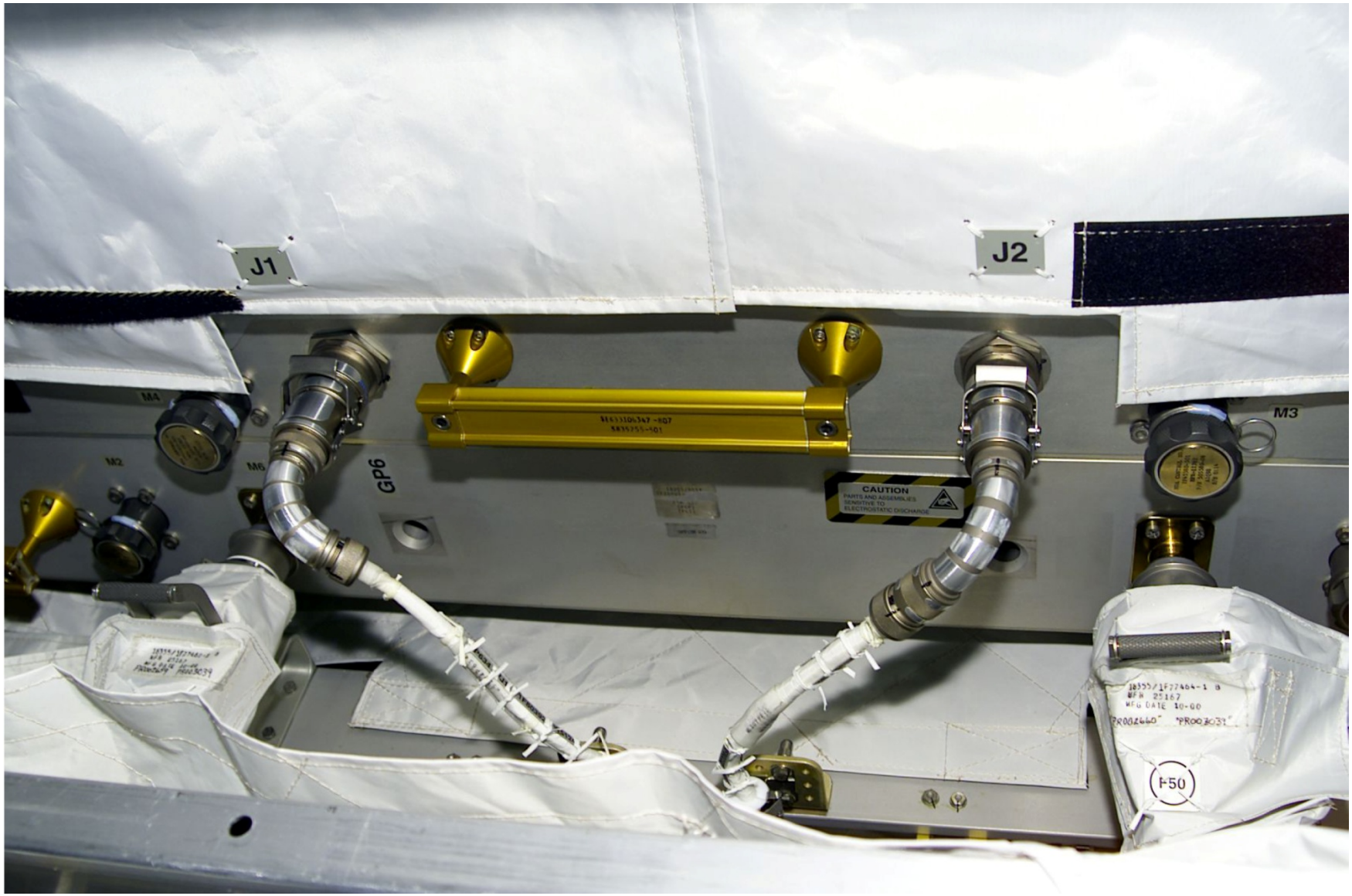
**P1 ATA BOLTS** (Cont)

**P1 ATA BOLTS** (Cont)

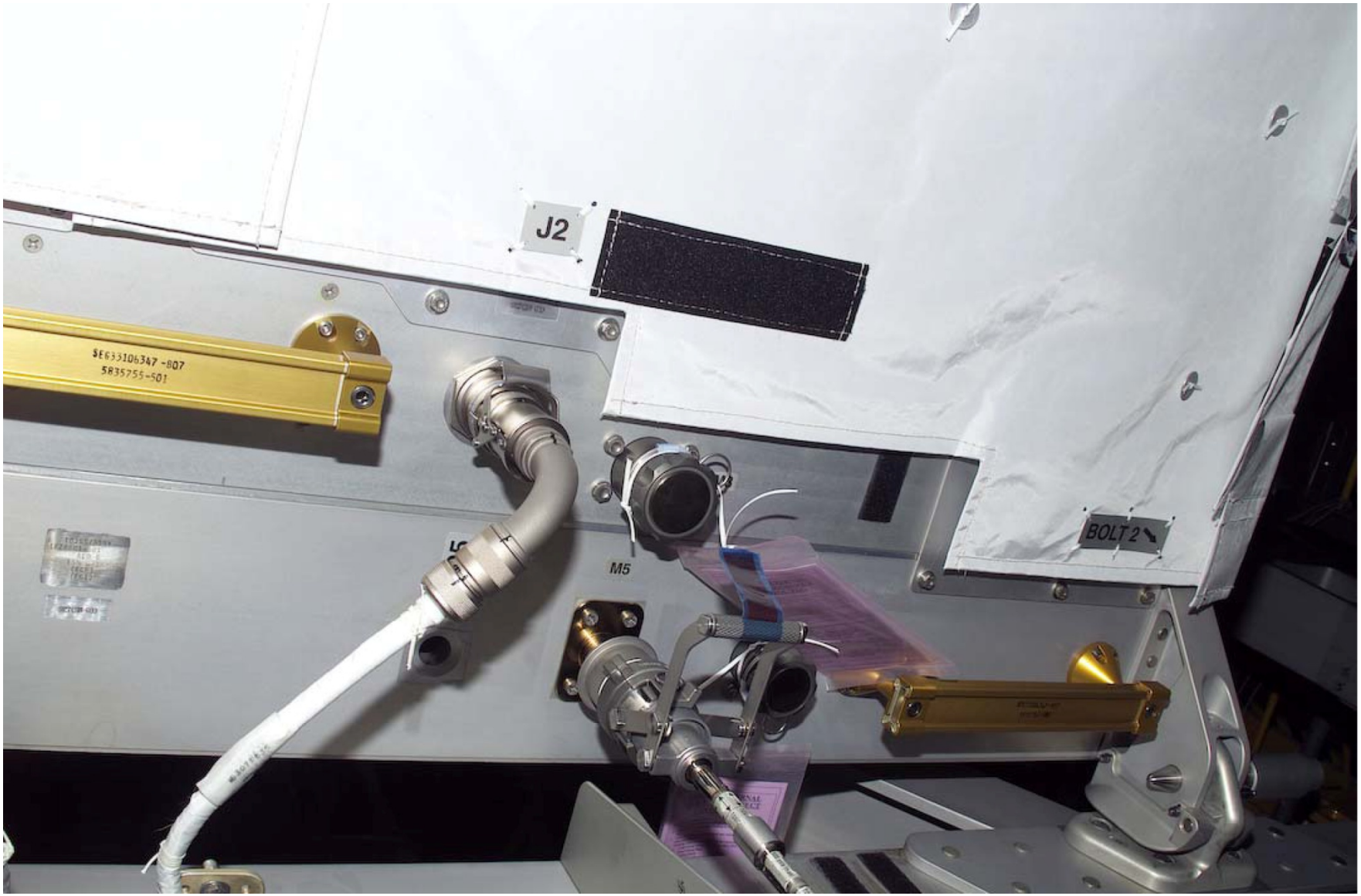
**P1 ATA CONNECTORS**



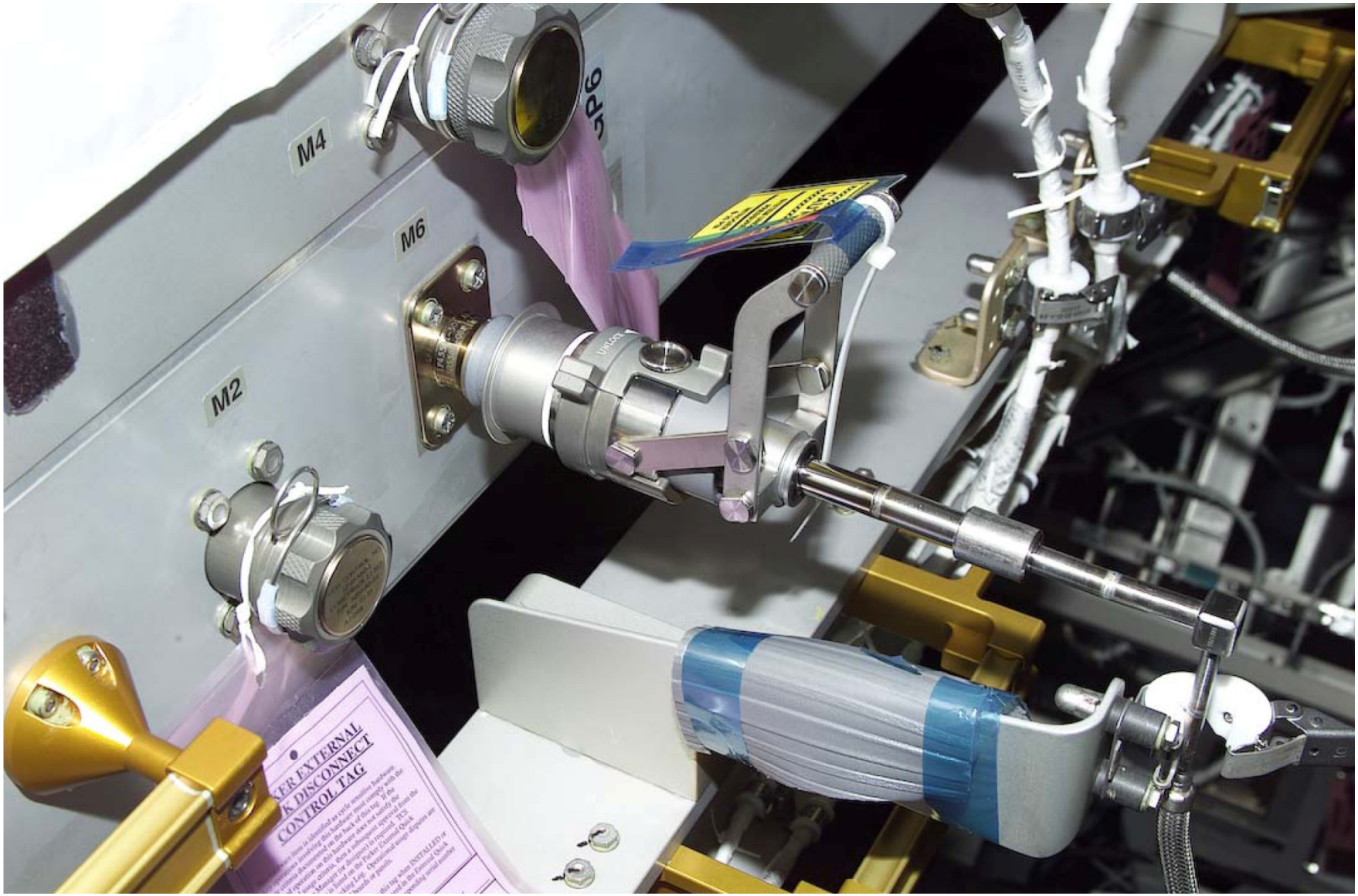
**P1 ATA CONNECTORS** (Cont)



**P1 ATA CONNECTORS** (Cont)

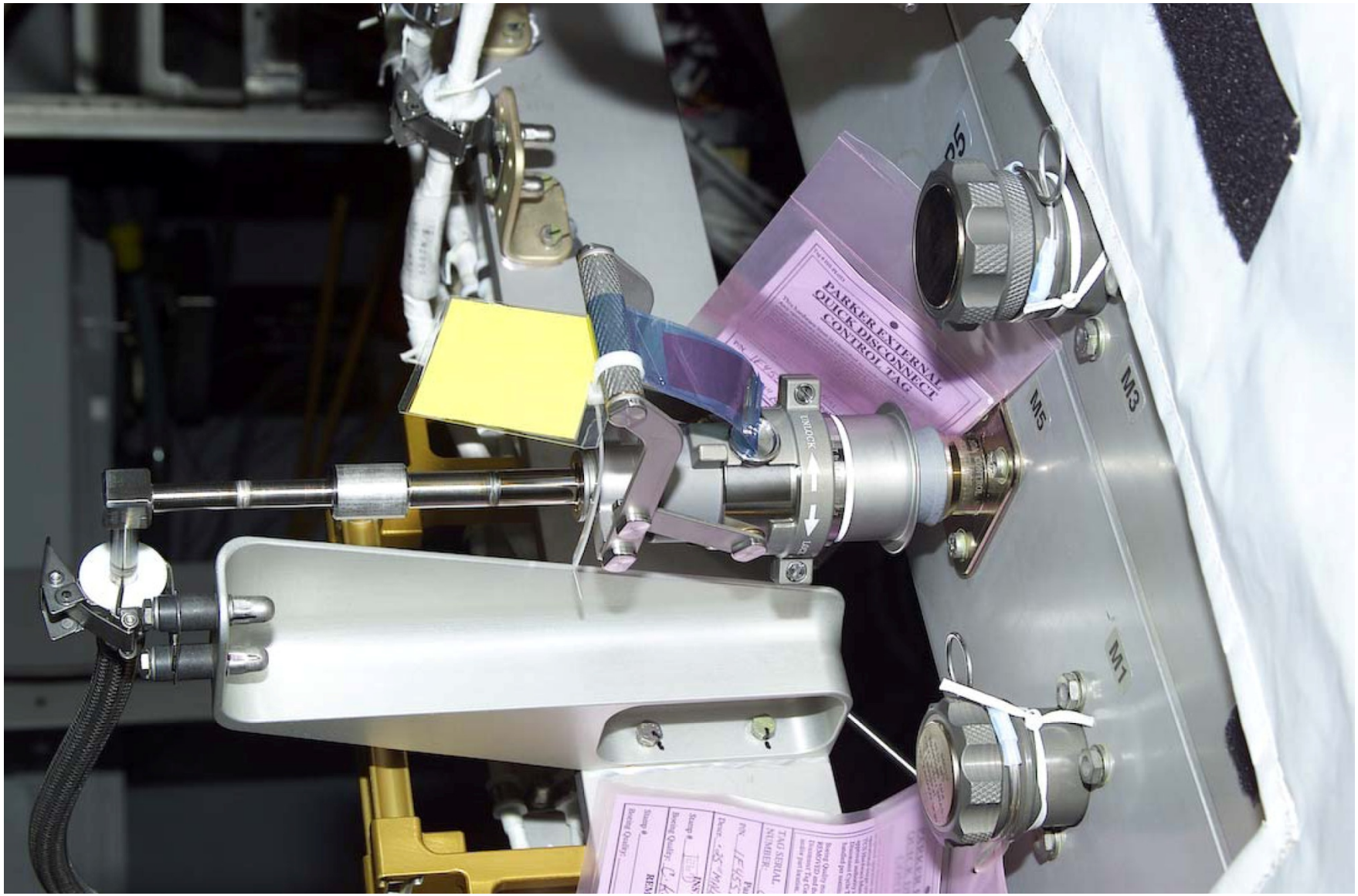


**P1 ATA CONNECTORS** (Cont)

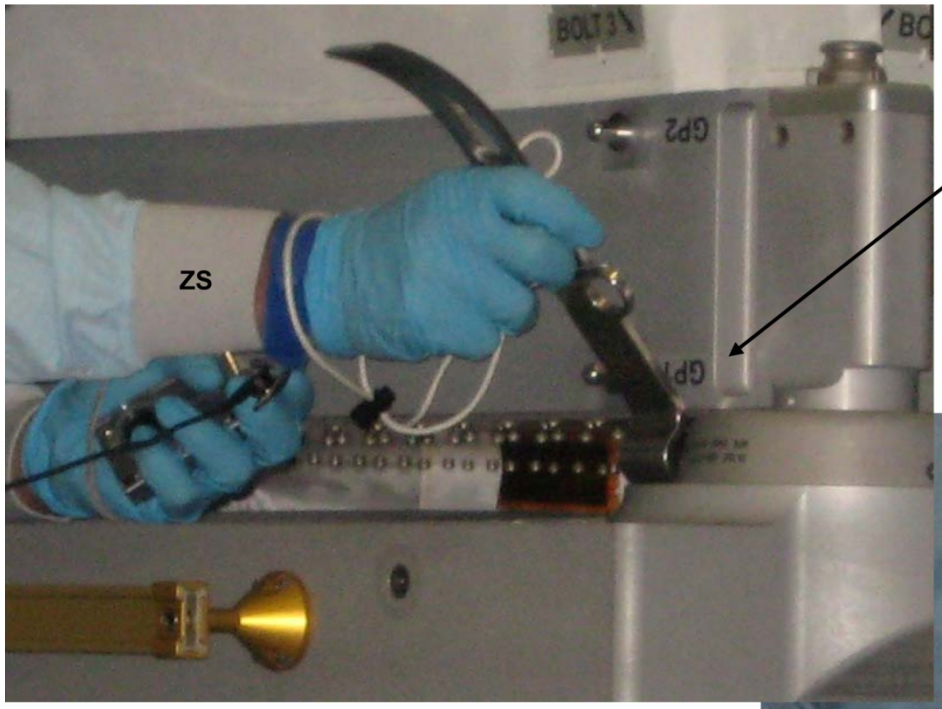


**P1 ATA CONNECTORS** (Cont)

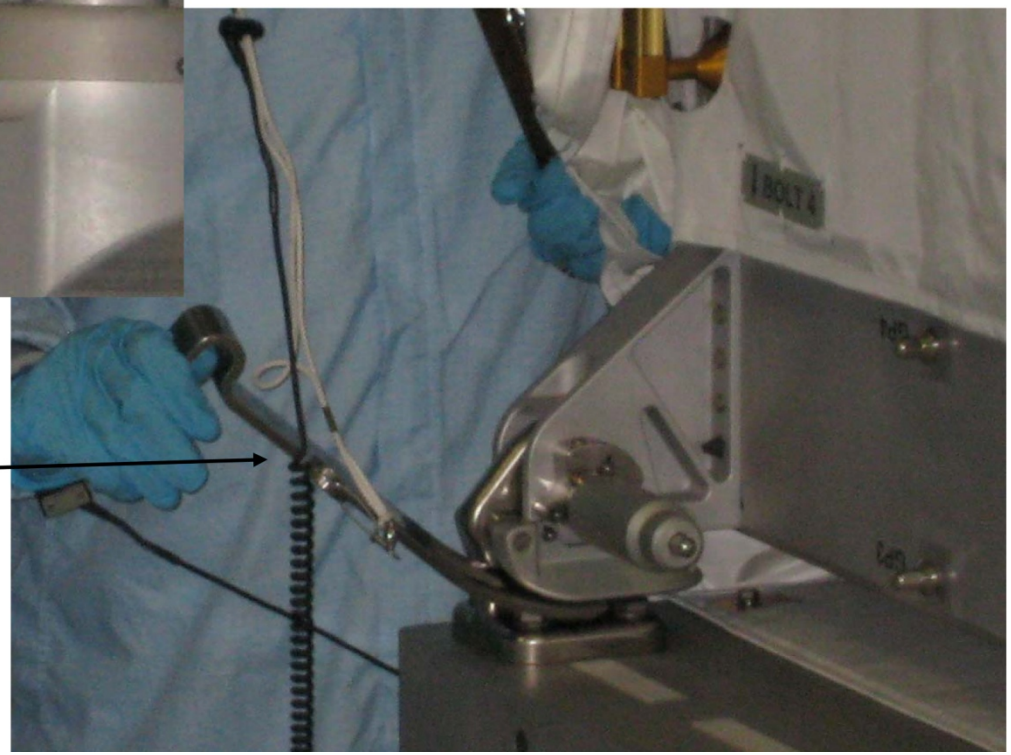
**P1 ATA CONNECTORS** (Cont)



## ATA CONTINGENCIES




**Prybar used to clear ATA from soft dock at Bolt 3**
**(<u>NOTE</u>: FSE has NO soft dock at Bolt 3; this assessment used to demonstrate technique to be used for ATA on P1)**

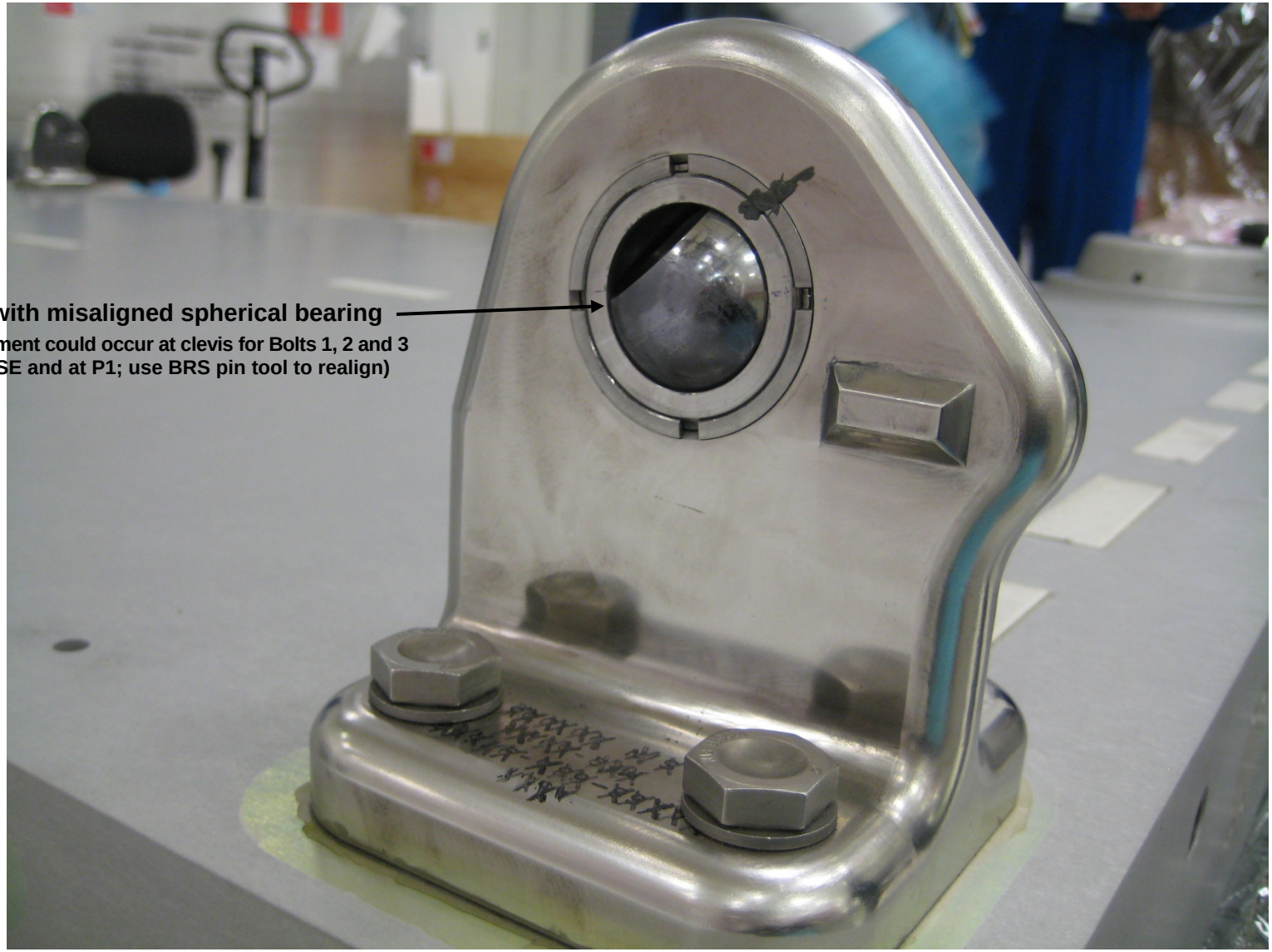



**Prybar used to clear ATA from soft dock at Bolt 4**
**(<u>NOTE</u>: Soft dock at Bolt 2 and Bolt 4 on both FSE and at P1)**

**ATA CONTINGENCIES** (Cont)

**Bolt 4 Clevis with misaligned spherical bearing**

**(<u>NOTE</u>: Misalignment could occur at clevis for Bolts 1, 2 and 3 on the FSE and at P1; use BRS pin tool to realign)**

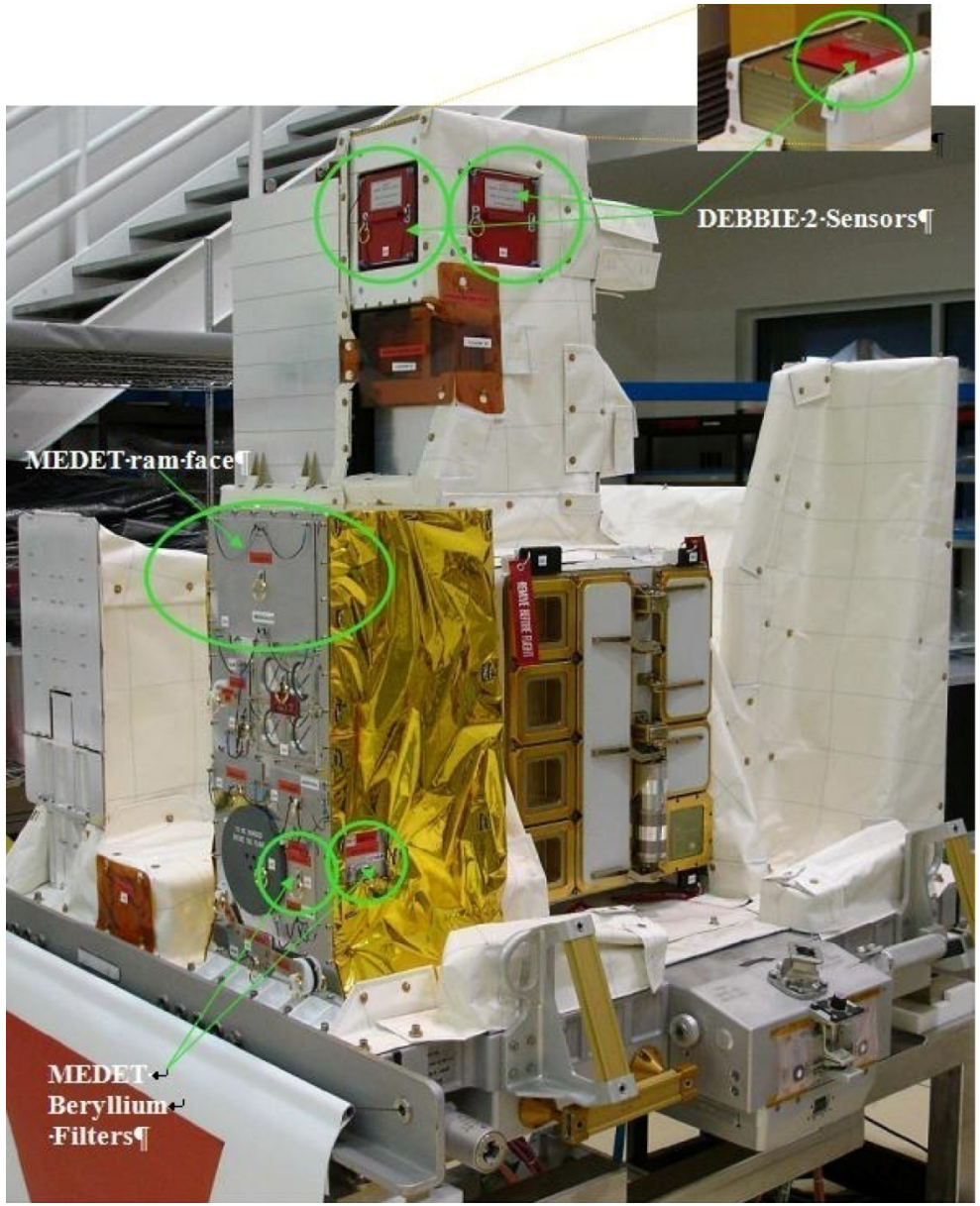


**BRS Pin Tool used to exercise sticky plungers at Bolts 2 and 4**

**(<u>NOTE</u>: Soft dock plungers interface with clevis brackets at Bolt 2 and Bolt 4 on both the FSE and P1)**

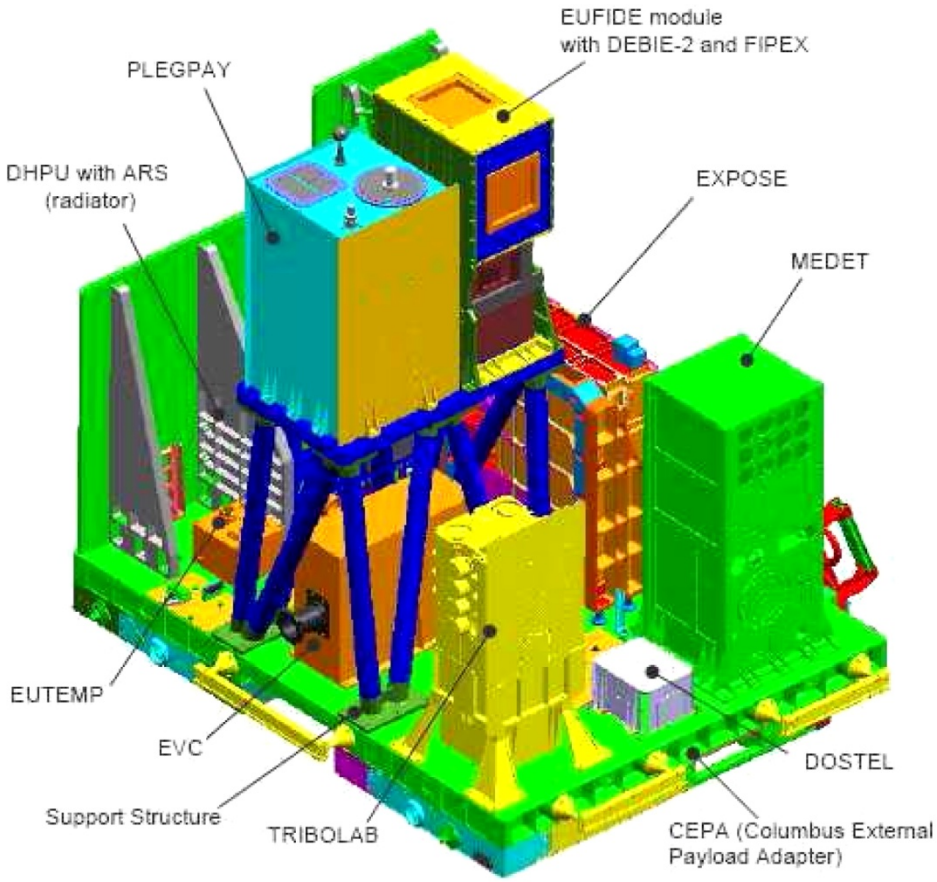
**LMC at Bolt 3 Cup Cone**
**(bottom view of upper surface)**

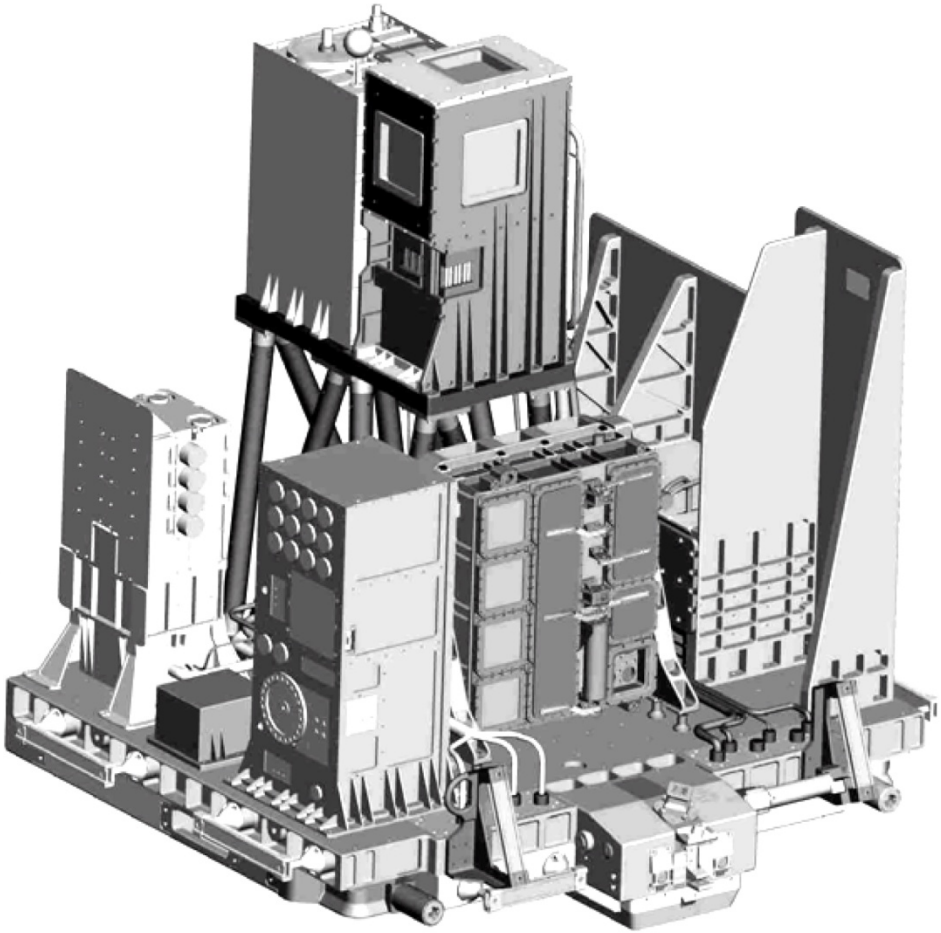
**EUTEF**



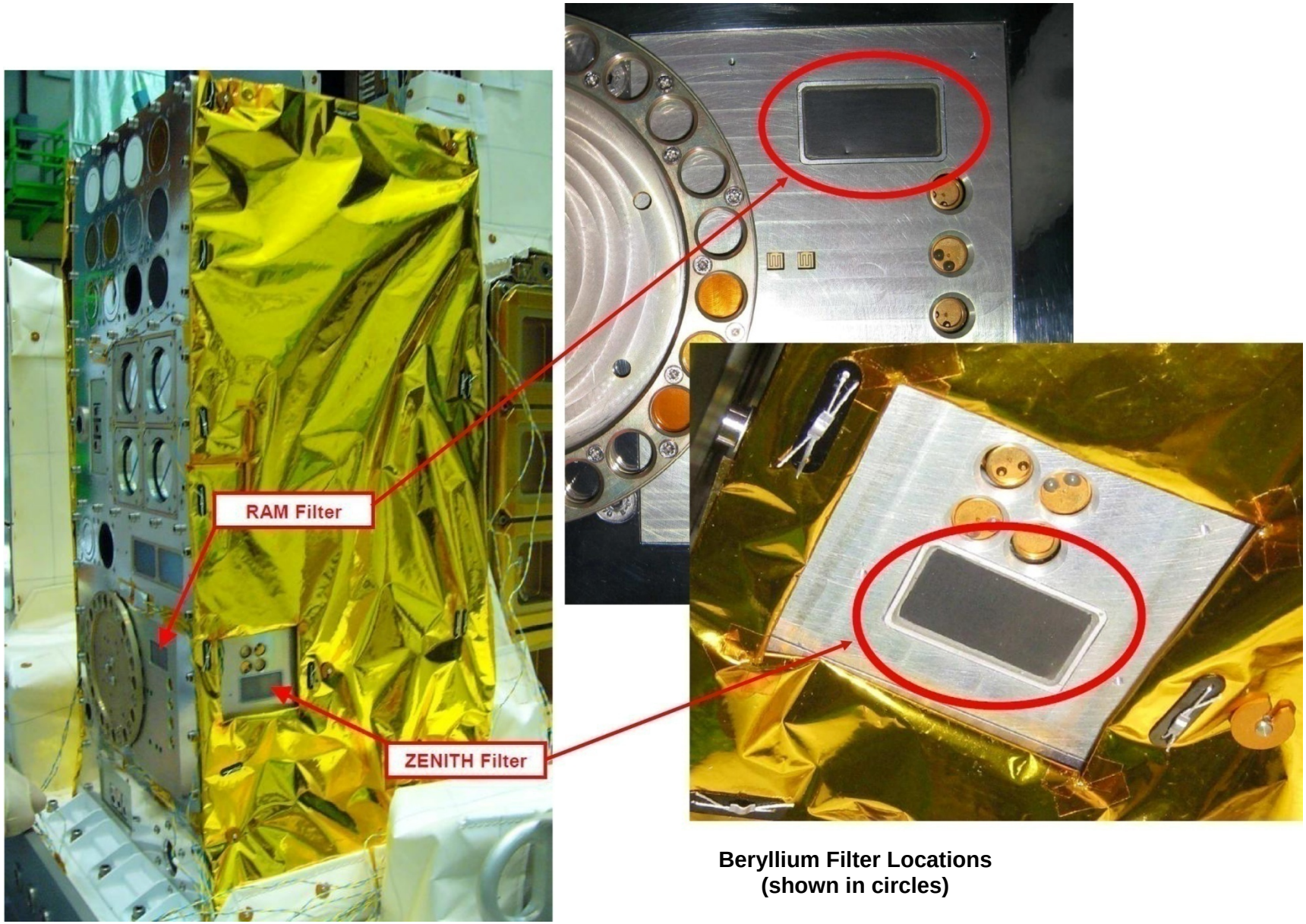

**EuTEF Photo Locations (shown in circles)**

**EUTEF** (Cont)


EUFIDE module
with DEBIE-2 and FIPEX
PLEGPAY
DHPU with ARS
(radiator)
EXPOSE
MEDET
EUTEMP
EVC
Support Structure
TRIBOLAB
DOSTEL
CEPA (Columbus External
Payload Adapter)

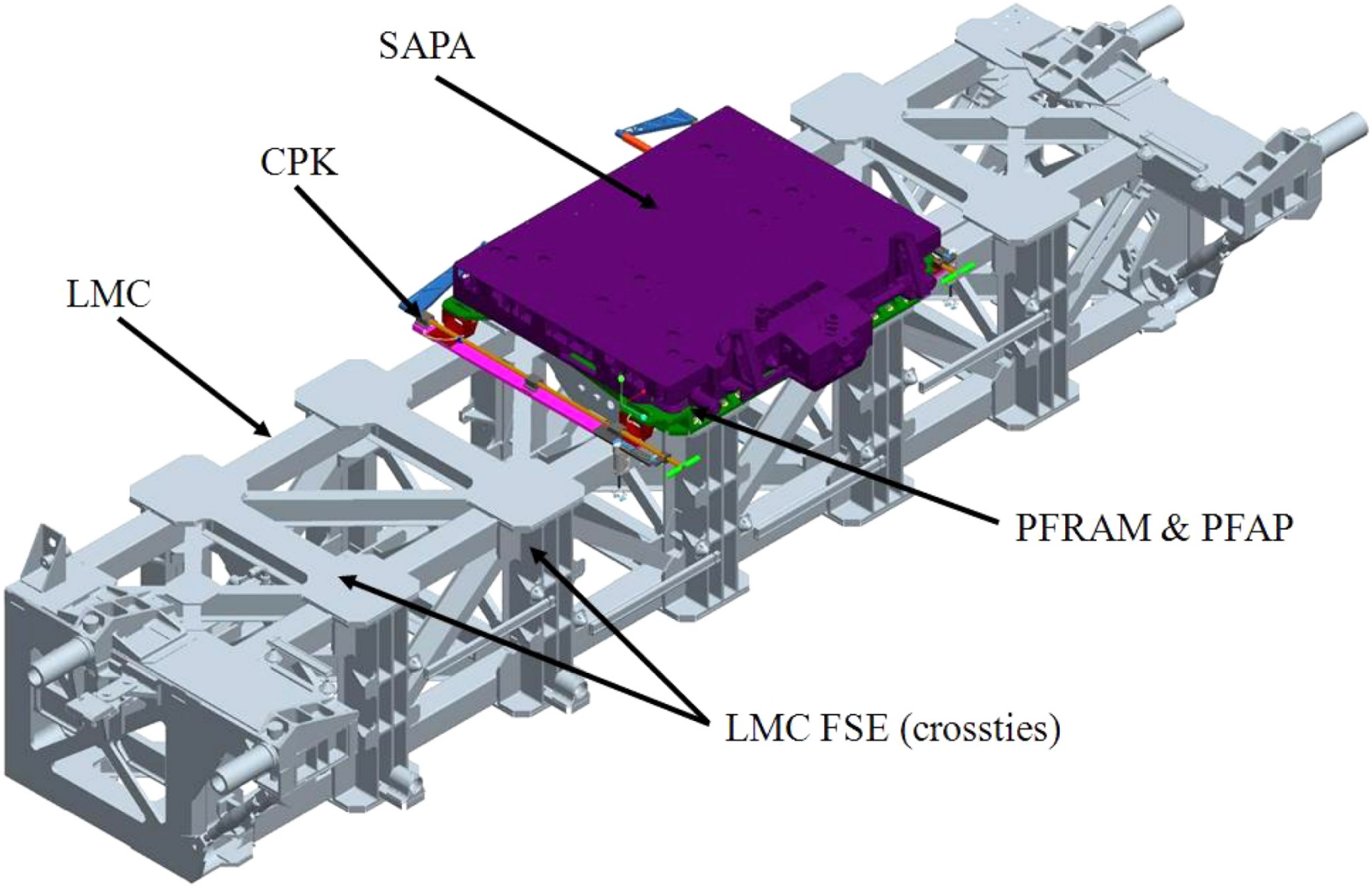


**EUTEF** (Cont)

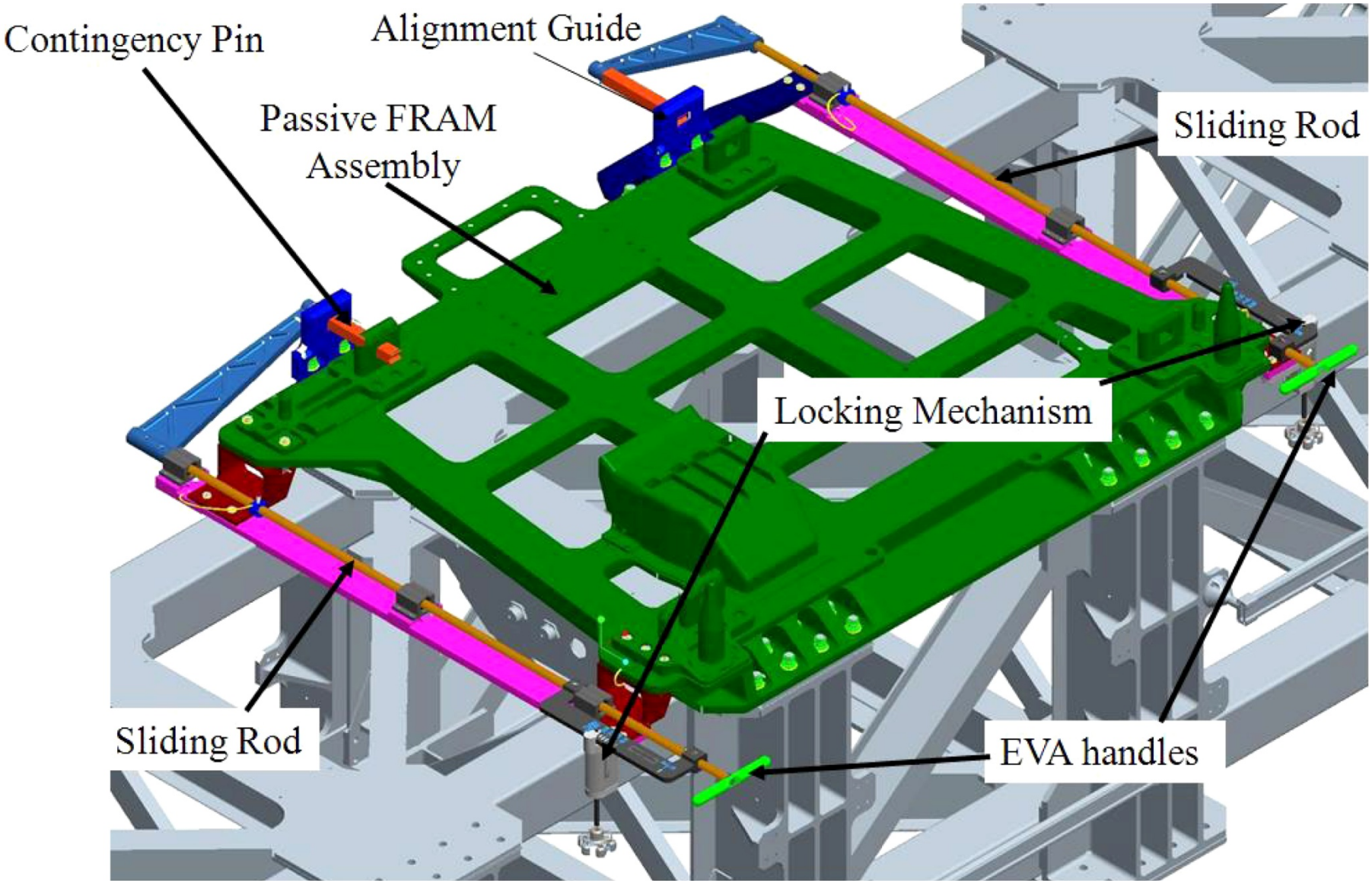



**Beryllium Filter Locations**
**(shown in circles)**

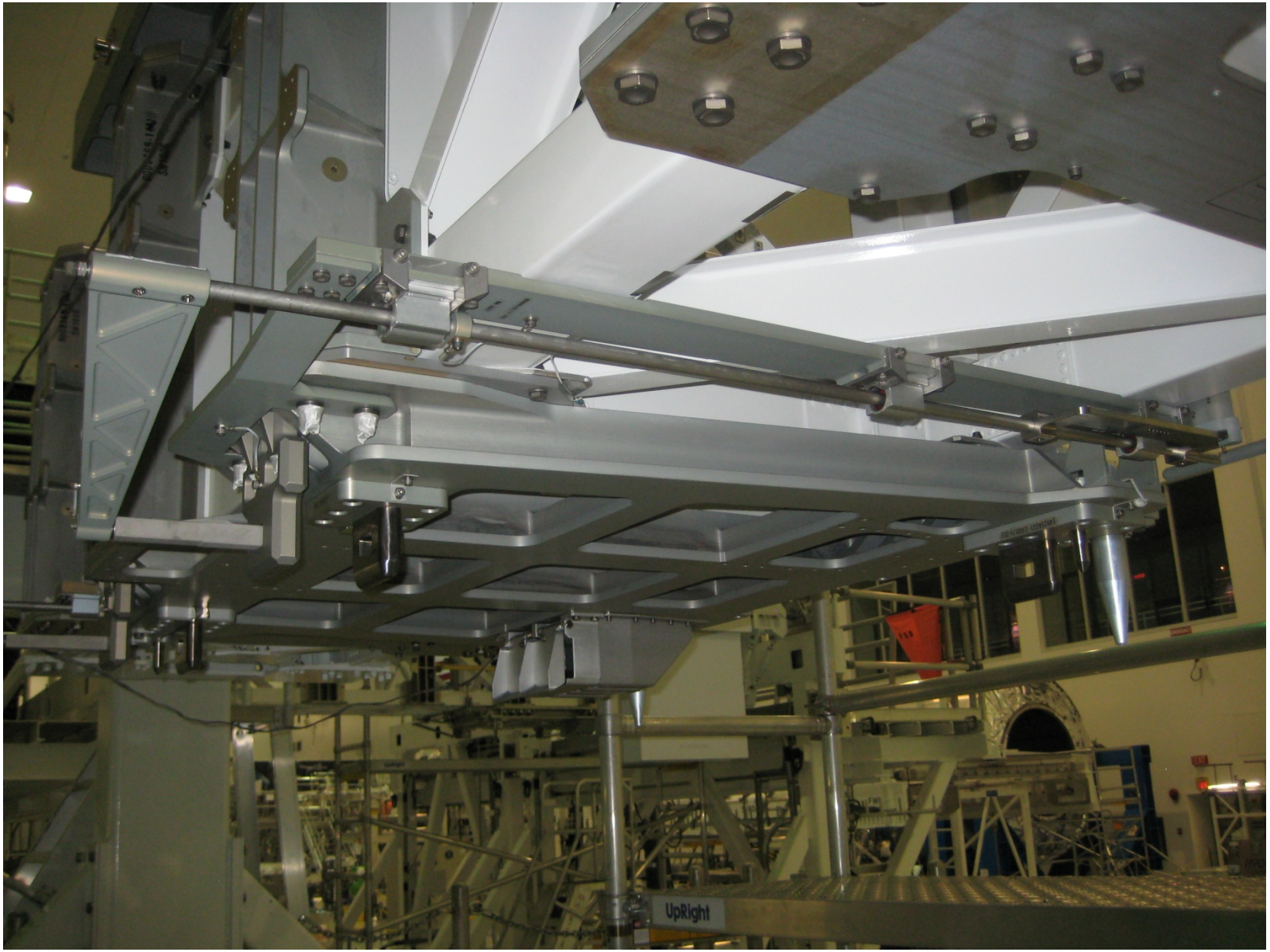
**FRAM CONTINGENCY PIN KIT**



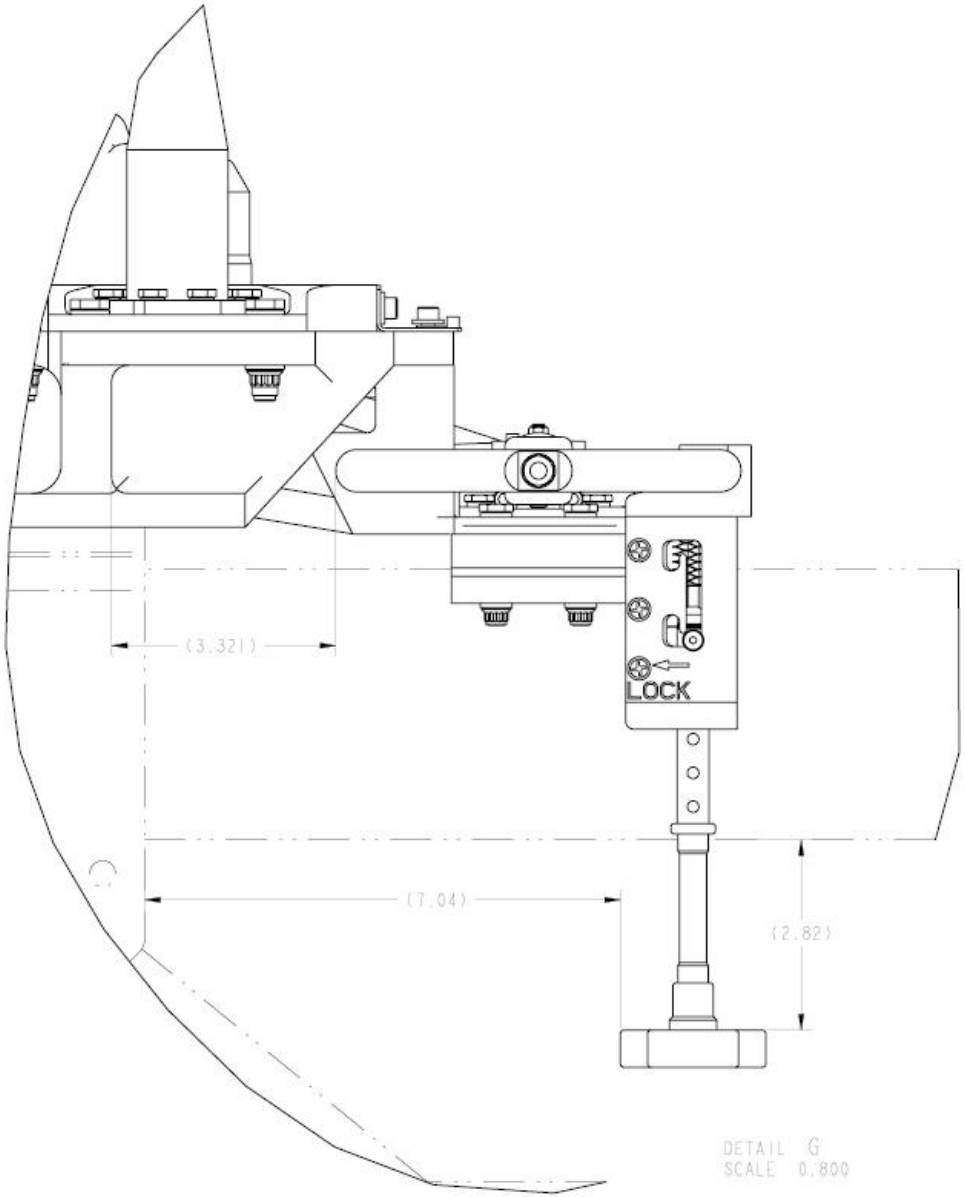
**FRAM CONTINGENCY PIN KIT** (Cont)



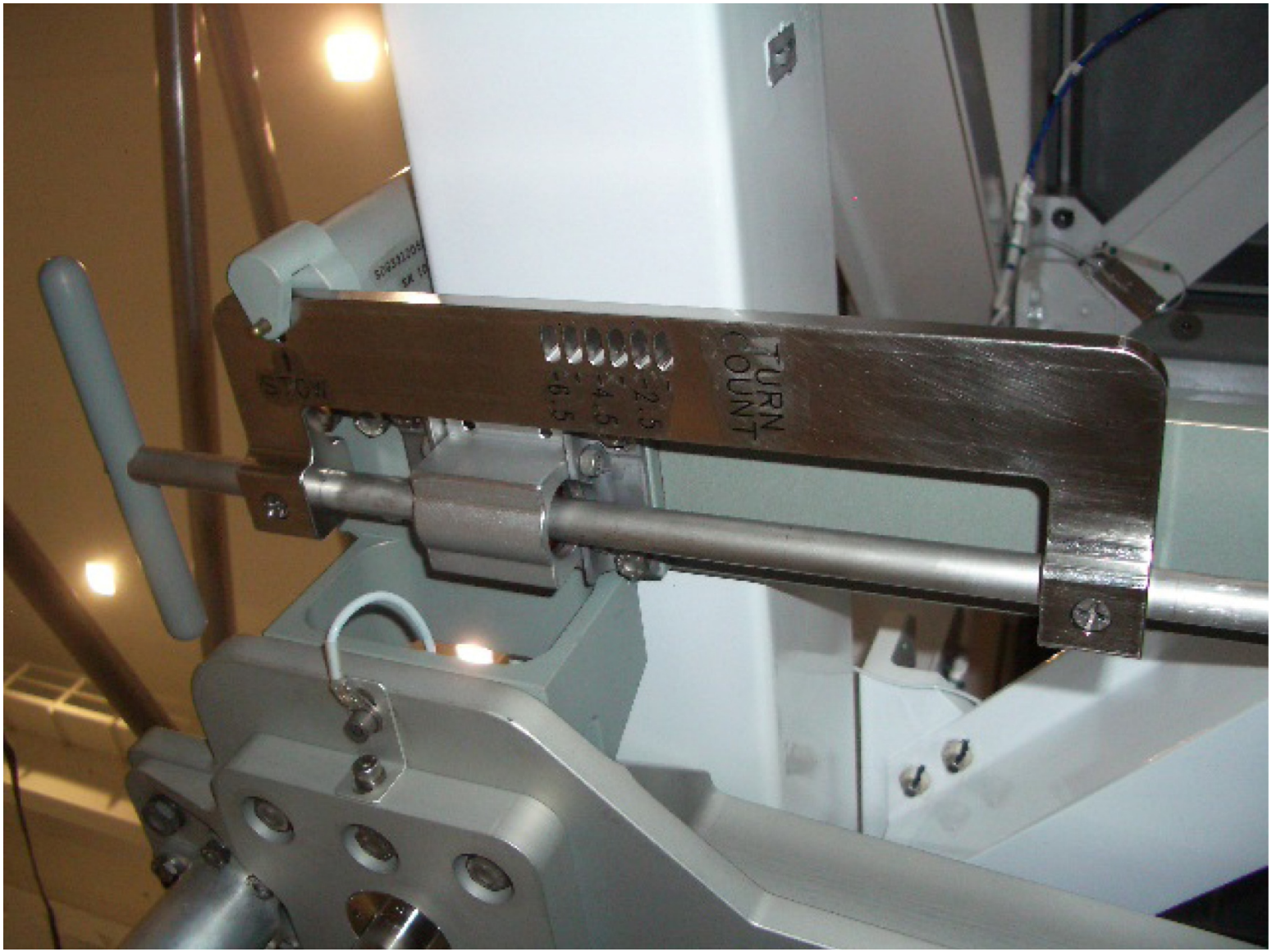
**FRAM CONTINGENCY PIN KIT** (Cont)



**FRAM CONTINGENCY PIN KIT** (Cont)

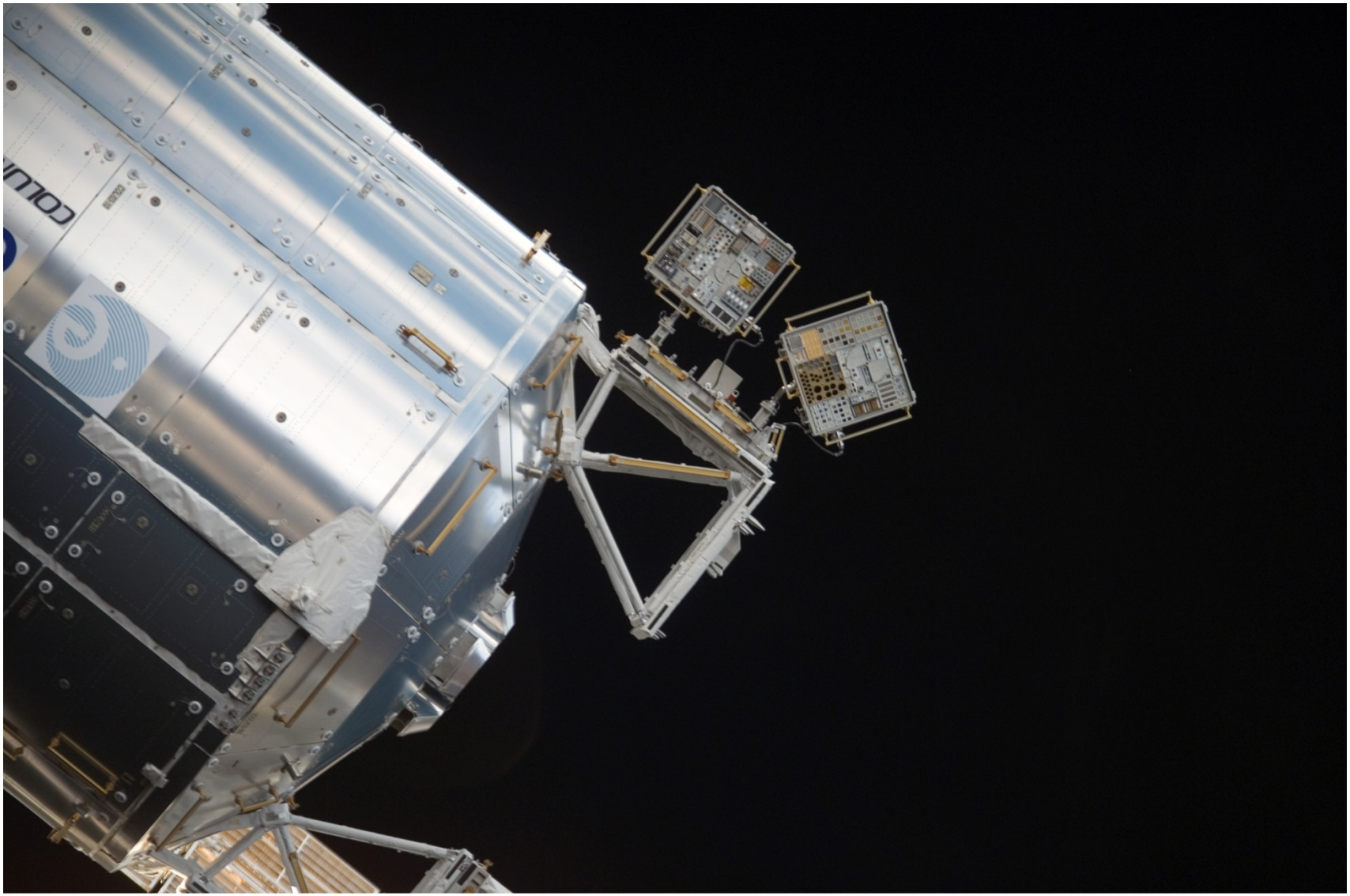


**FRAM CONTINGENCY PIN KIT** (Cont)



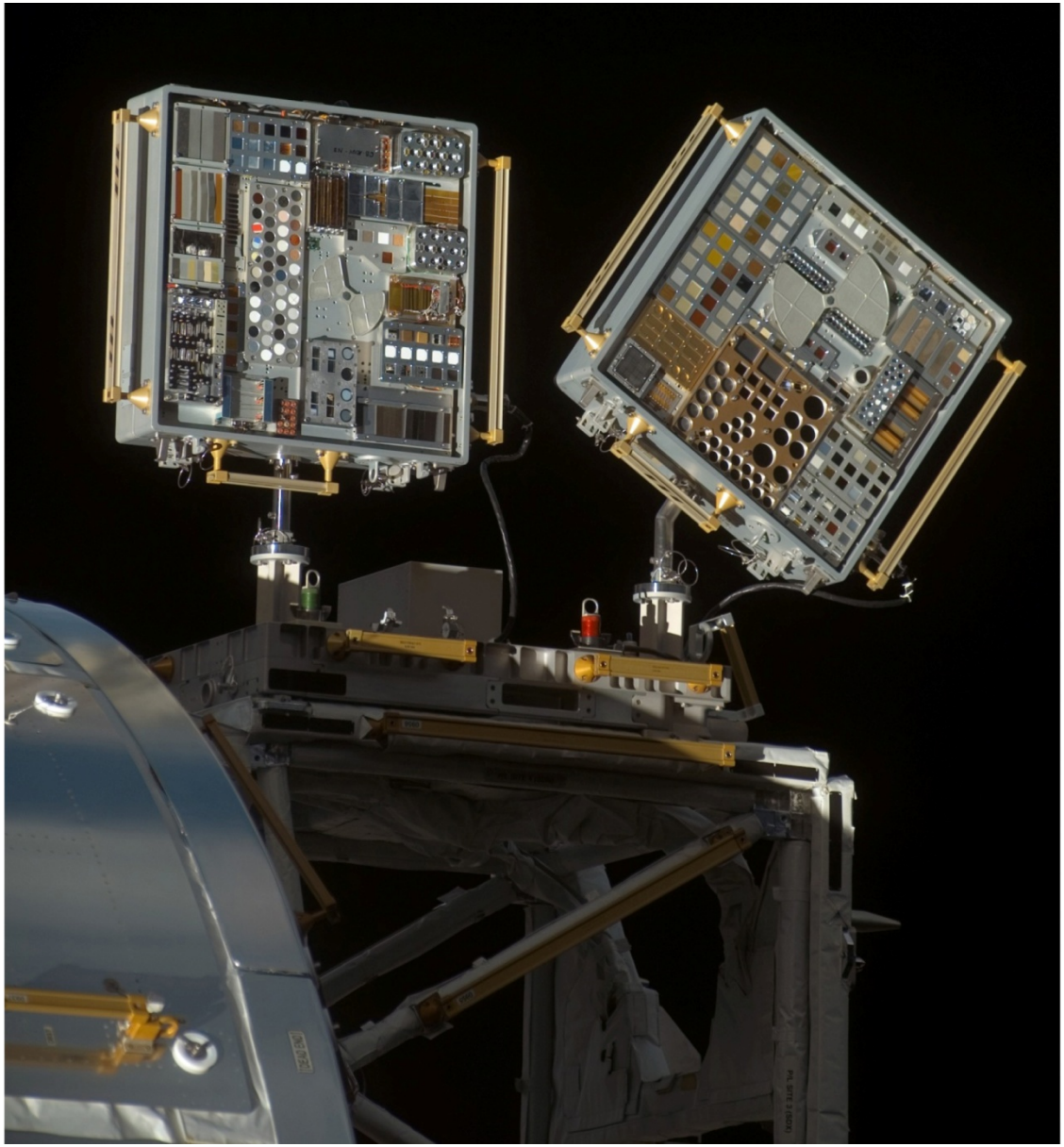
**FRAM CONTINGENCY PIN KIT** (Cont)

**MISSE 6**

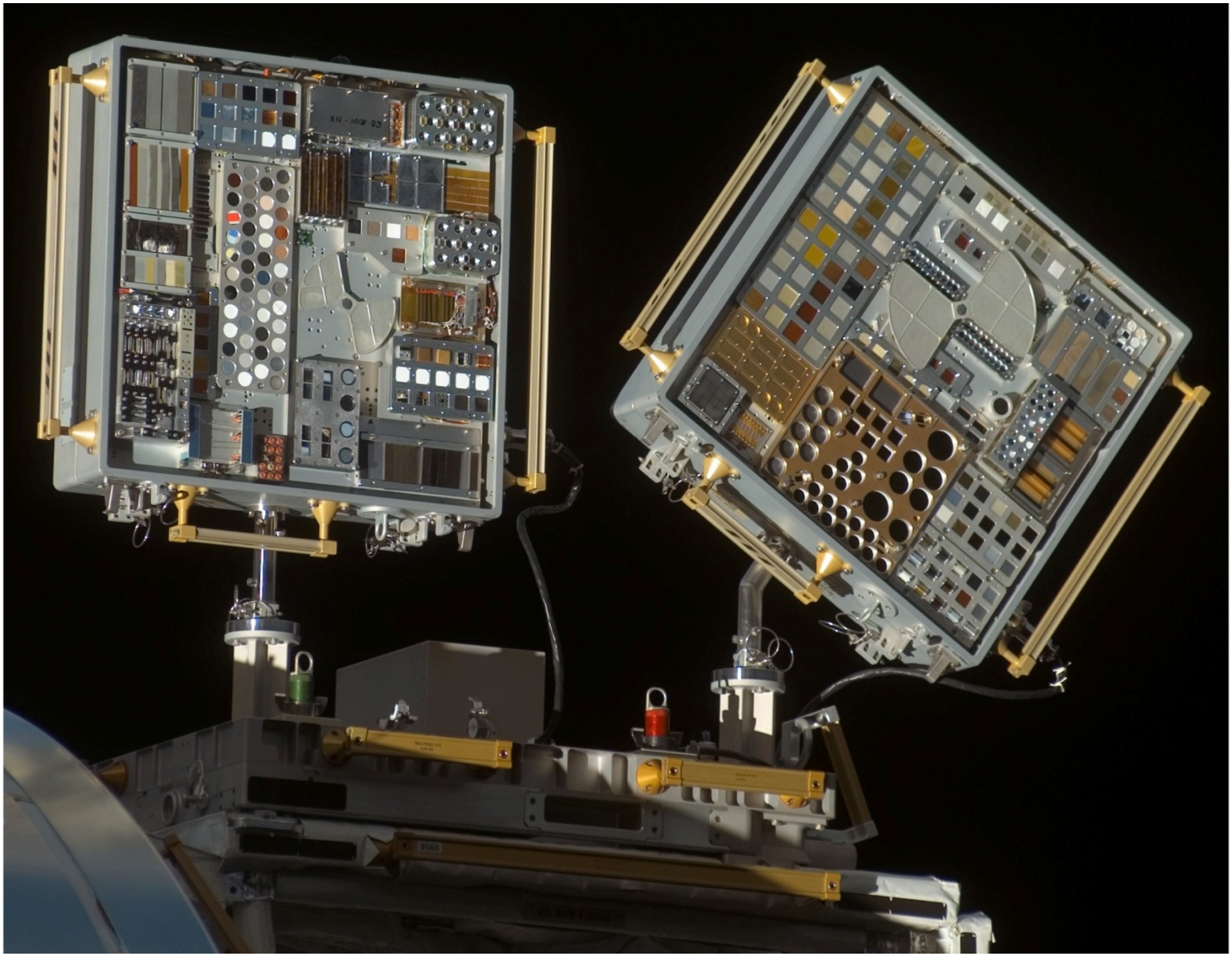


S123E009551

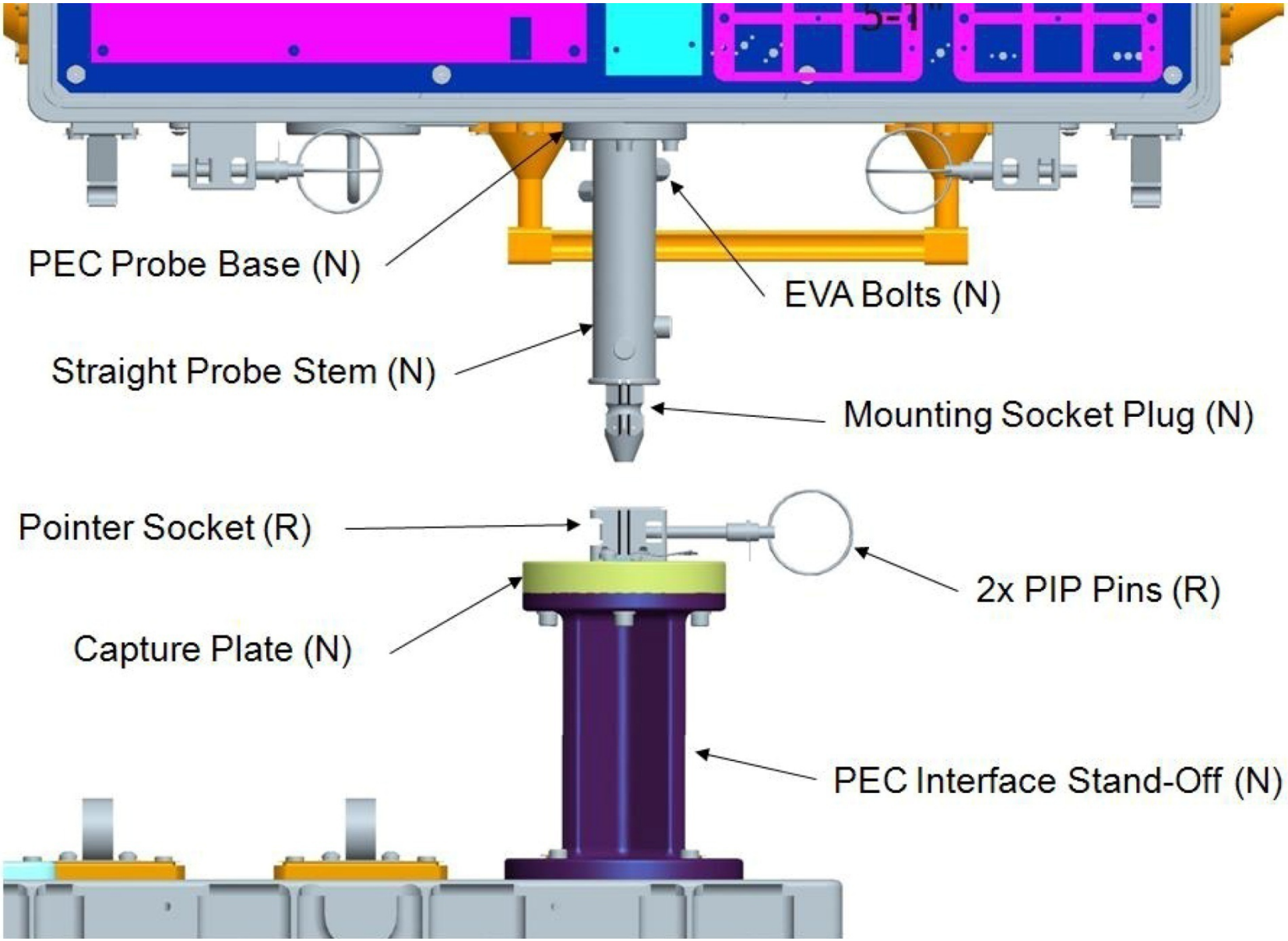
**MISSE 6** (Cont)



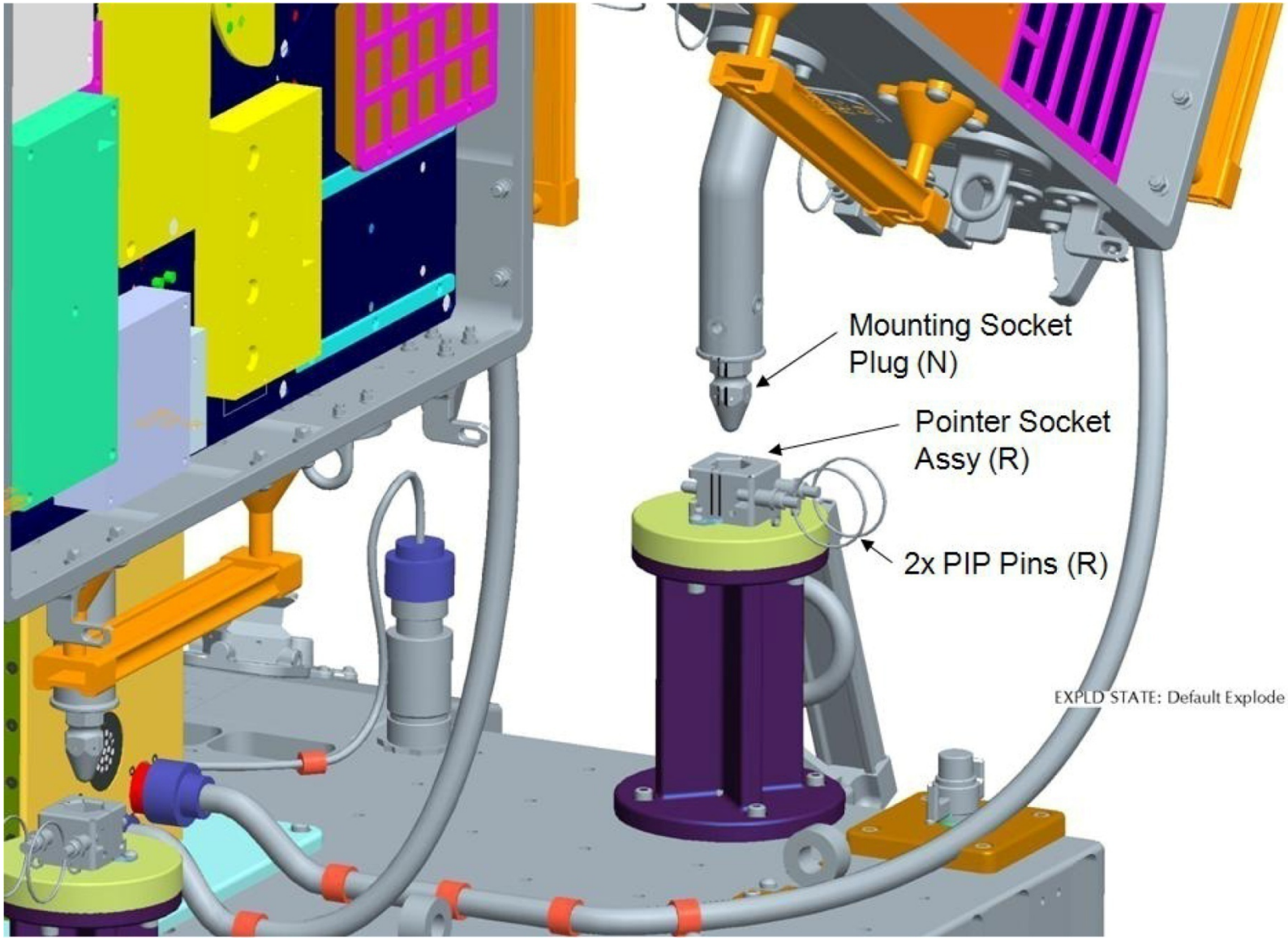
**MISSE 6** (Cont)



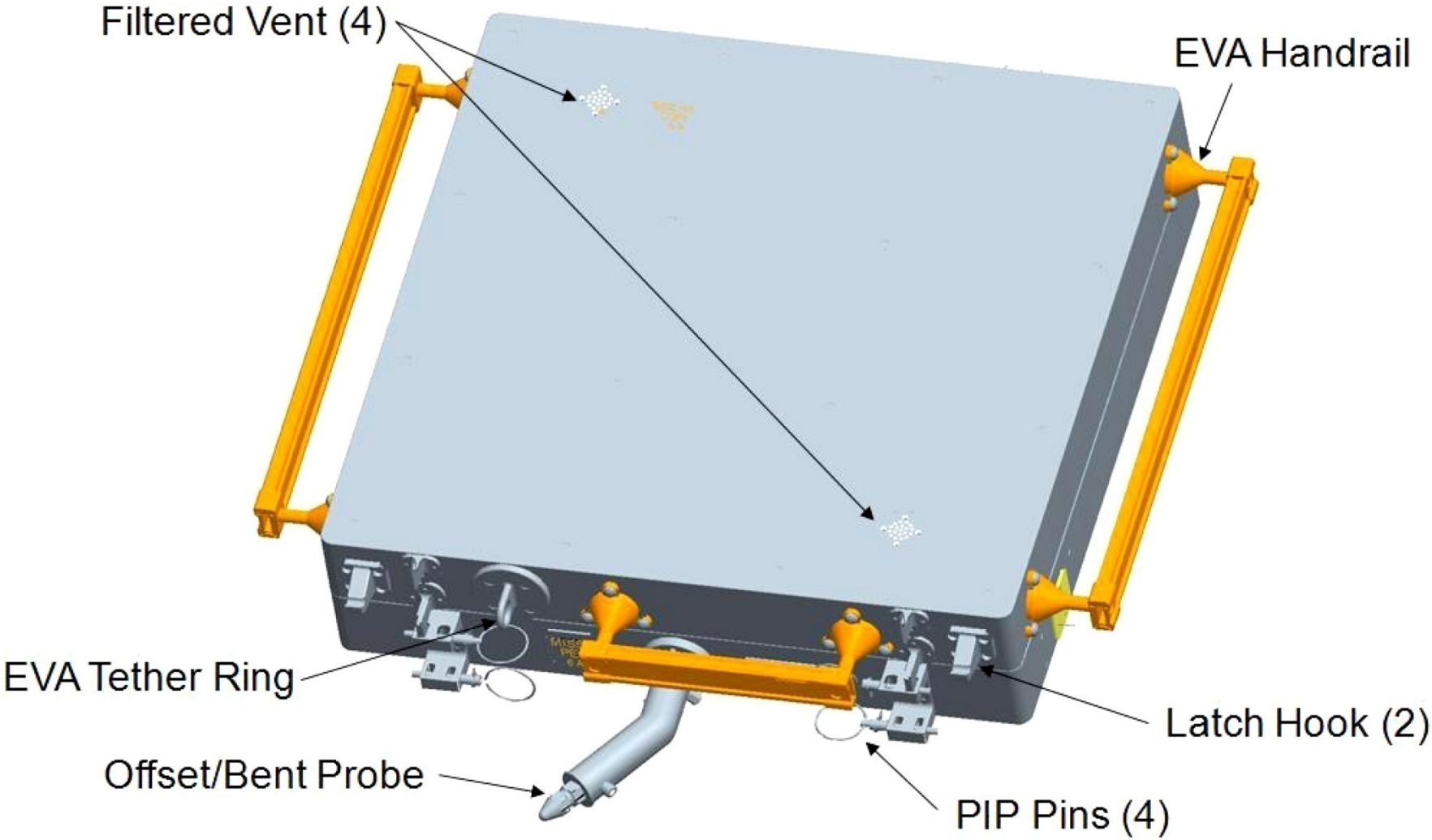
**MISSE 6** (Cont)


PEC Probe Base (N)
EVA Bolts (N)
Straight Probe Stem (N)
Mounting Socket Plug (N)
Pointer Socket (R)
2x PIP Pins (R)
Capture Plate (N)
PEC Interface Stand-Off (N)

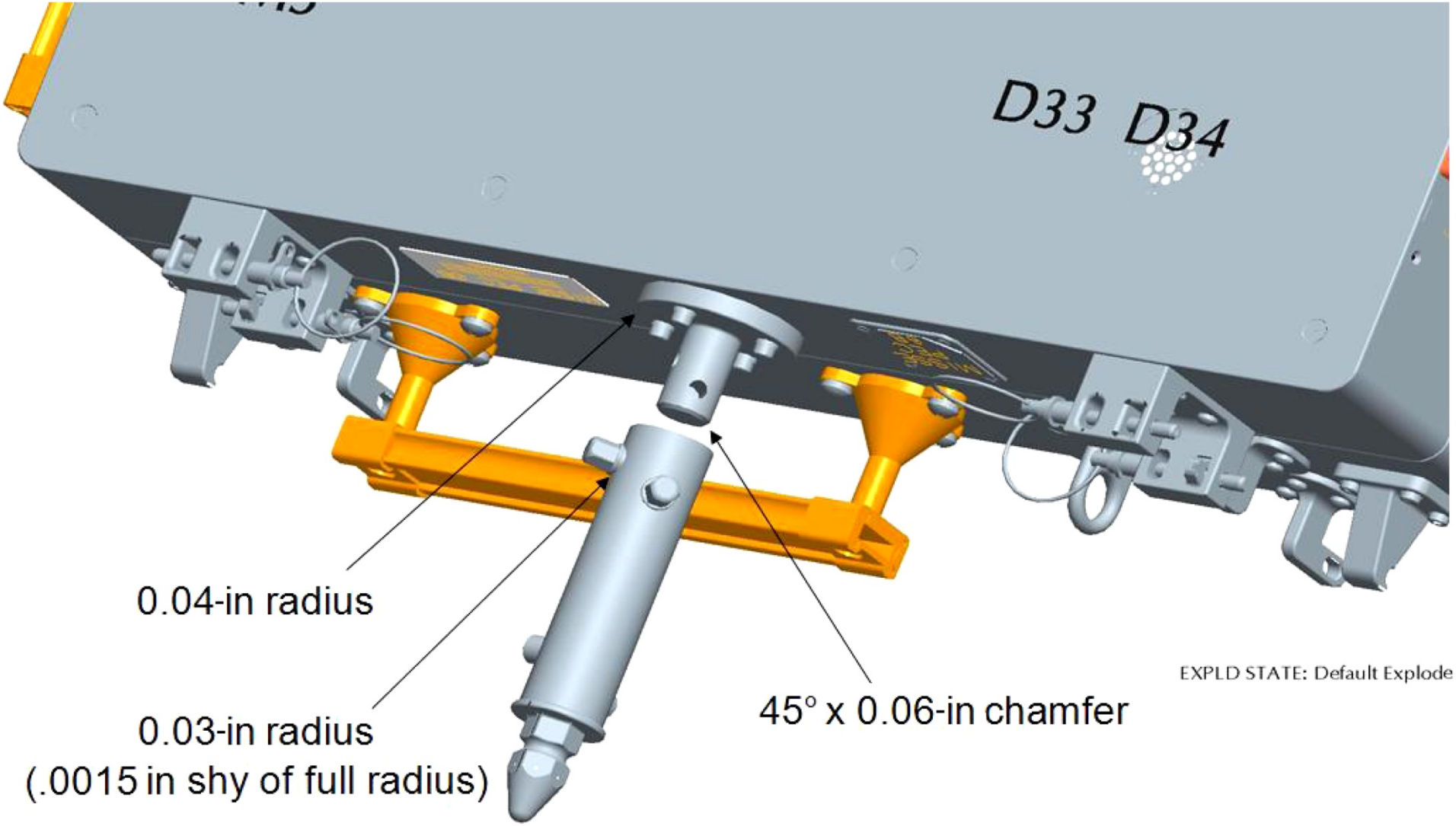
**MISSE 6** (Cont)


Mounting Socket
Plug (N)
Pointer Socket
Assy (R)
2x PIP Pins (R)
EXPLD STATE: Default Explode

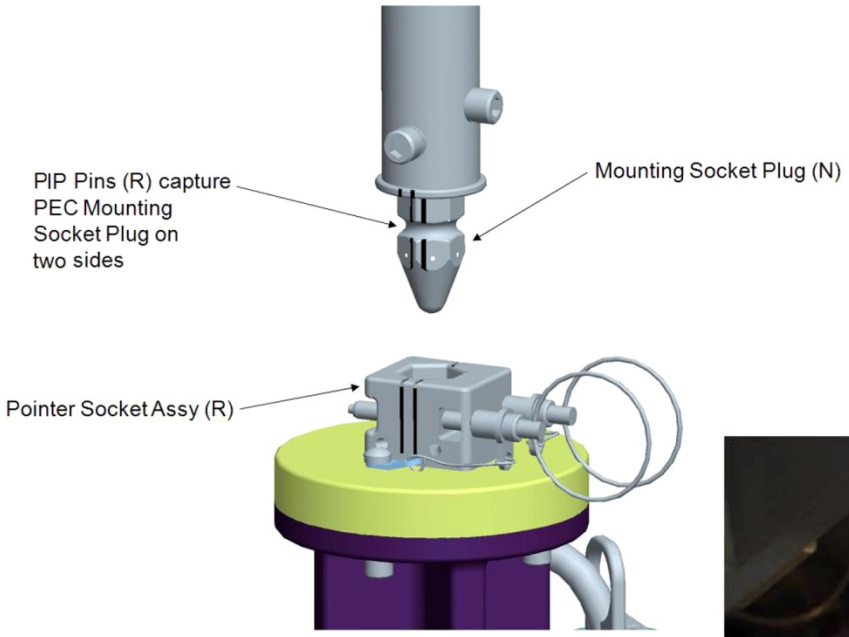
# PEC Closed

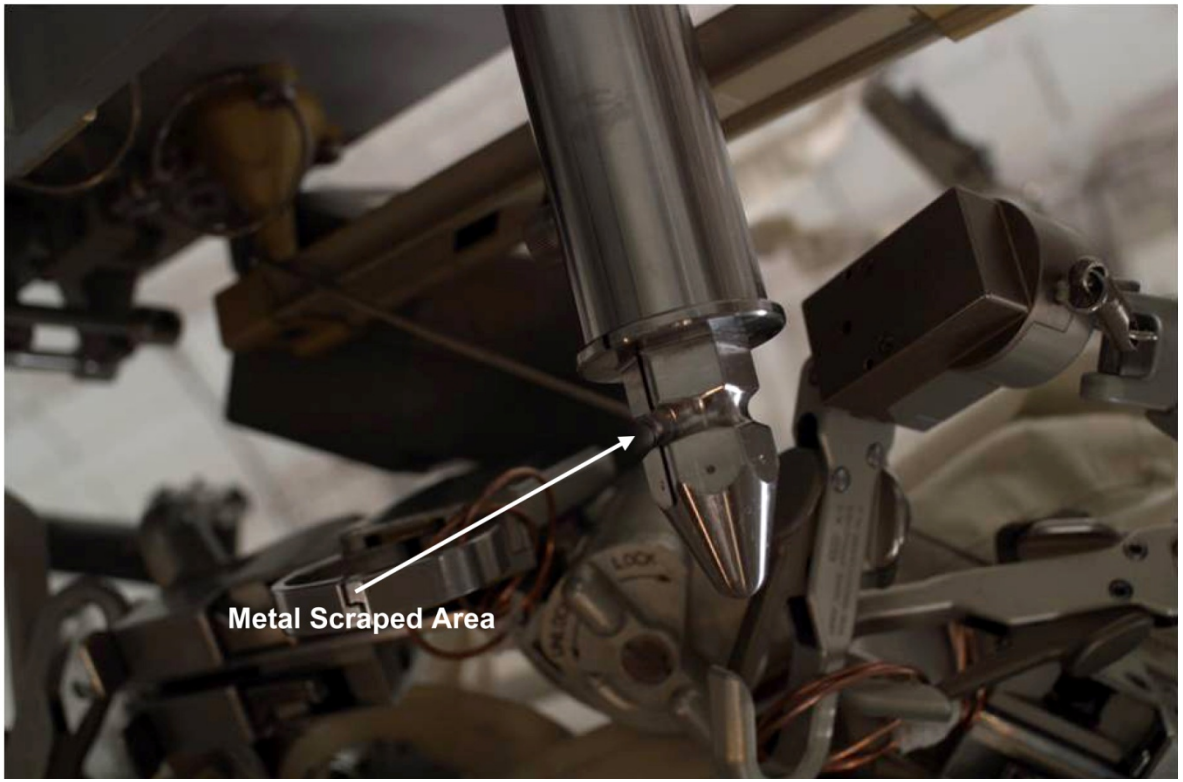

Filtered Vent (4)
EVA Handrail
EVA Tether Ring
Latch Hook (2)
Offset/Bent Probe
PIP Pins (4)

**MISSE 6** (Cont)

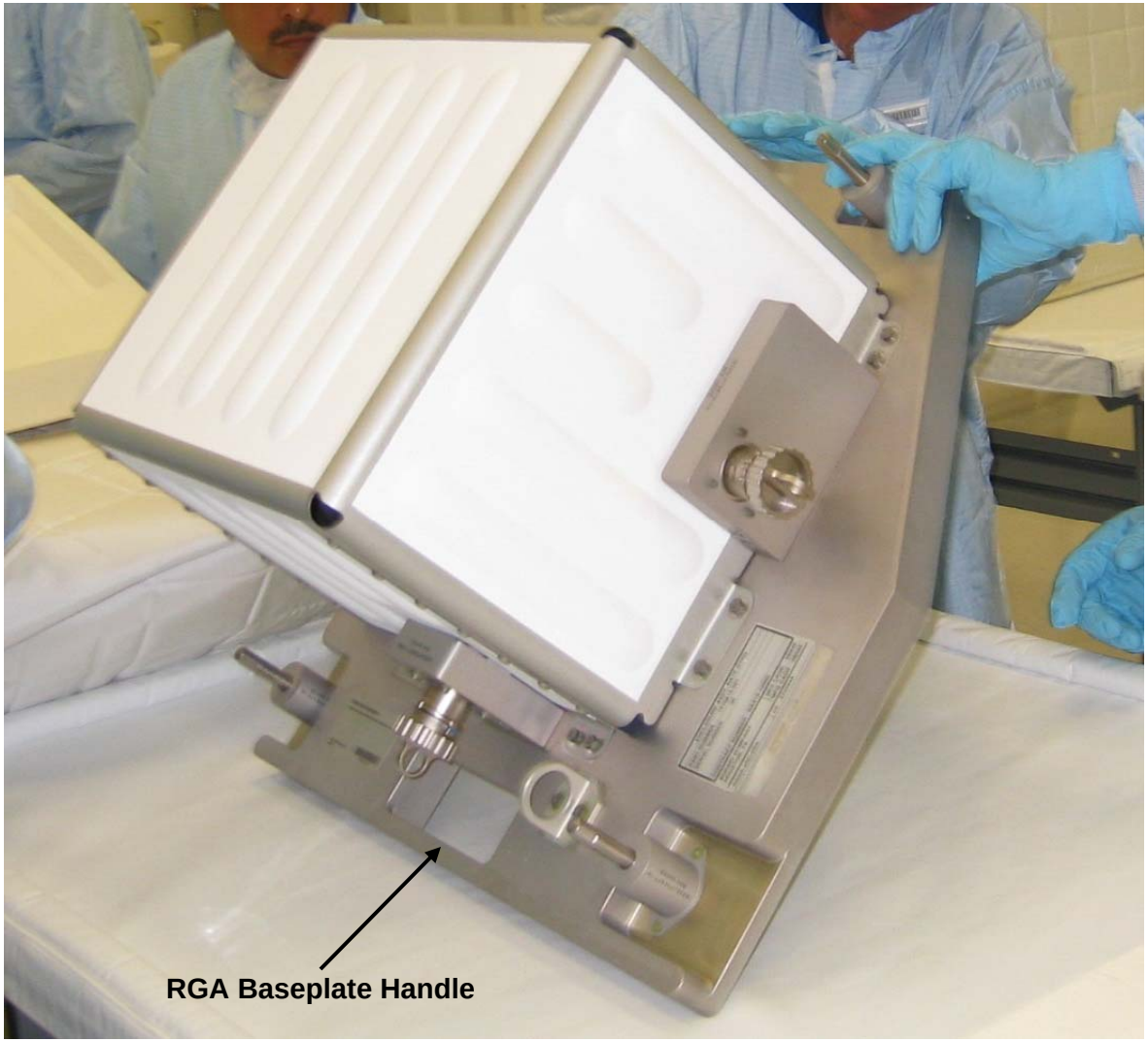

D33 D34
0.04-in radius
0.03-in radius
(.0015 in shy of full radius)
45° x 0.06-in chamfer
EXPLD STATE: Default Explode

**MISSE 6** (Cont)

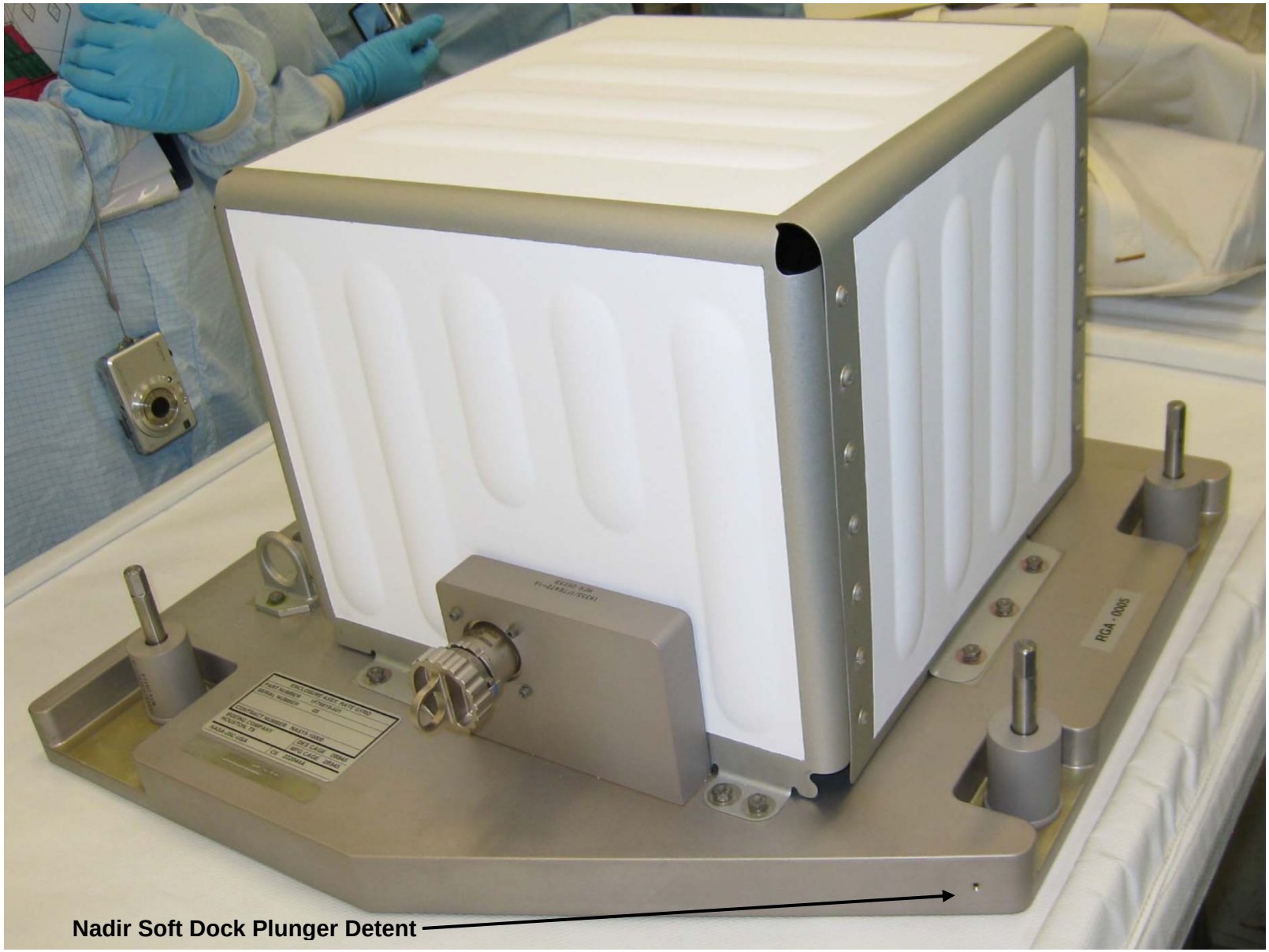

PIP Pins (R) capture PEC Mounting Socket Plug on two sides
Mounting Socket Plug (N)
Pointer Socket Assy (R)


Metal Scraped Area

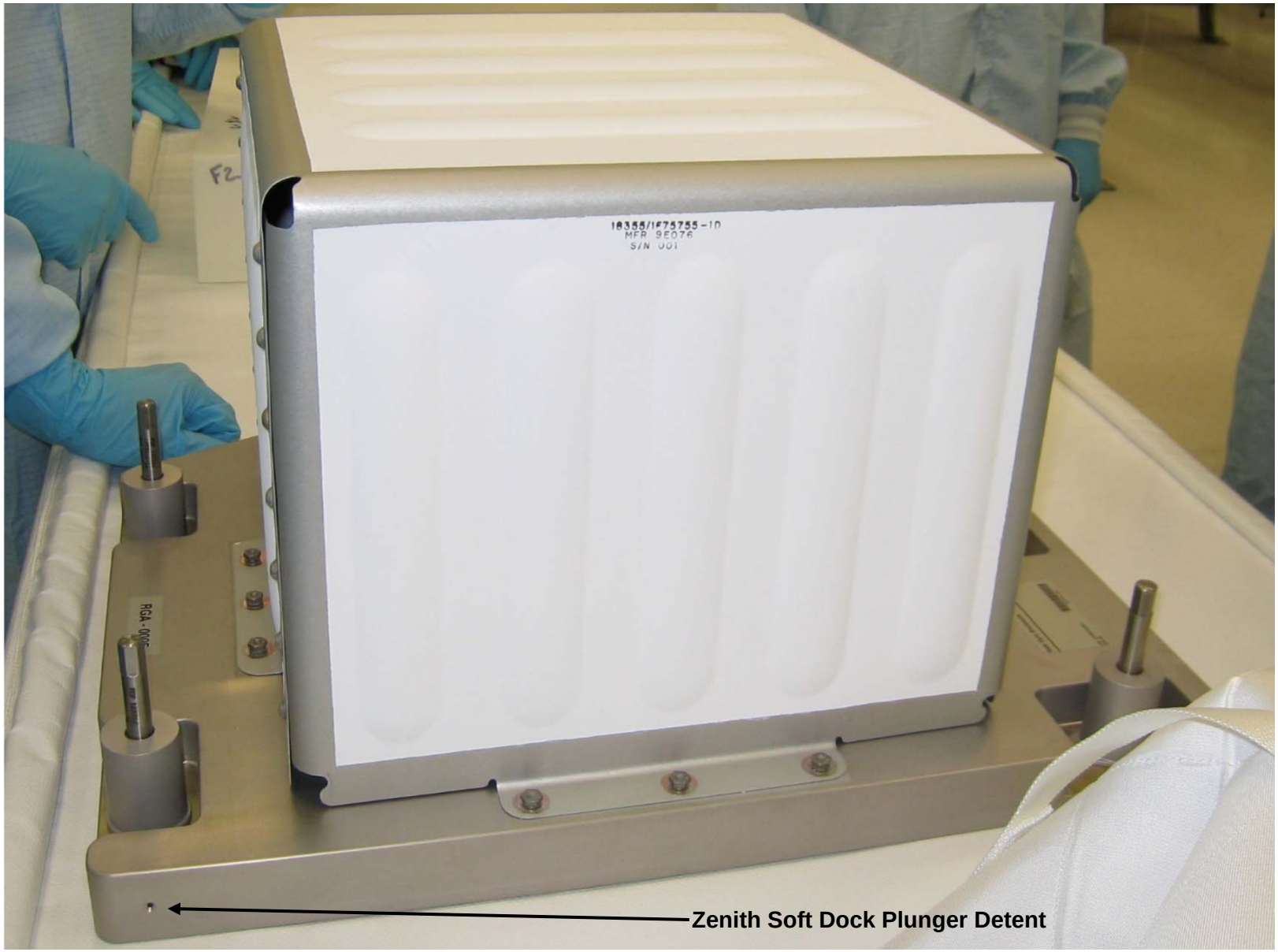
**RGA 2**



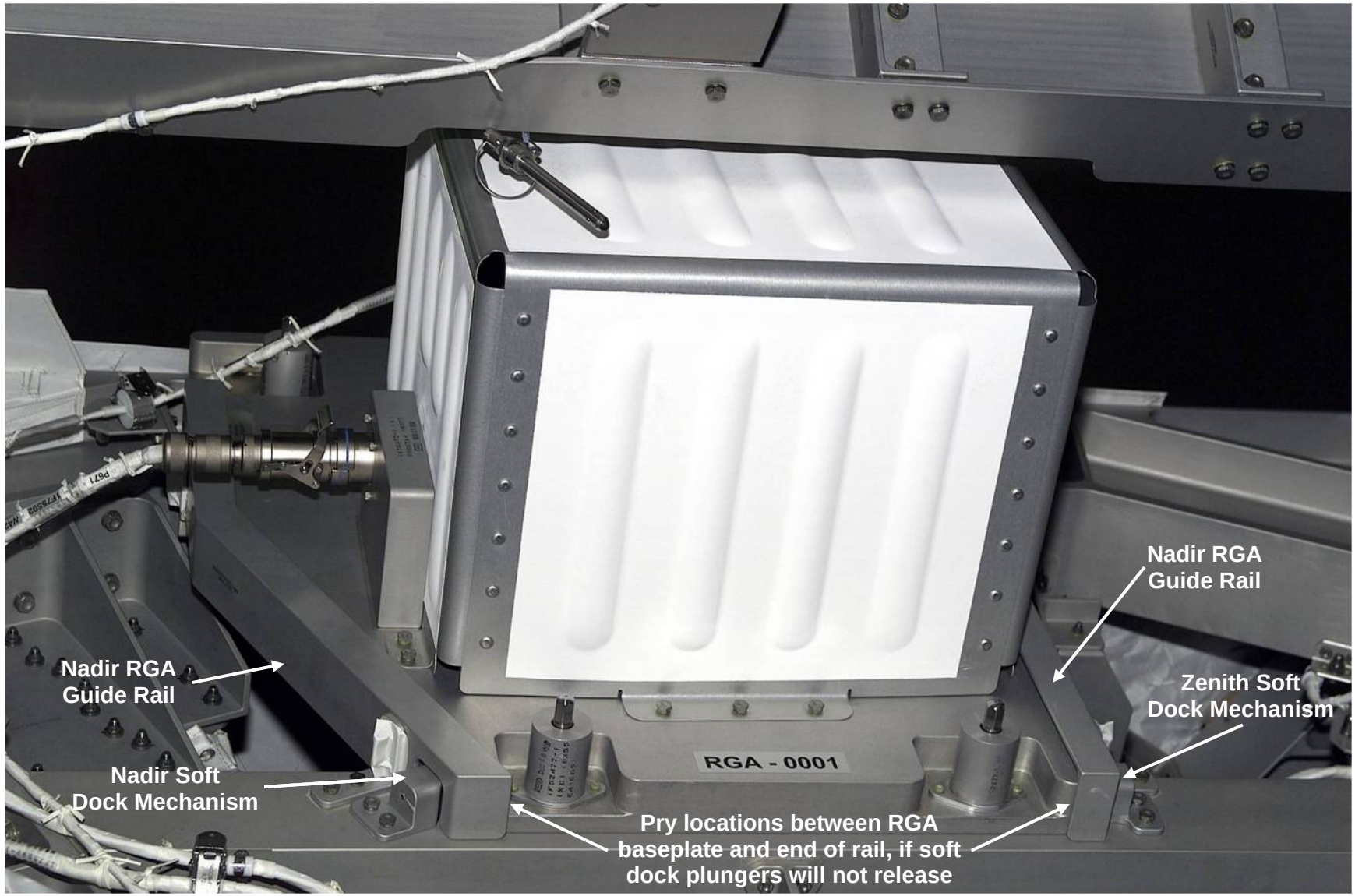
**RGA 2** (Cont)



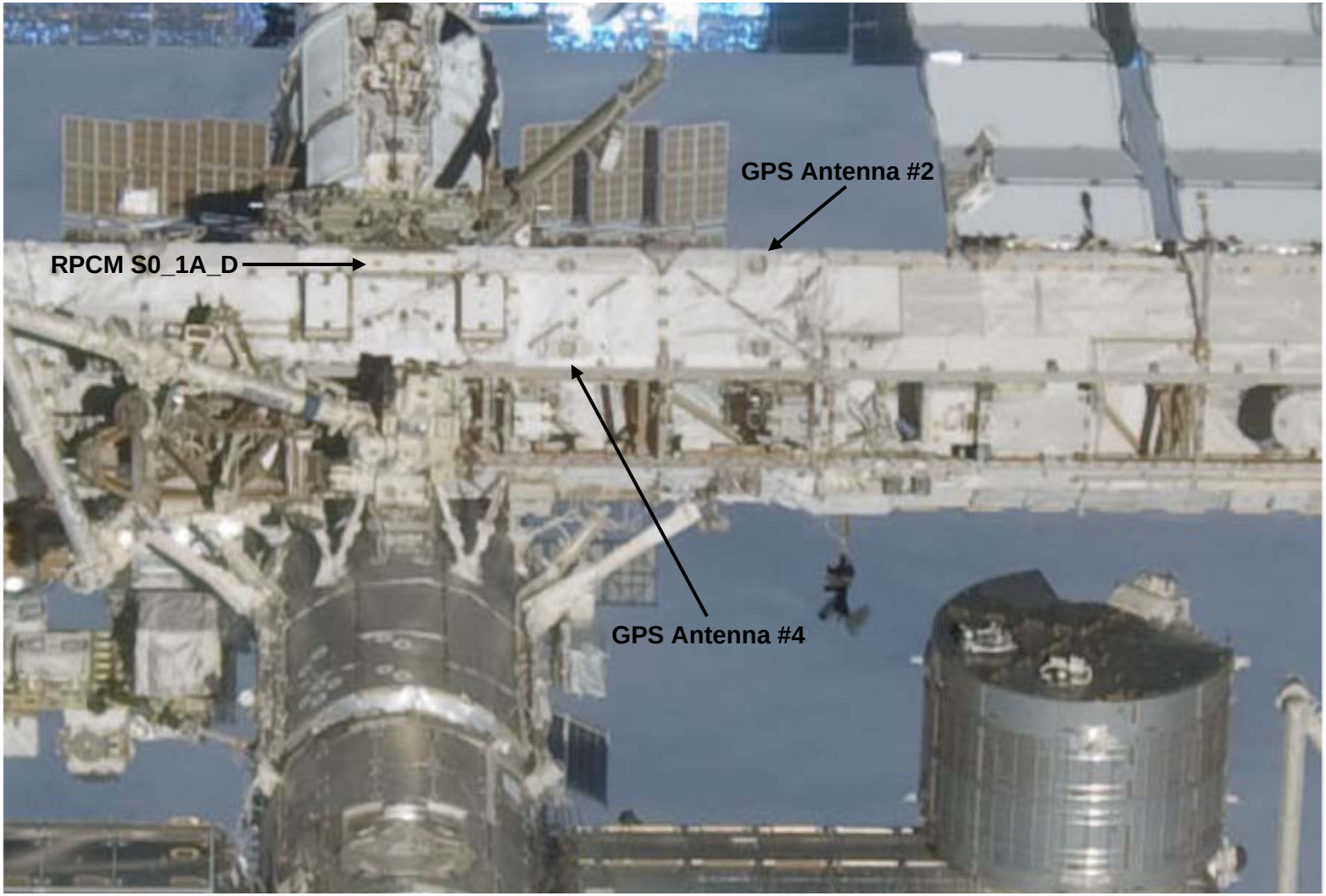
**RGA 2** (Cont)



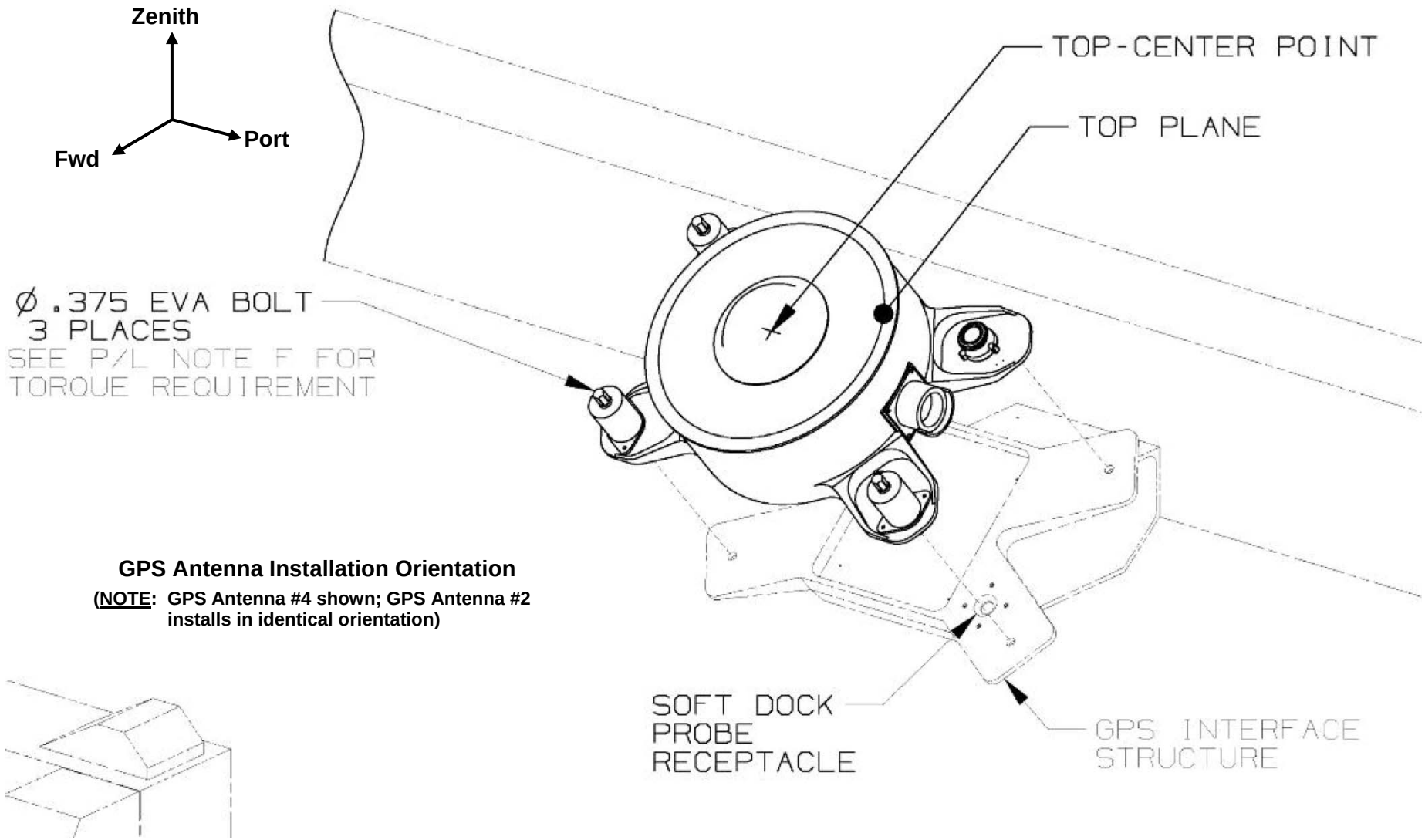
**RGA 2** (Cont)


Nadir RGA
Guide Rail
Nadir RGA
Guide Rail
Zenith Soft
Dock Mechanism
Nadir Soft
Dock Mechanism
RGA - 0001
Pry locations between RGA
baseplate and end of rail, if soft
dock plungers will not release

**GPS ANTENNA #2 AND #4**



**GPS ANTENNA #2 AND #4** (Cont)




**GPS Antenna Installation Orientation**

**(<u>NOTE</u>: GPS Antenna #4 shown; GPS Antenna #2 installs in identical orientation)**

## PMA3 HEATER CABLE

**PMA3 Heater Cable Connector Caps**

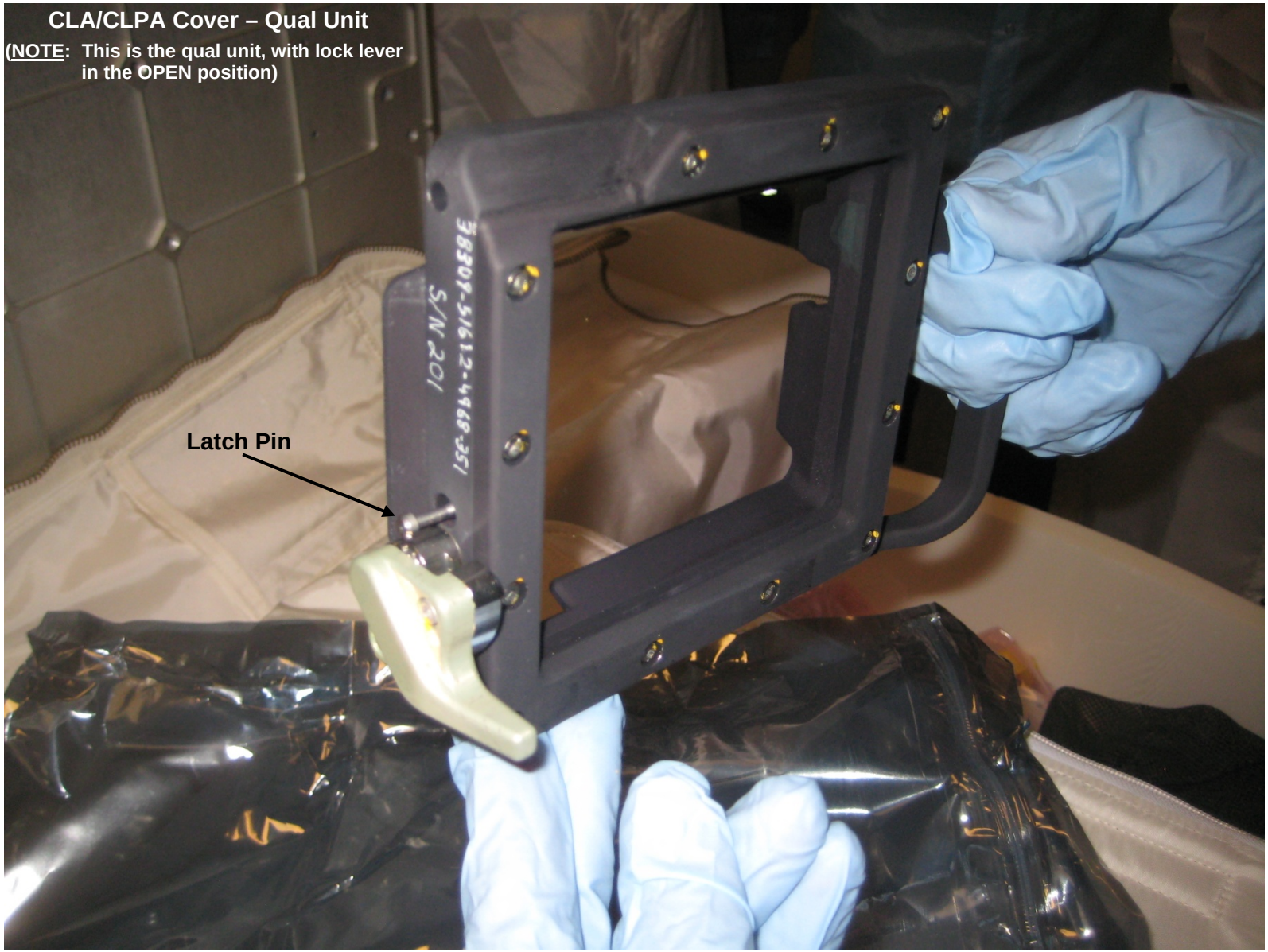
**(<u>NOTE</u>: These caps need to be wire tied together with a long wire tie prior to stowage in the PMA3 crewlock bag for EVA 3)**

## CLA/CLPA COVER

**CLA/CLPA Cover**

**(<u>NOTE</u>: This is the flight unit, with lock lever in the LOCK position, as required to fit in the CLA Cover MLI Case)**

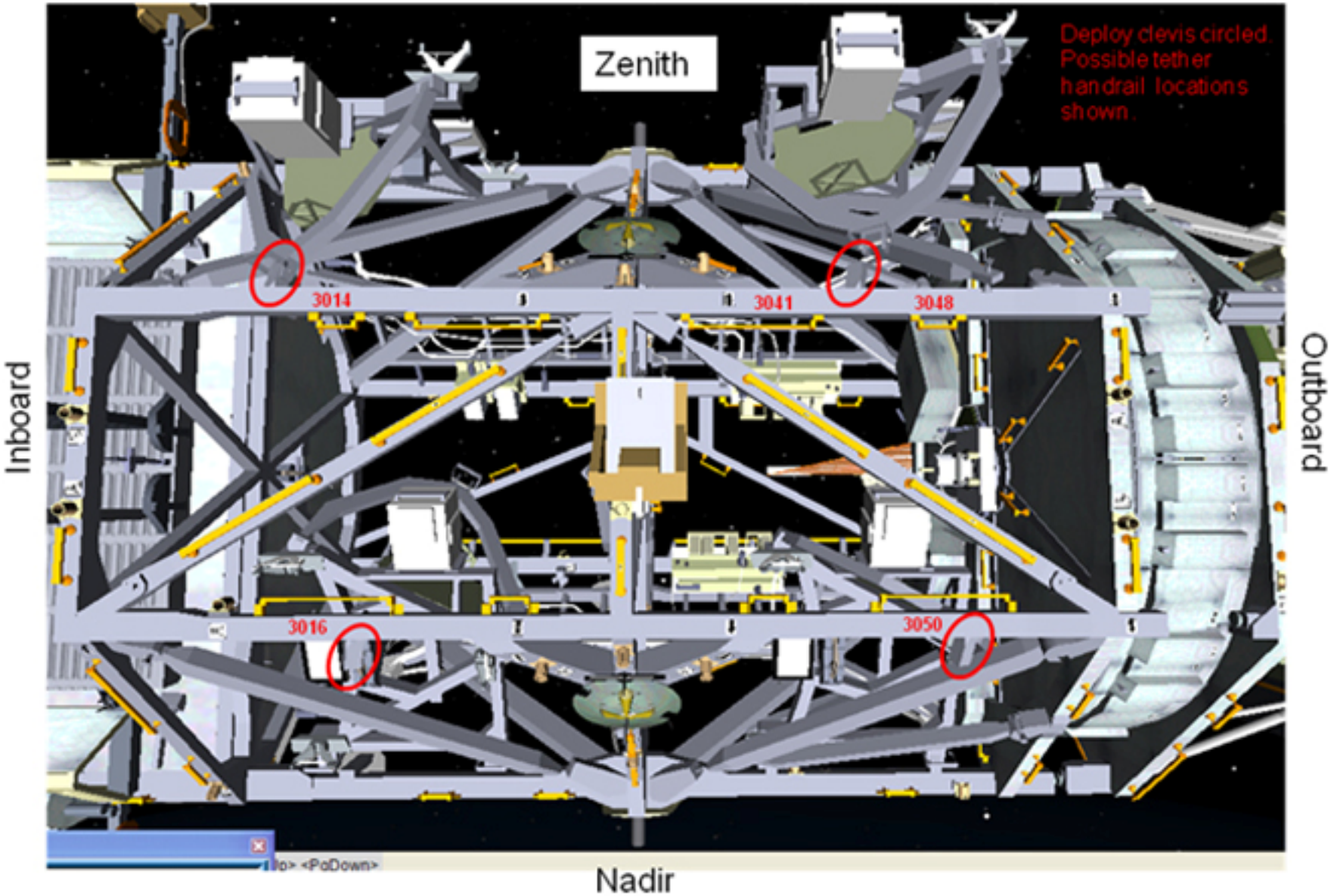
**CLA/CLPA COVER** (Cont)



**CLA/CLPA COVER** (Cont)

**CLA/CLPA Cover MLI Case**

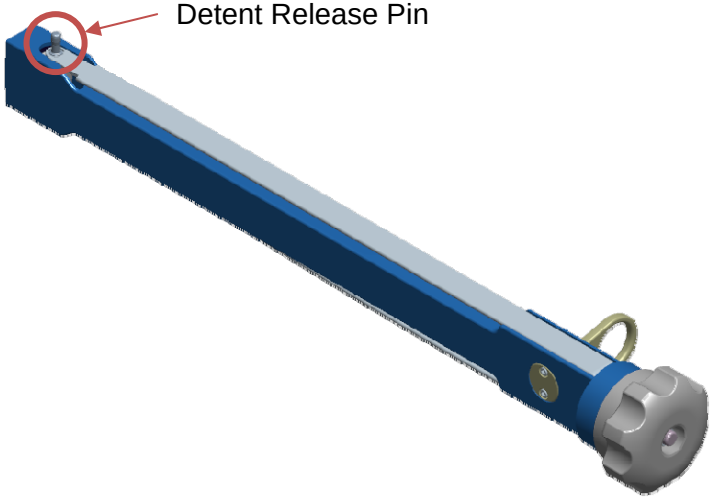
**S3 PAS**

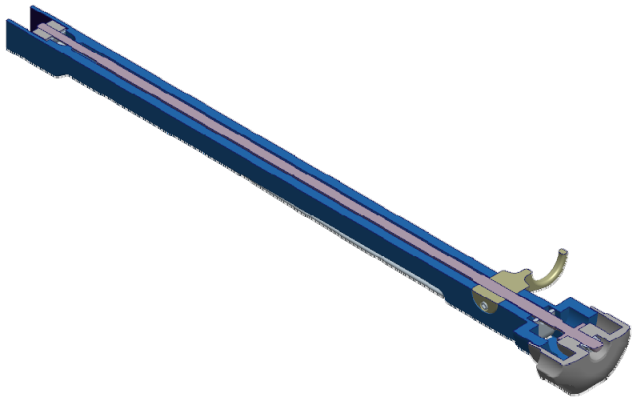


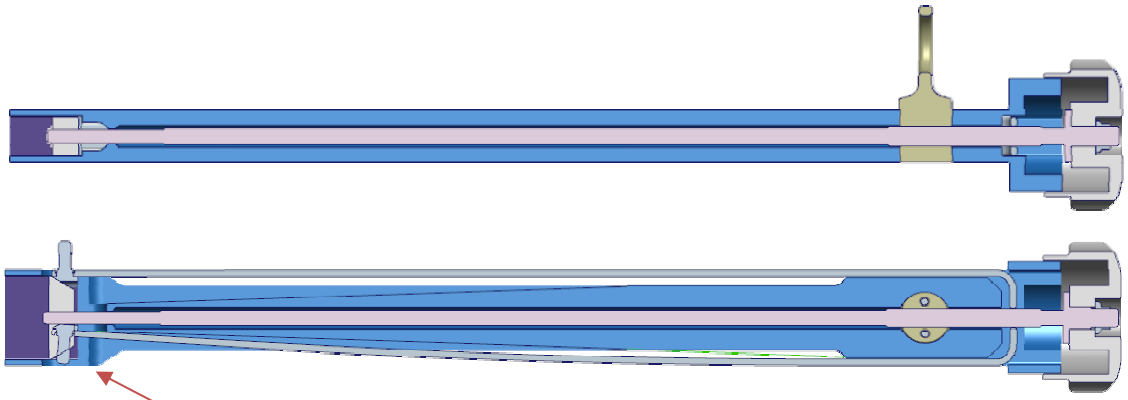

S3 handrail possibilities for Lg-Sm Adjustable Tether

## UCCAS DETENT TOOL

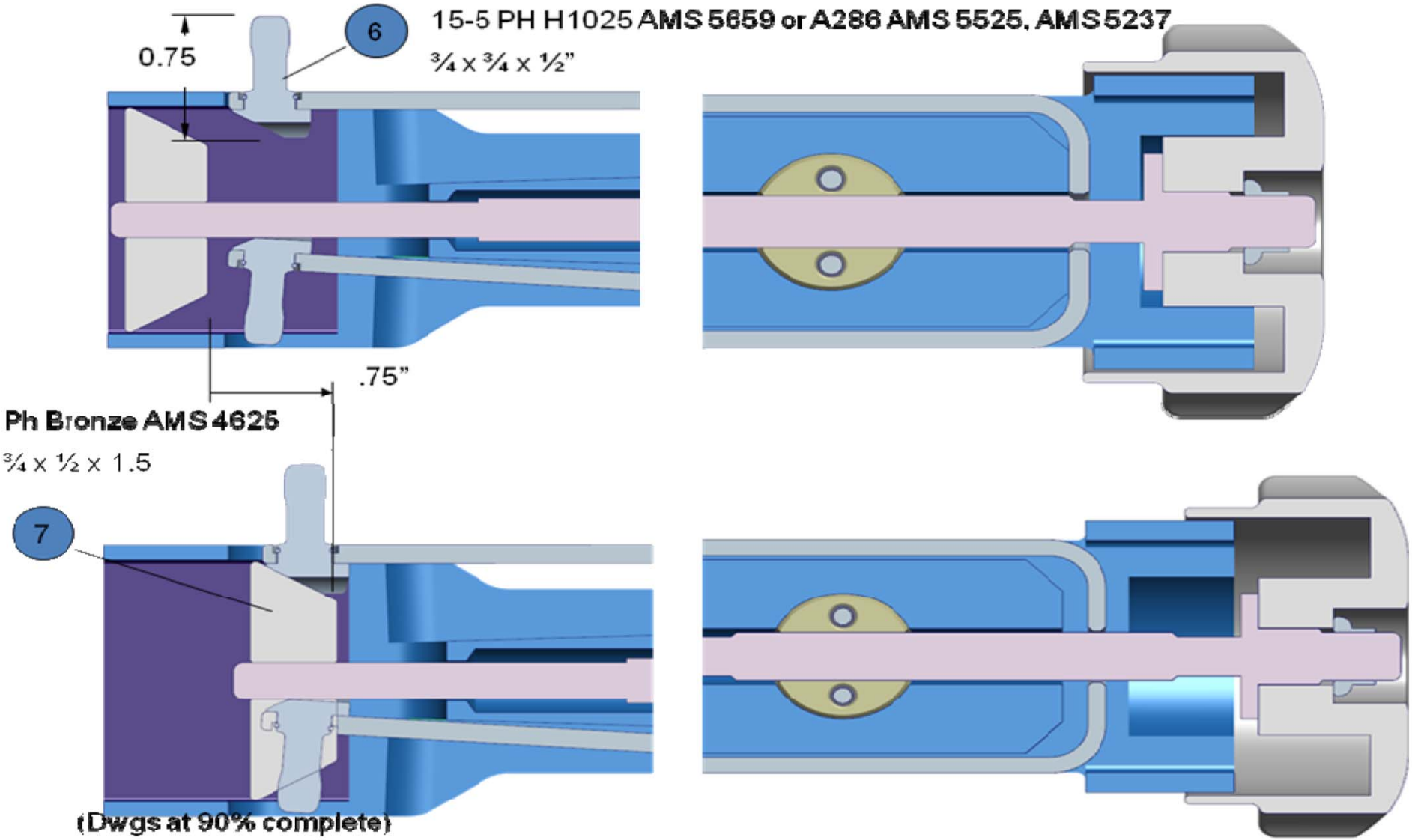
Detent Release Tool (DRT)



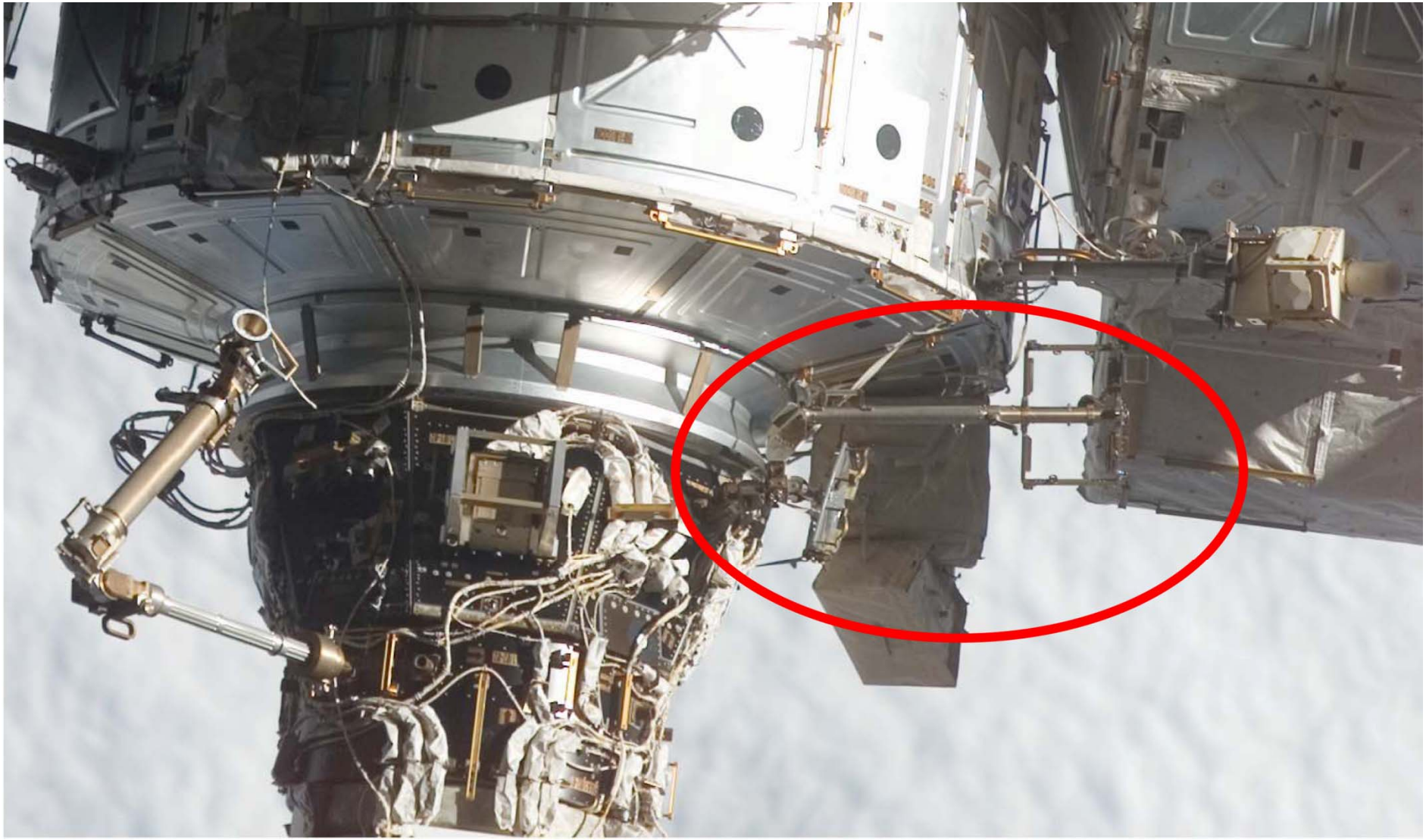





**UCCAS DETENT TOOL** (Cont)



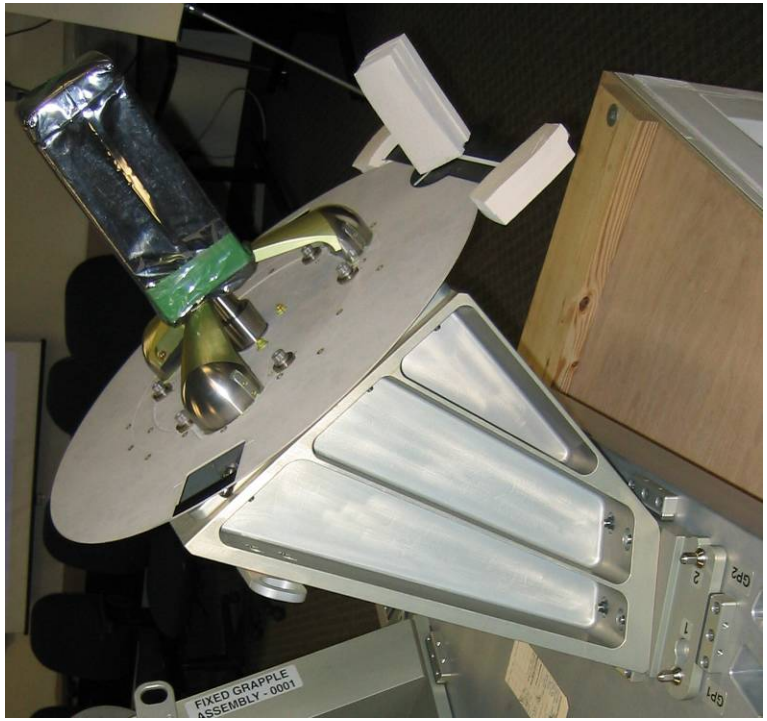
**PMA1 APFR 5/TOOL STANCHION**



**PMA1 – ZENITH**

**STARBOARD**

## MISC FIXED GRAPPLE BAR



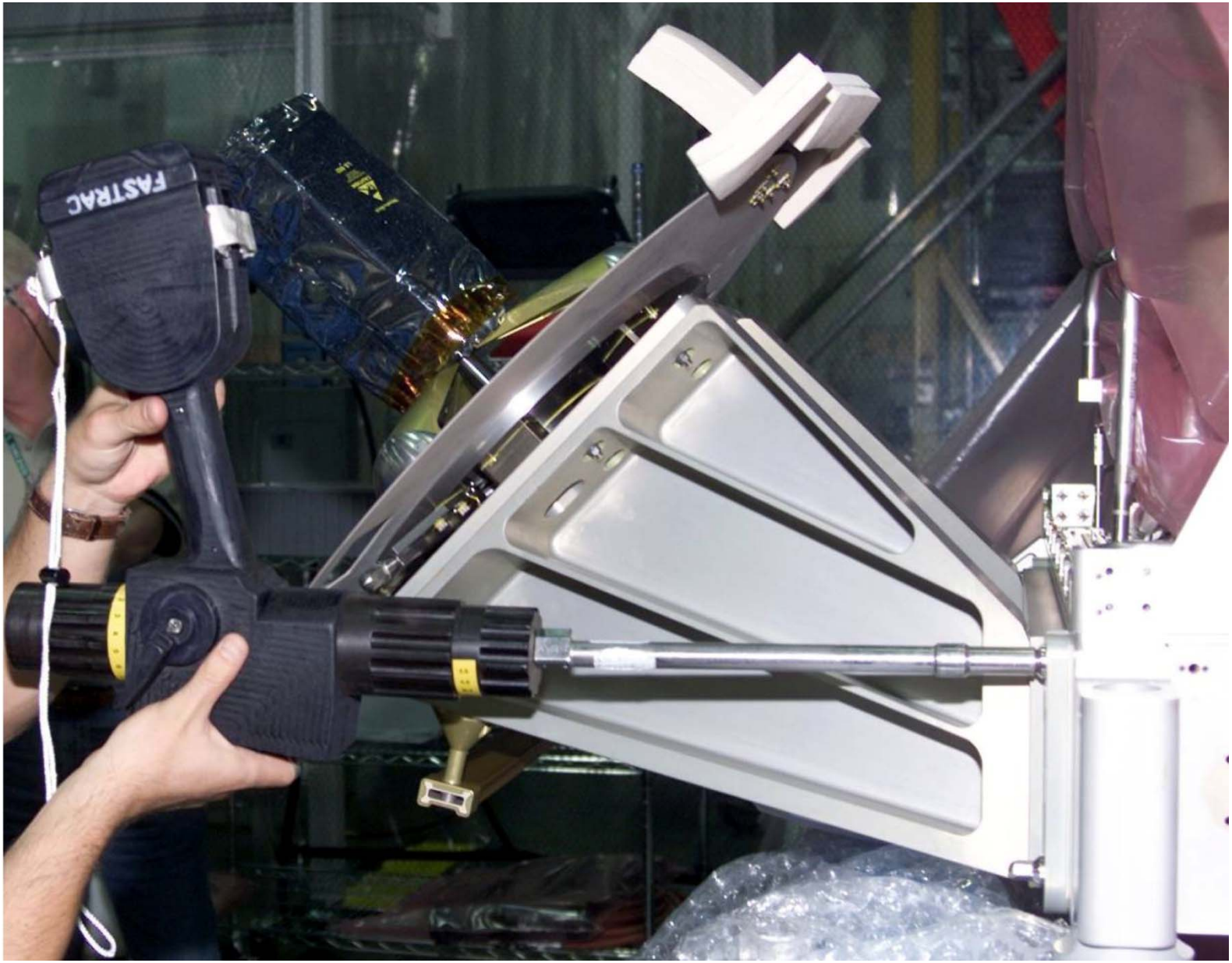
DETENT ON BOLT 3 ONLY

**MISC FIXED GRAPPLE BAR** (Cont)

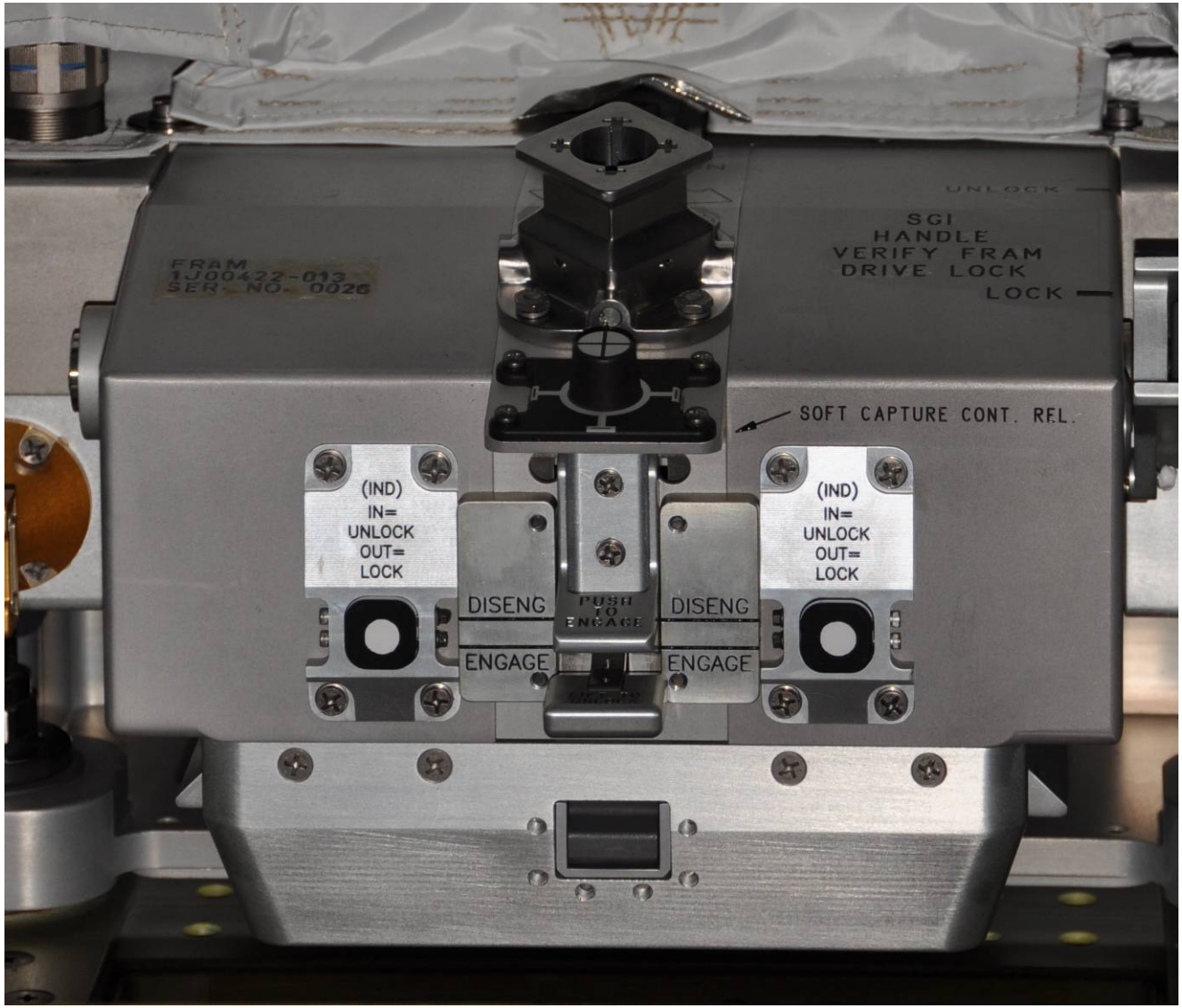
DETENT ON BOLT 3 ONLY

**MISC FIXED GRAPPLE BAR – ON P1 ATA**

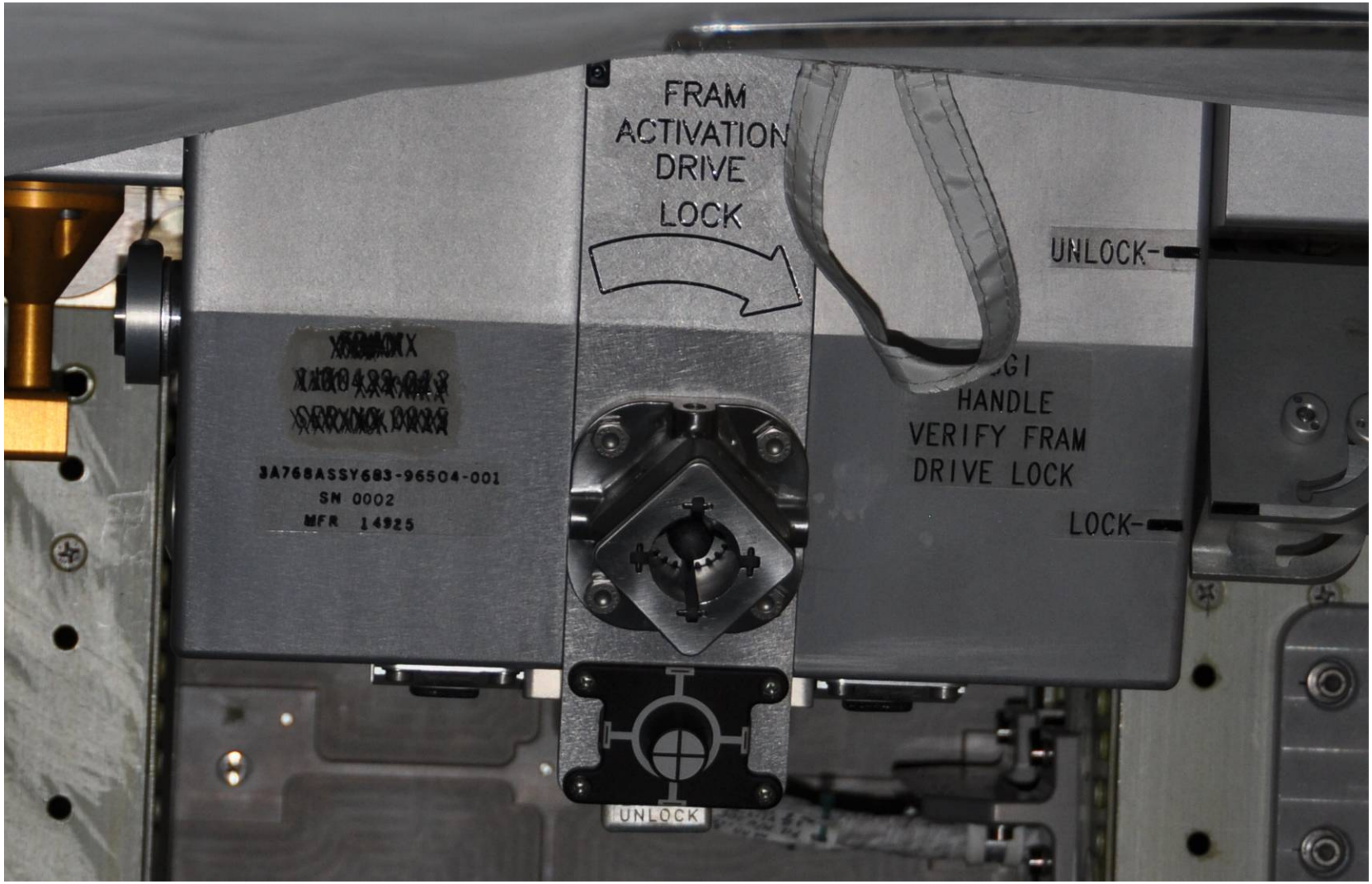
NOTE: 12" SOCKET PICTURED, BUT 6" PASSED FIT CHECK



**MISC FRAM**

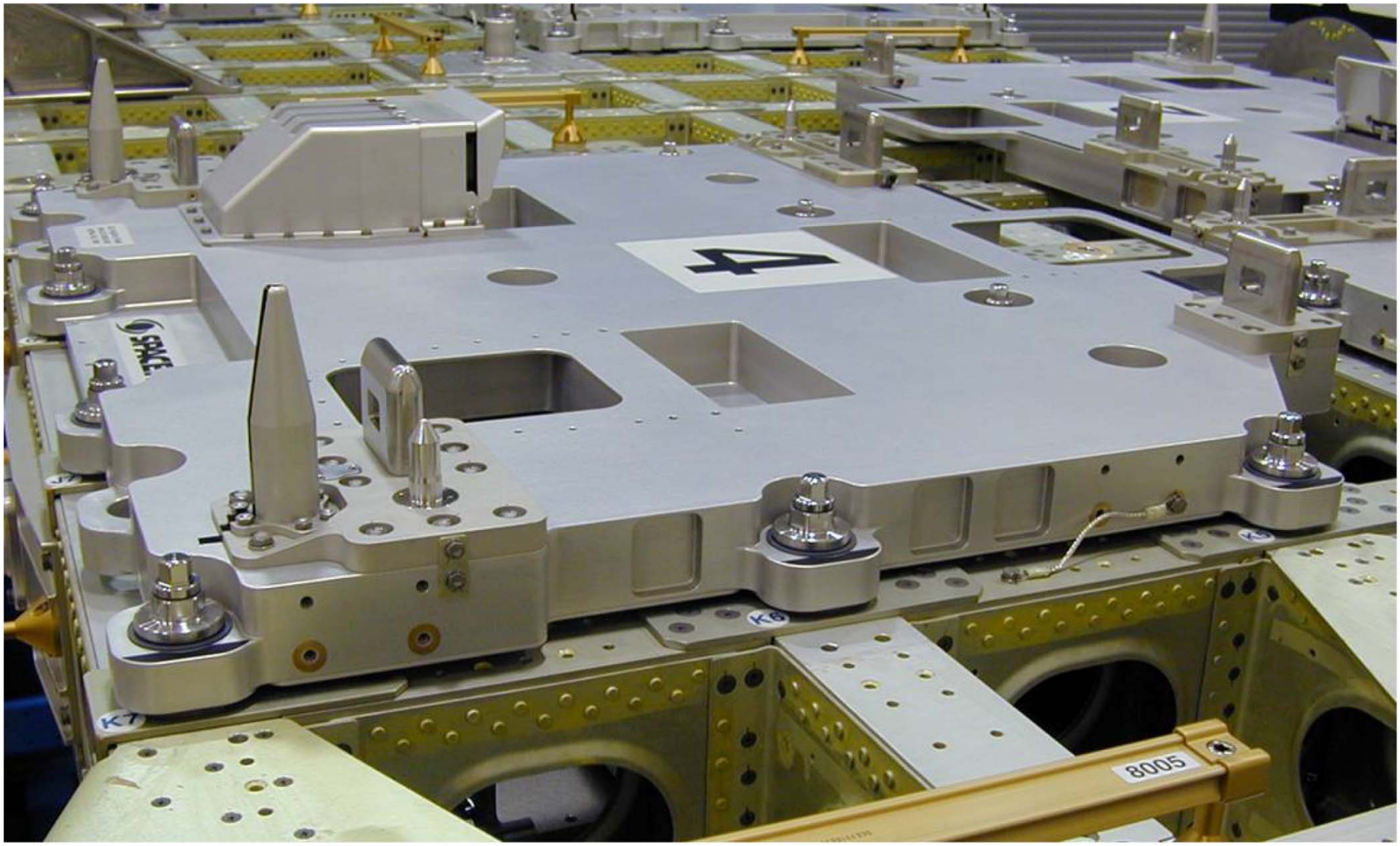

FRAM
1J00422-013
SER. NO. 0026
UNLOCK
SGI
HANDLE
VERIFY FRAM
DRIVE LOCK
LOCK
SOFT CAPTURE CONT. REL.
(IND)
IN=
UNLOCK
OUT=
LOCK
DISENG
PUSH
TO
ENGAGE
ENGAGE
(IND)
IN=
UNLOCK
OUT=
LOCK
DISENG
ENGAGE

**MISC FRAM** (Cont)

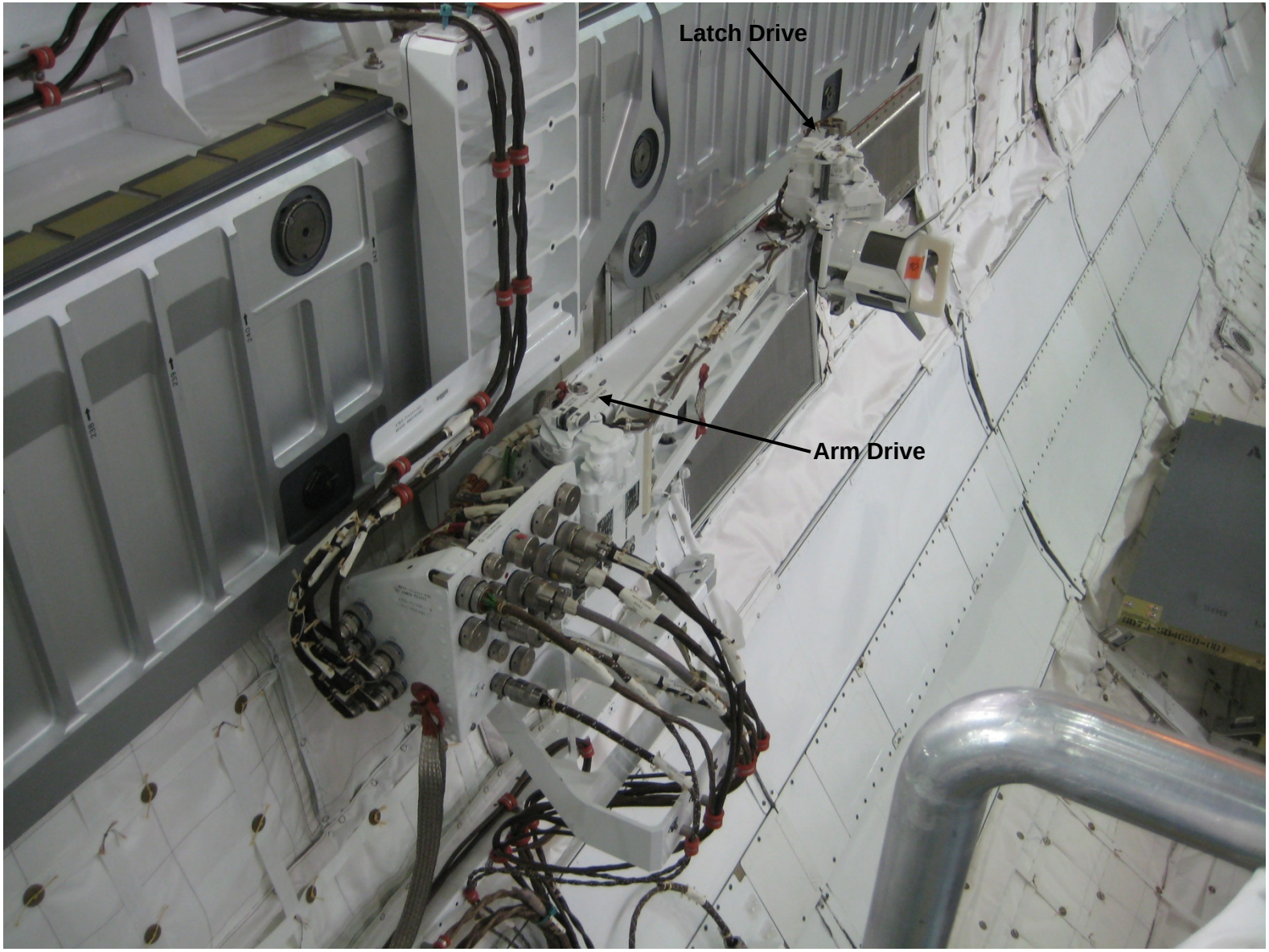


**MISC FRAM**

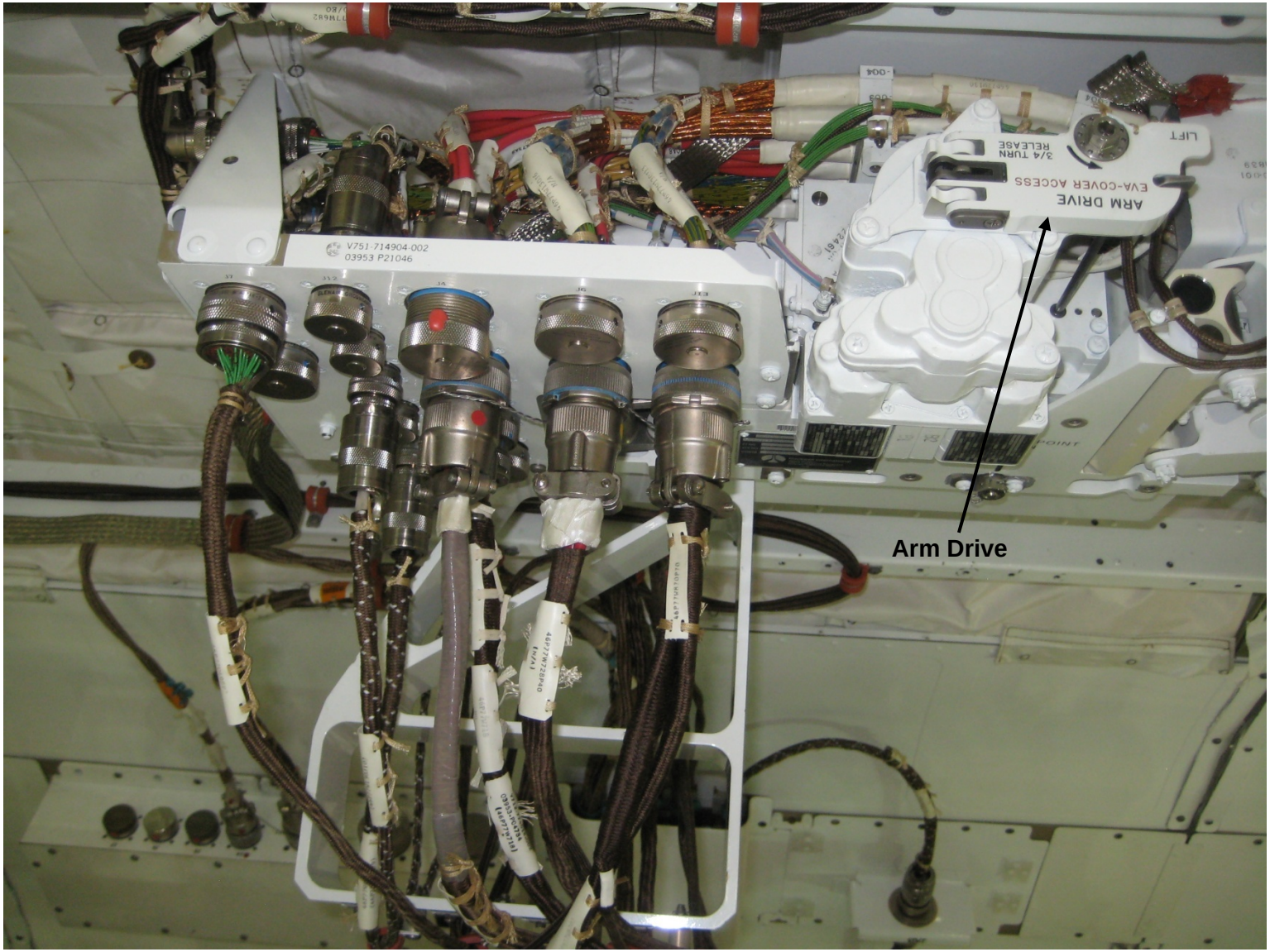
**MISC FRAM**



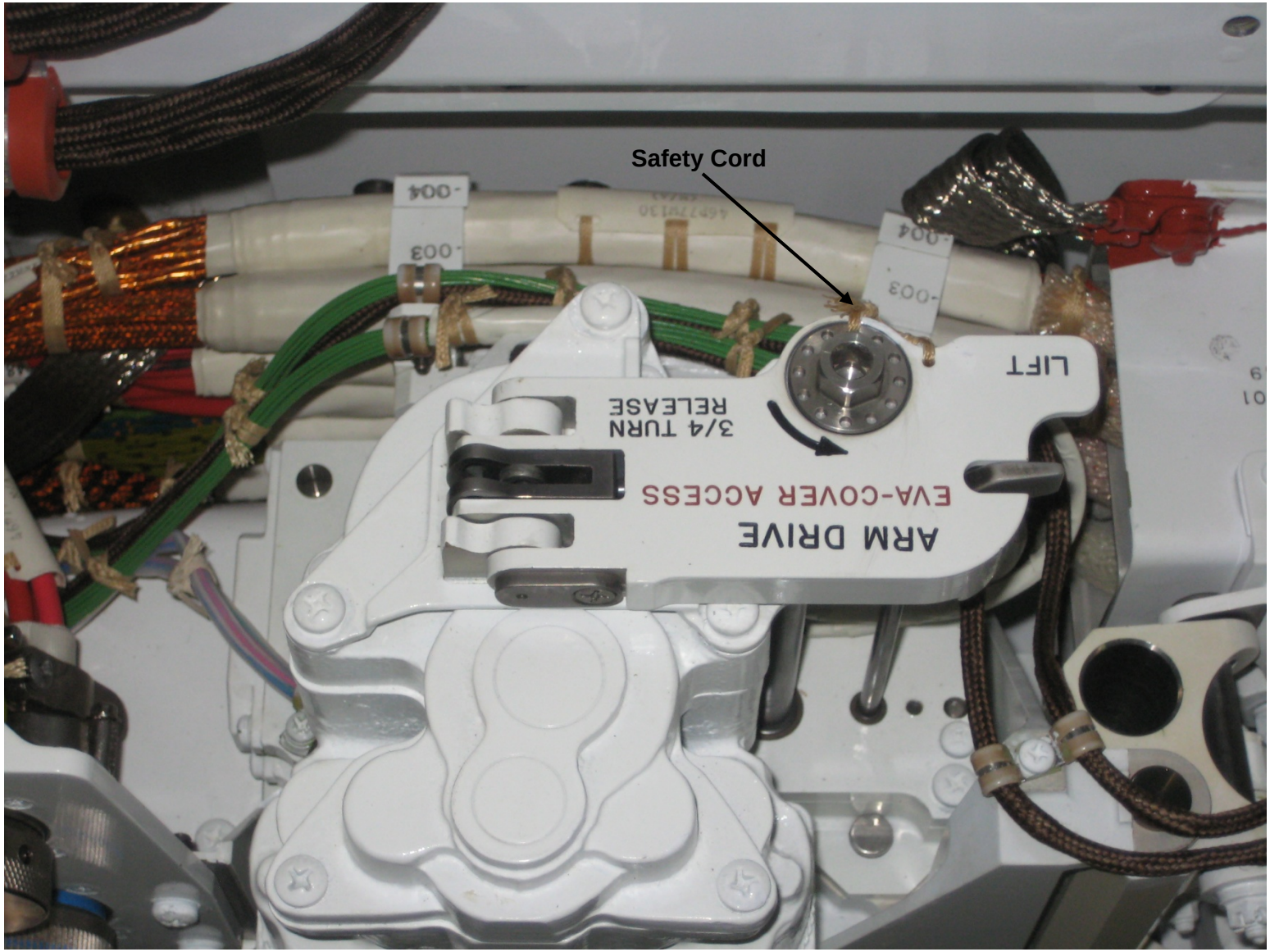
**ROEU**



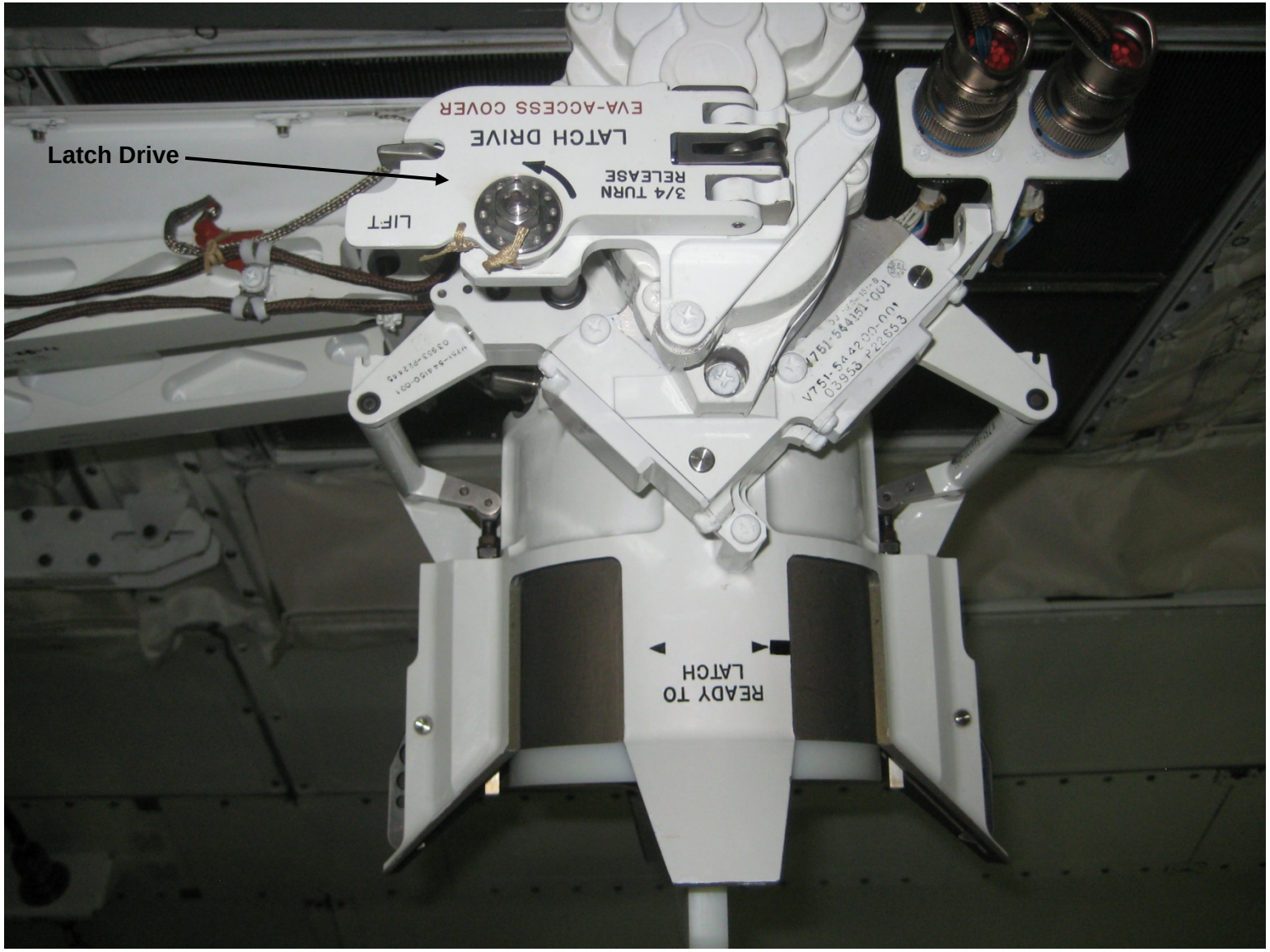
**ROEU** (Cont)


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

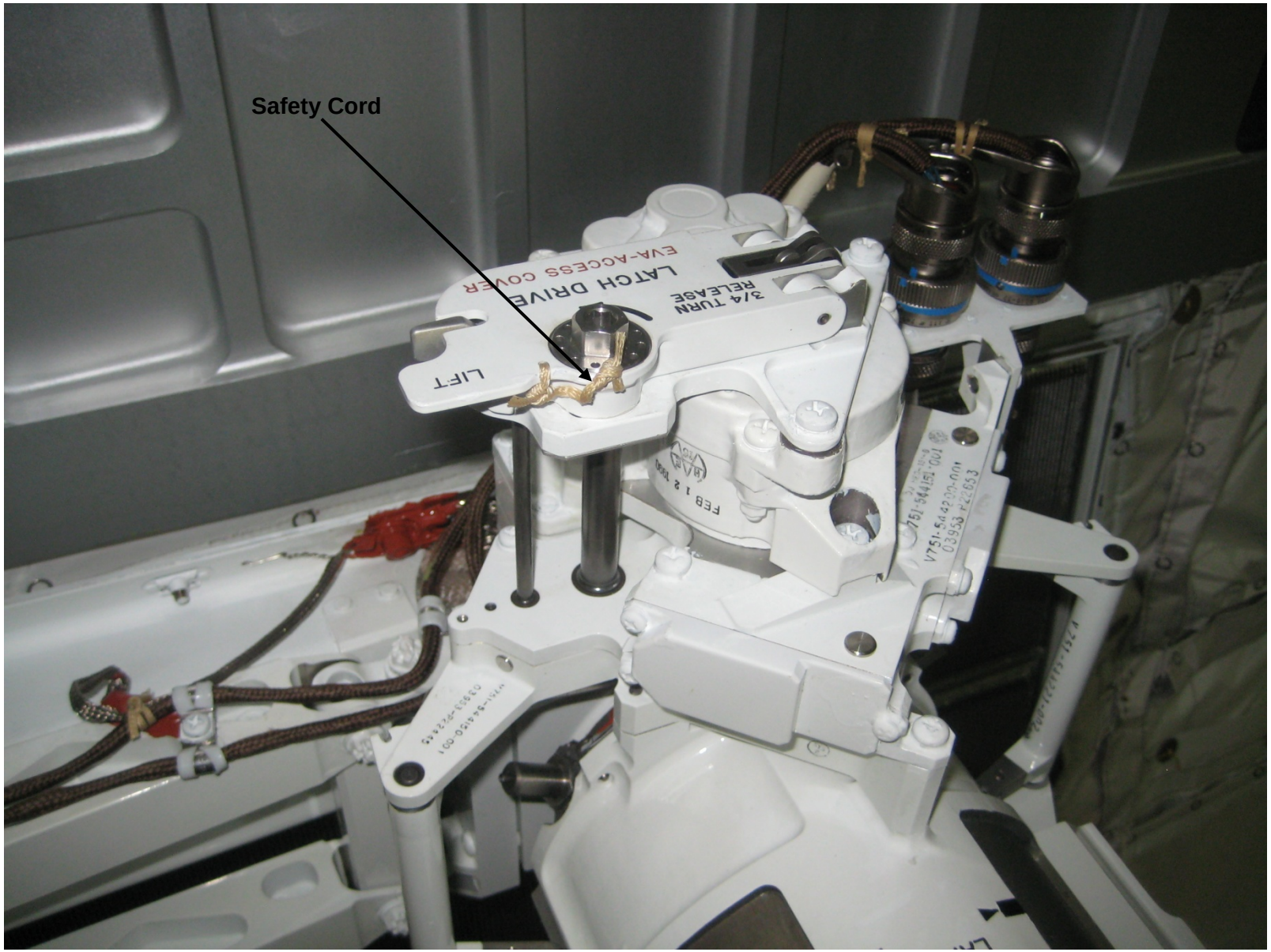
**ROEU** (Cont)


Safety Cord
LIFT
3/4 TURN
RELEASE
ARM DRIVE
EVA-COVER ACCESS
-003
-004

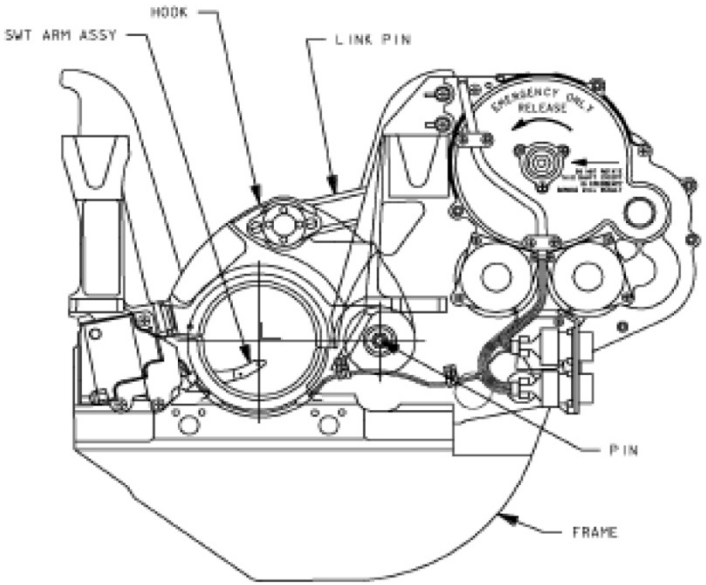
**ROEU** (Cont)


Latch Drive
LIFT
3/4 TURN
RELEASE
LATCH DRIVE
EVA-ACCESS COVER
READY TO
LATCH

**ROEU** (Cont)

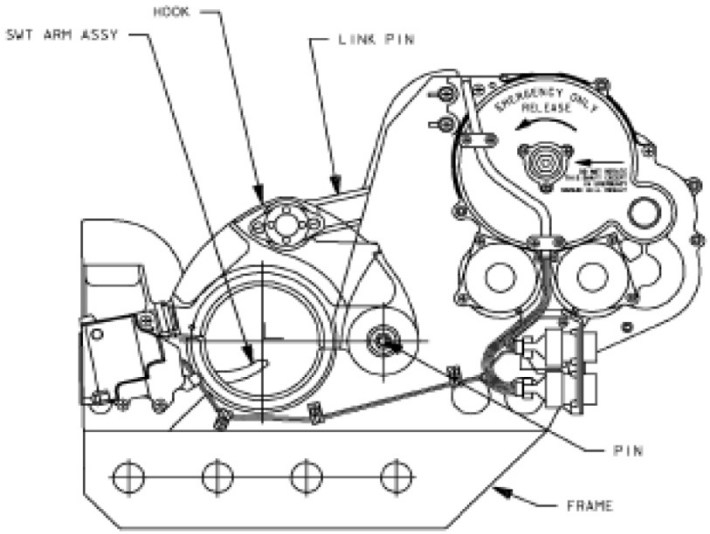

Safety Cord
LATCH DRIVE
EVA-ACCESS COVER
3/4 TURN
RELEASE
LIFT

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




LWLL/MWLL/SMWLL

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




173253111.ART.1

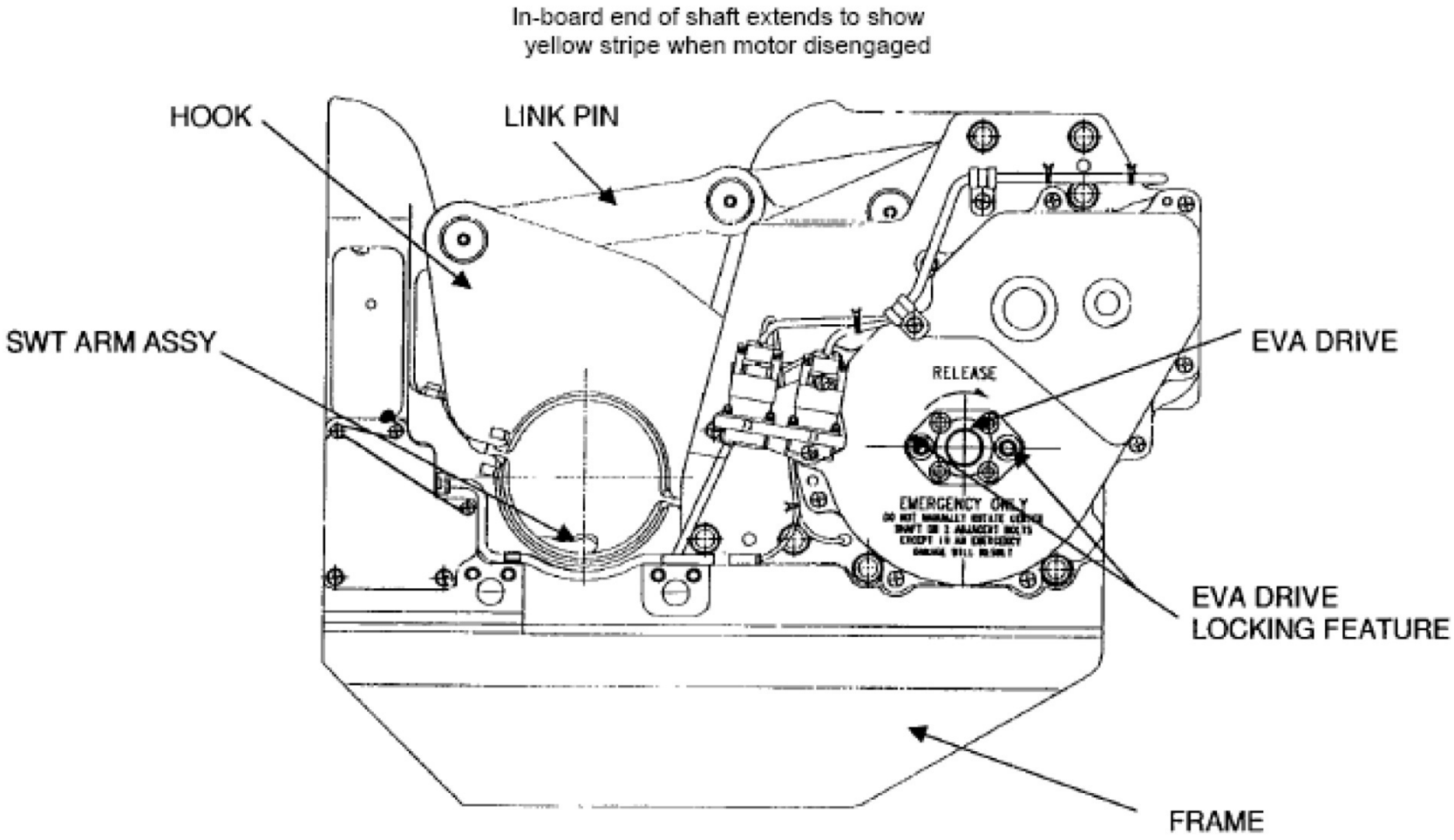
MMWL

MODIFIED MIDDLEWEIGHT LATCH

**EVA RELEASABLE PAYLOAD RETENTION LATCHES**

**PRLA** (Cont)

EVA Release Bolt
(NOTE: This style PRLA only on FWD trunnion pin of MPLM, stbd and port)
EMERGENCY ONLY
RELEASE



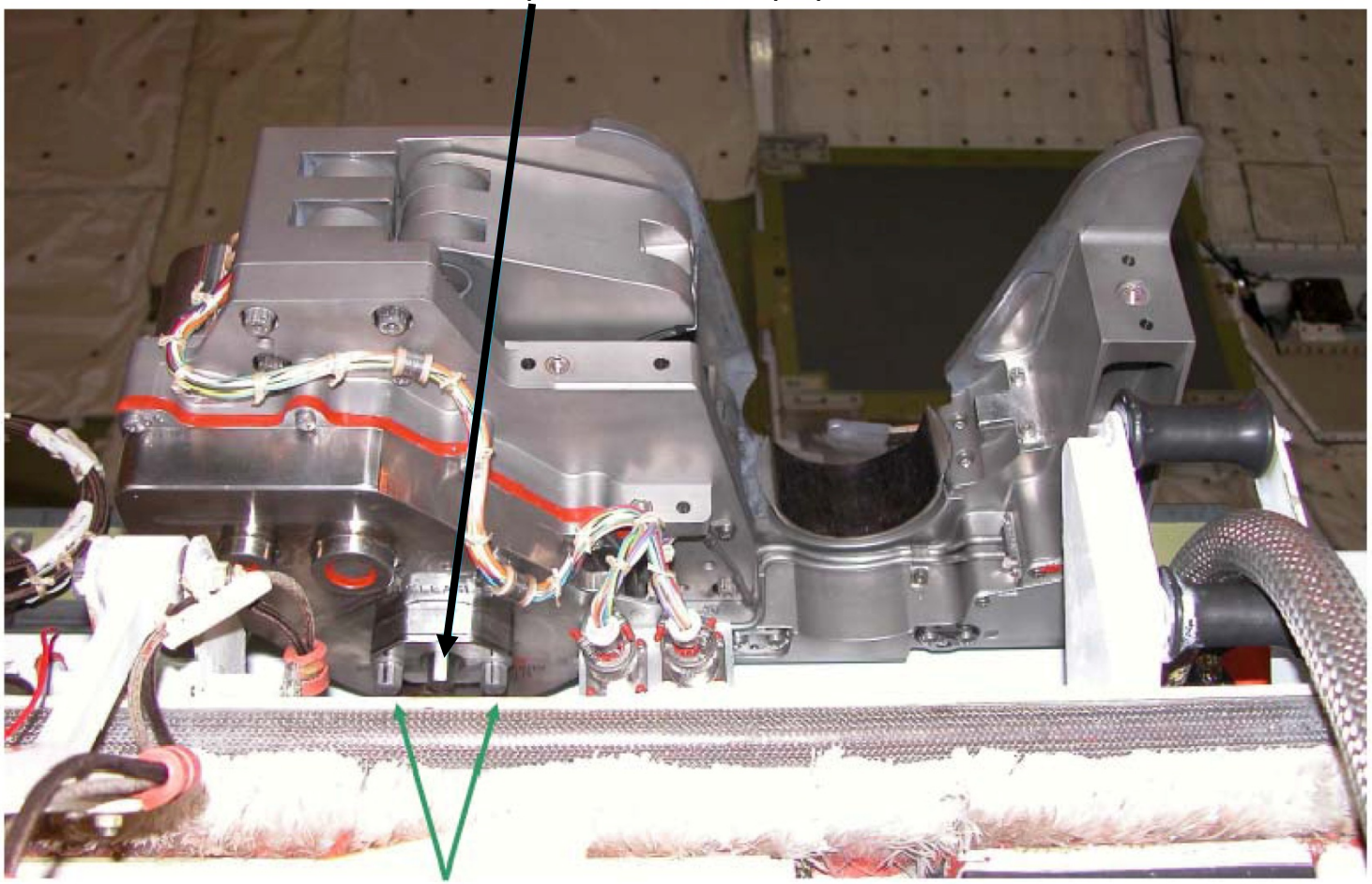

STANDARD WEIGHT LATCH

EVA RELEASABLE PAYLOAD RETENTION LATCHES (Cont)

**PRLA** (Cont)

**EVA Release Bolt**

**(NOTE: This style PRLA only on AFT trunnion pin of MPLM, stbd and port)**



Locking Bolts (2)

**Standard Weight PRLA**

**PRLA** (Cont)

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

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

Space Shuttle Program
FLIGHT DATA FILE

JSC-48024-128
FINAL

# EVA CHECKLIST

STS
# 128

Flight Cover (trim bottom to expose tabs)