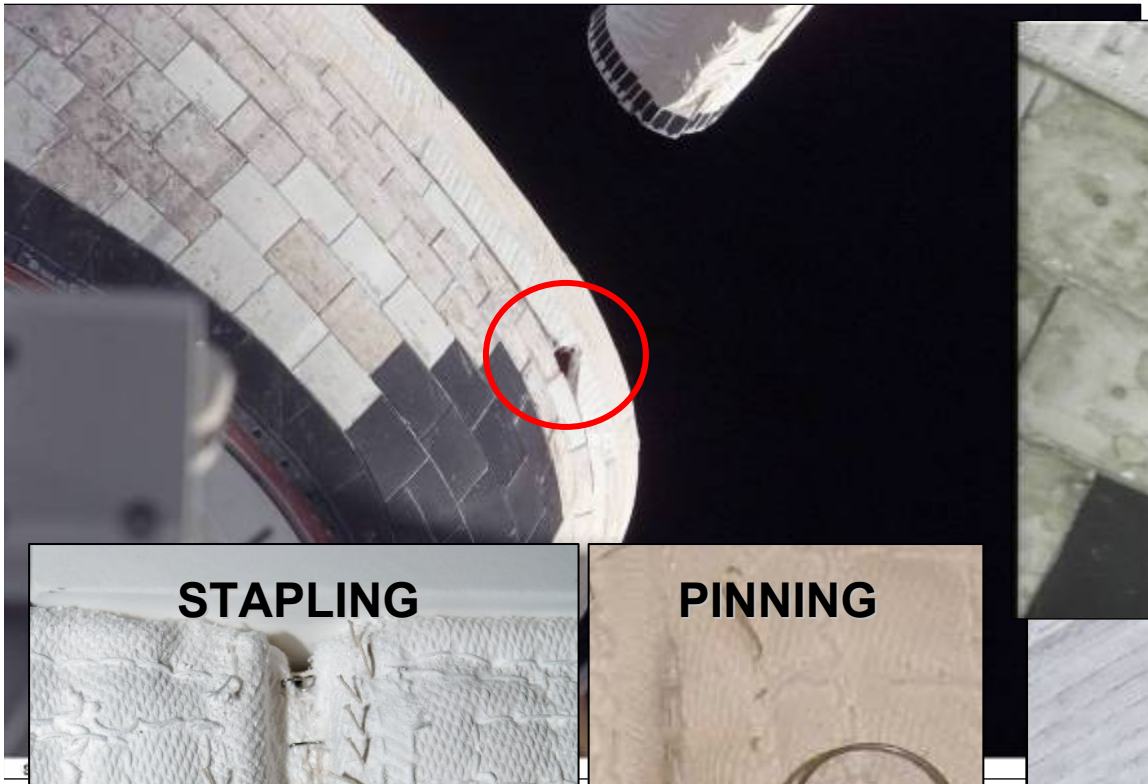
MSG 052 (15-0430) - CREW OVERVIEW PACKAGE – OMS POD BLANKET REPAIR



Primary Options

BIG PICTURE WORDS

All of us would like to extend a warm congratulations to both the STS-117 crew and ISS crew for the exemplary teamwork and leadership demonstrated thus far during the 13A mission. The challenges associated with such a complex mission demand nothing less than everyone's best efforts and performance. Here on the ground we're proud to be part of such a great team, and together are working out a plan to repair the damaged OMS Pod Blanket during EVA 3.

As you know, a corner of an AFRSI blanket has partially lifted from the IML on the left OMS Pod. In addition, the adjacent blanket to the left of the damaged blanket has partially lifted along the leading edge of the white tile. We have excellent photos on the ground that have helped us to fully understand the damaged areas, and as a result have built detailed mockups of the blankets and tile to aid us in designing a workable plan to fix it.

A highly trained team of DX, CB, DA8, XA, KSC, TPS, and engineering reps have worked through several iterations of repair techniques in B9, the NBL, VR Lab, and various thermal and aero testing environments. We've narrowed down the repair options from three leading candidates, to one, and the primary option has been ranked #1 in terms of EVA comfort-level, do-ability, thermal/aero testing, and ease of operations. Outlined below is a high-level description of the repair. Very detailed information regarding tools and techniques will follow on future slides, accompanied with photos depicting repair details and nomenclature.

The primary repair plan includes 4 basic parts (order depends on which blanket we are addressing):

1. Patting down the lifted leading edge on the adjacent blanket (use gloved hand or TPS scraper)
2. Patting down the damaged blanket (use gloved hand or TPS scraper)
3. Stapling damaged blanket to adjacent blanket using IV medical stapler
4. Pinning the adjacent blanket to white tiles using Tile Overlay NiC pins (to be called tile pins and retention pins)
5. Pinning the damaged blanket to white tiles using Tile Overlay NiC pins
6. Taking very specific photo closeouts and WVS scans of the repaired worksite

Consider the following details regarding the TPS material properties and constraints:

1. Avoid contact with tiles, they are fragile
2. Damaged blanket is thick AFRSI with a ceramic coating; ceramic coating is somewhat difficult to punch through using pin. An IV dental tool with modified tether point can be used to puncture through blanket and tile first, if required
3. Avoid pushing any pins through gap filler (frayed cylindrical gap filler ok to penetrate if necessary)
4. Be aware of MWS and tool proximity to tile

BIG PICTURE WORDS - CONT

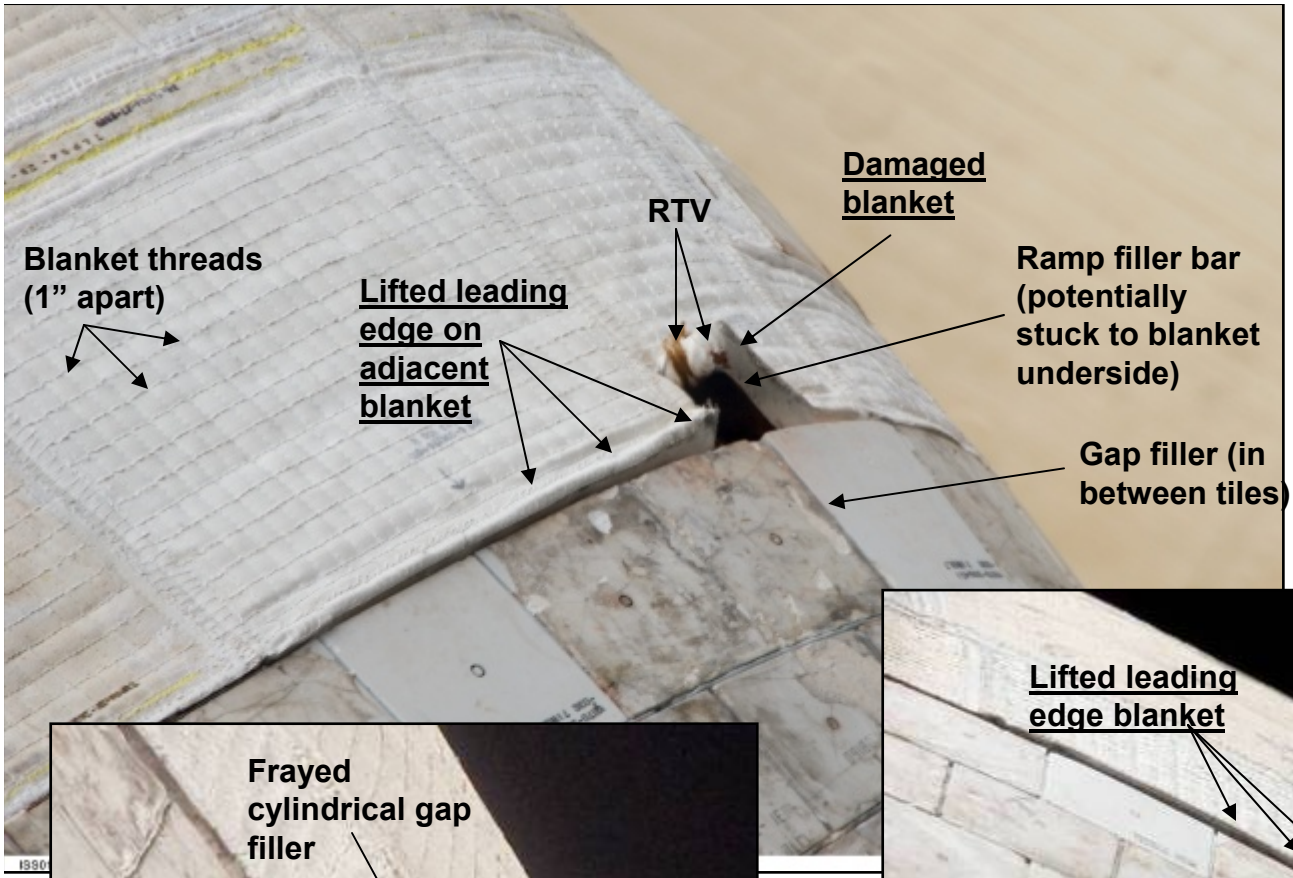
- A series of IFM procedures will be uplinked outlining required work to prepare various IFM/Medical tools to be used during the EVA. In addition, this package will include high-level recommendations for MWS tool config. There will be IV time dedicated to building and practicing with these tools
- The PDRS folks designed a workable position at the damaged worksite. We modeled the position in the VR lab using Charlotte, and had CB reps perform repair techniques. A fully extended WIF extender is required to reach the worksite, and we have deleted the ingress aid option because it gets too close to tile. There isn't much room for GCA forward/aft of the worksite; however, there is ~ 5 feet of margin left and right of the damaged blanket. The following conclusions were reached at the VR eval:

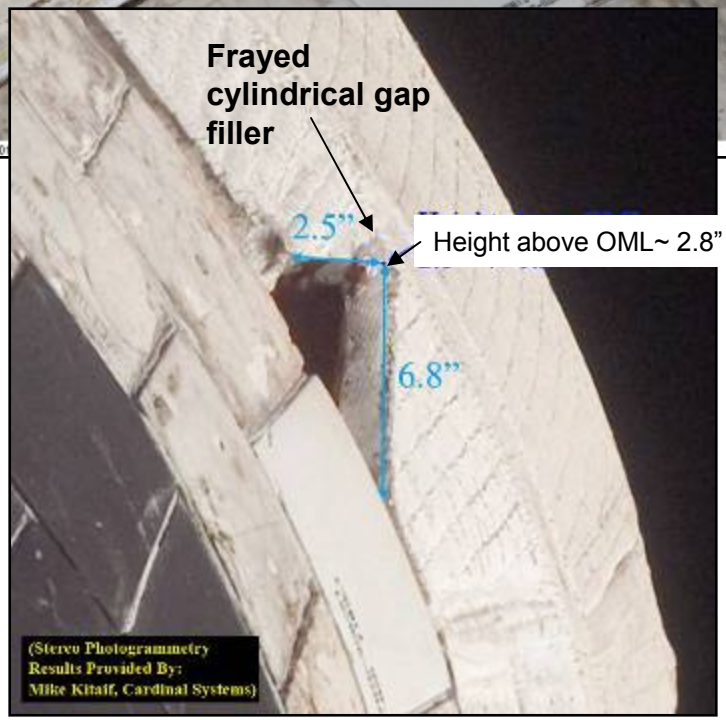
1. The stapling technique induced very low loads into the arm. It required a very high force to slip a joint (with purposely induced high loads)
2. In general, perform actions using short and quick impulses, avoid imparting high loads over a long period.
3. Visibility using the stapler is acceptable
4. Crewmember may have to pitch body down to optimize access to damaged blanket
5. Pin insertion into the blanket involves breaking through a pretty tough coating; crew noted that inserting pin at 45 degrees to surface of blanket was easier than installing pin orthogonal to surface. Insertion at less than 45 degrees tends to slide off of coating without puncturing
6. Worksite access and visibility is acceptable

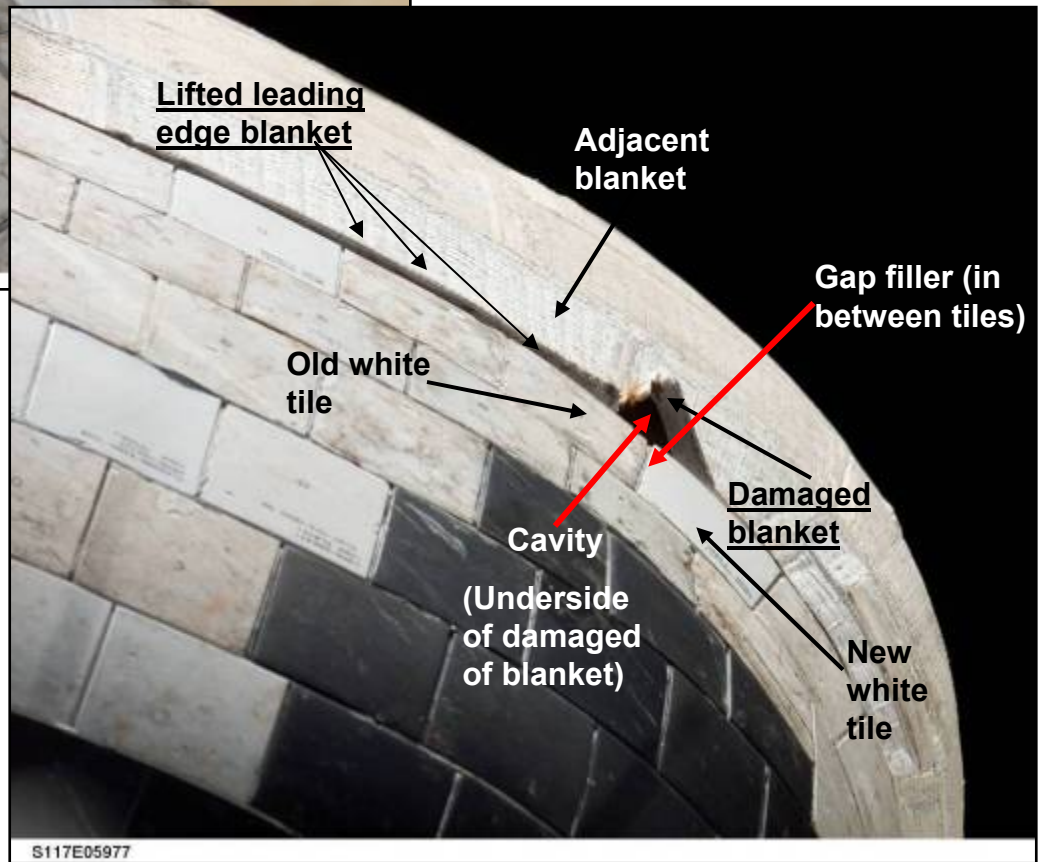
- Recommend discussing EVA comm and RMS protocol for EVA 3 repair plan. Consider plan if emergency ingress is required
- The rest of the overview pitch will include information regarding Damaged Cavity Details, Worksite Overview, Repair Details, and Tool Config Recommendations

UNDERSTANDING THE PROBLEM

LEFT OMS POD
BLANKET DAMAGE
NOMENCLATURE

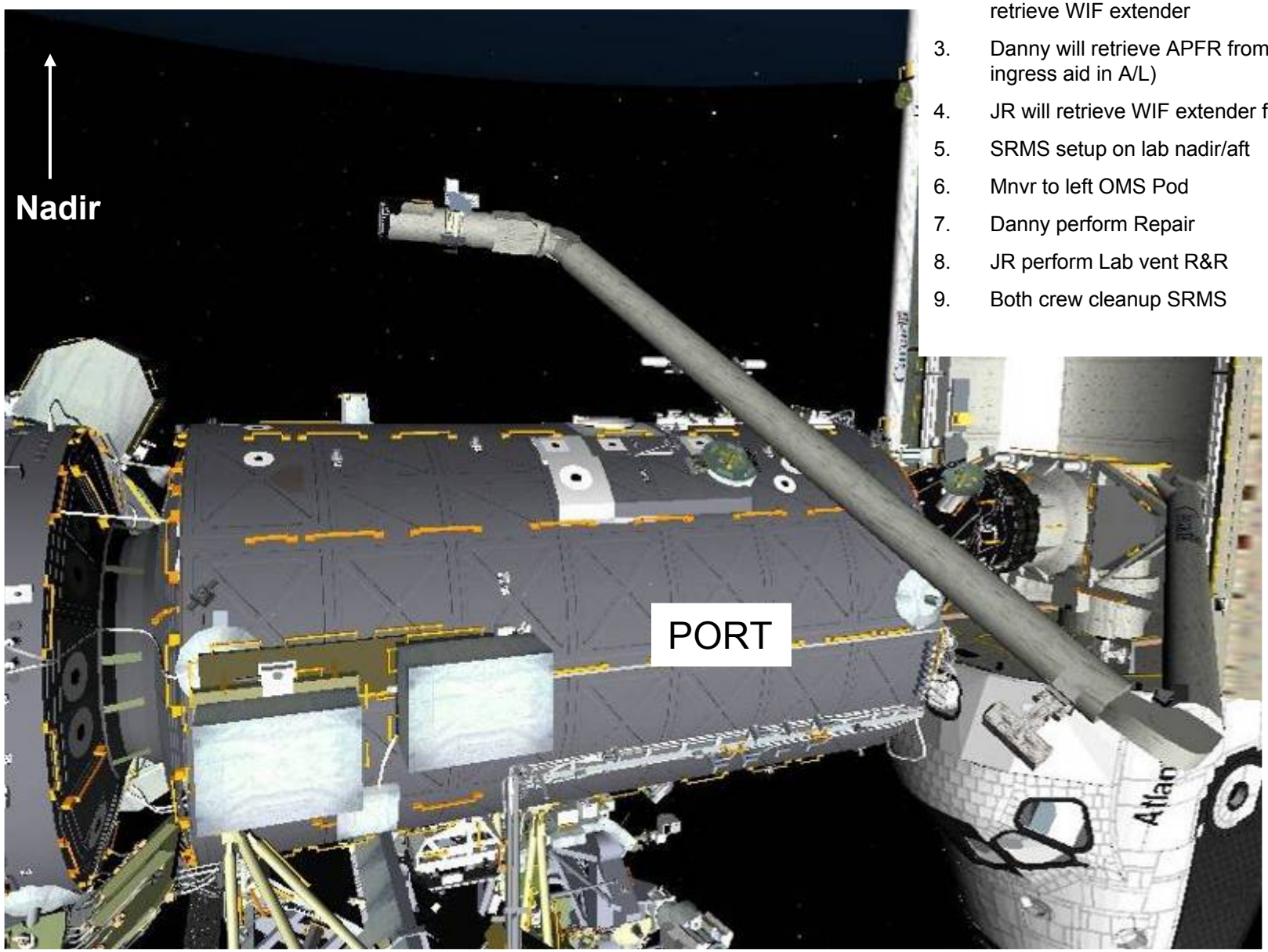






WORKSITE OVERVIEW

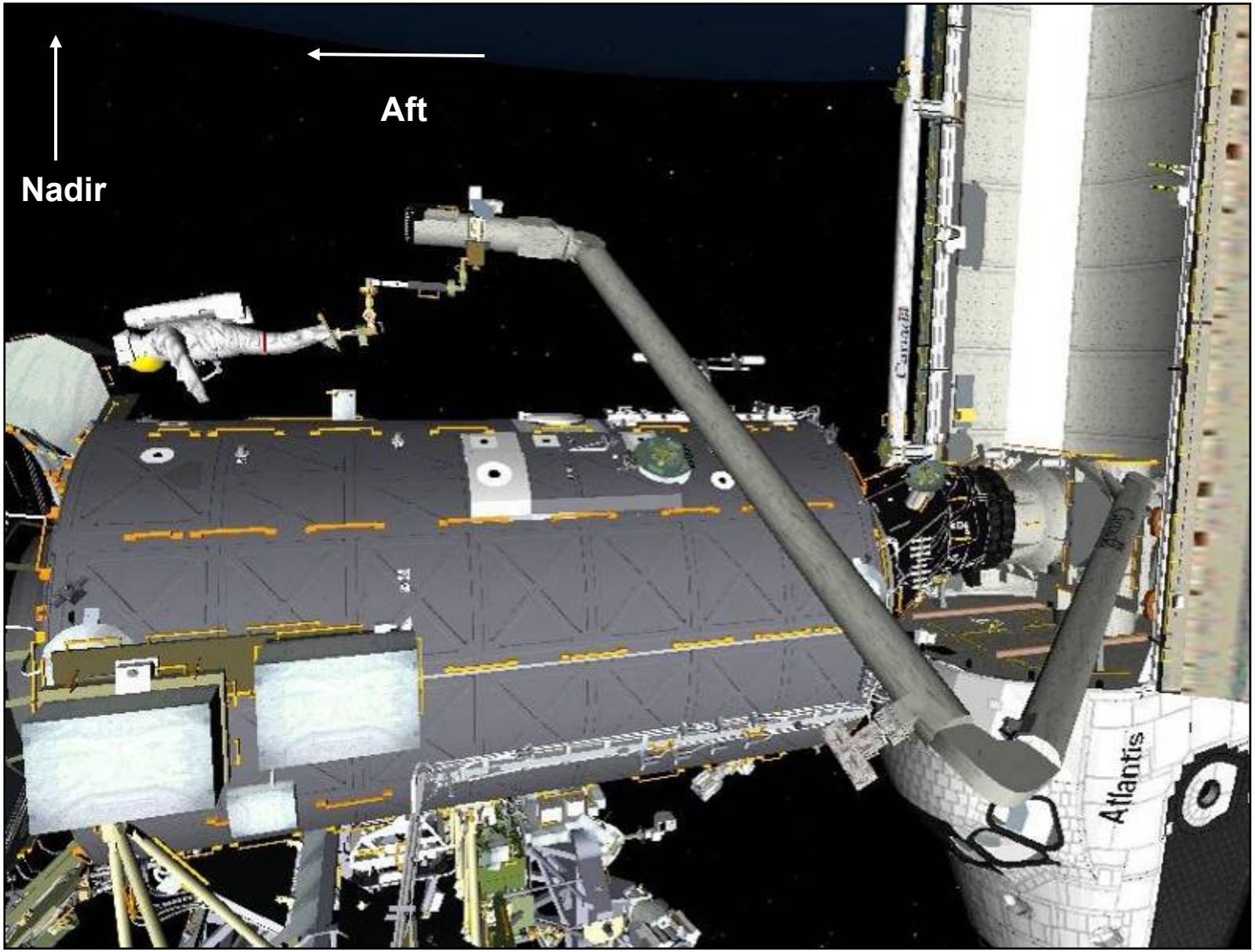
SRMS PRE-INSTALL POSITION



BIG PICTURE SETUP PLAN

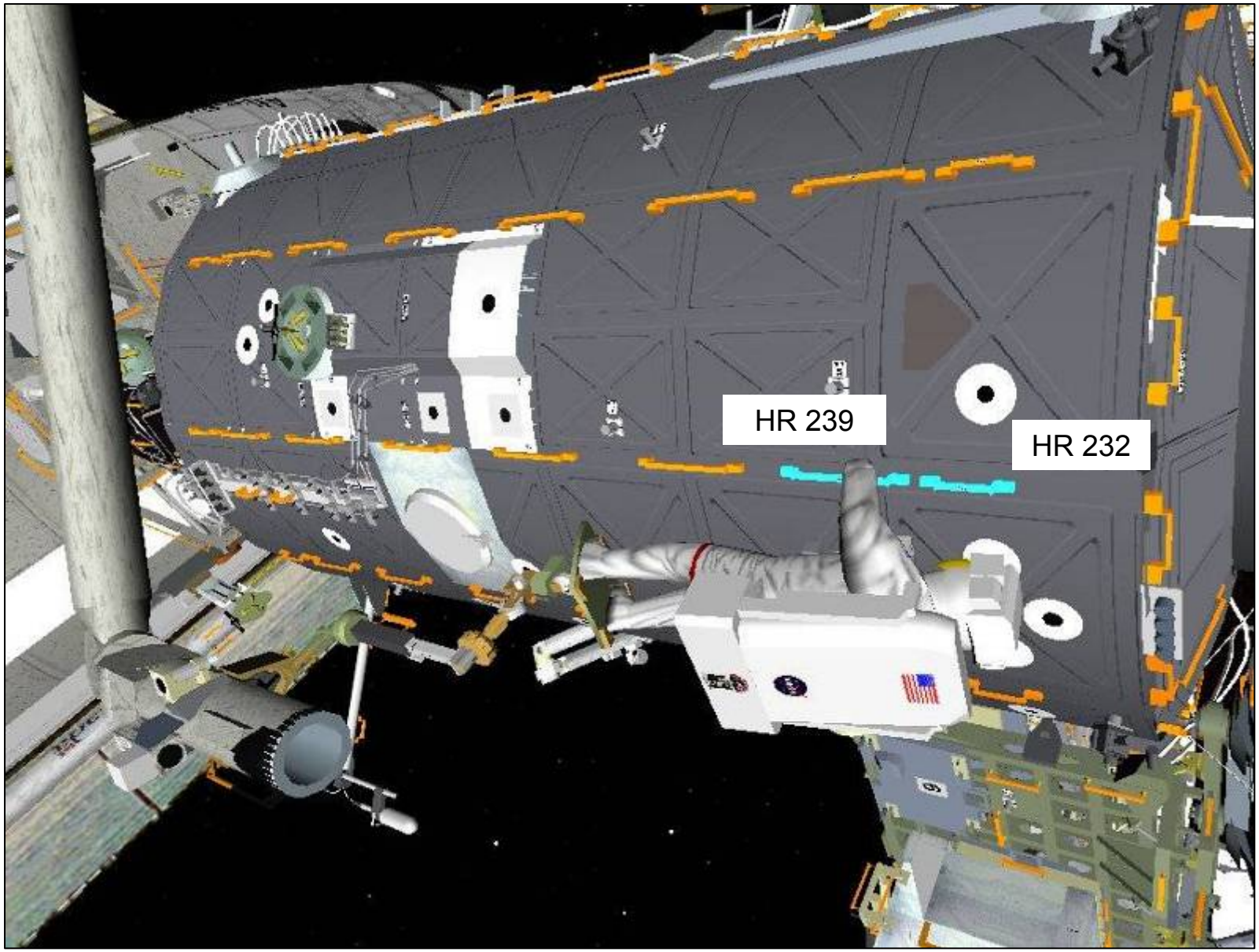
1. Danny will egress with all tools in crewlock bag and will retrieve APFR
2. JR will egress with PAD and WIF adapter and will retrieve WIF extender
3. Danny will retrieve APFR from S0-07 (temp stow ingress aid in A/L)
4. JR will retrieve WIF extender from ESP2
5. SRMS setup on lab nadir/aft
6. Mnvr to left OMS Pod
7. Danny perform Repair
8. JR perform Lab vent R&R
9. Both crew cleanup SRMS

SRMS INGRESS POSITION

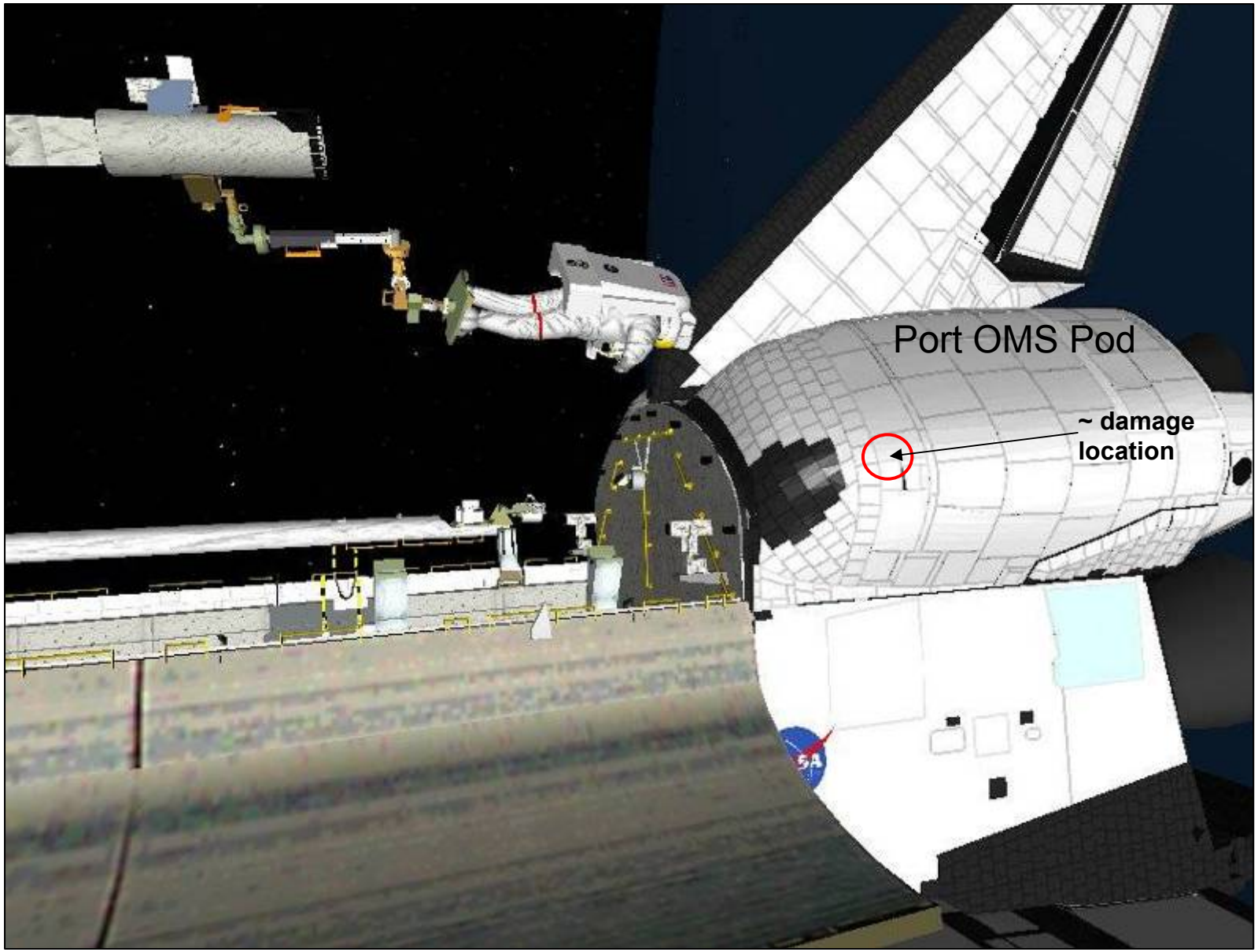


SRMS INGRESS POSITION – CLOSE-UP

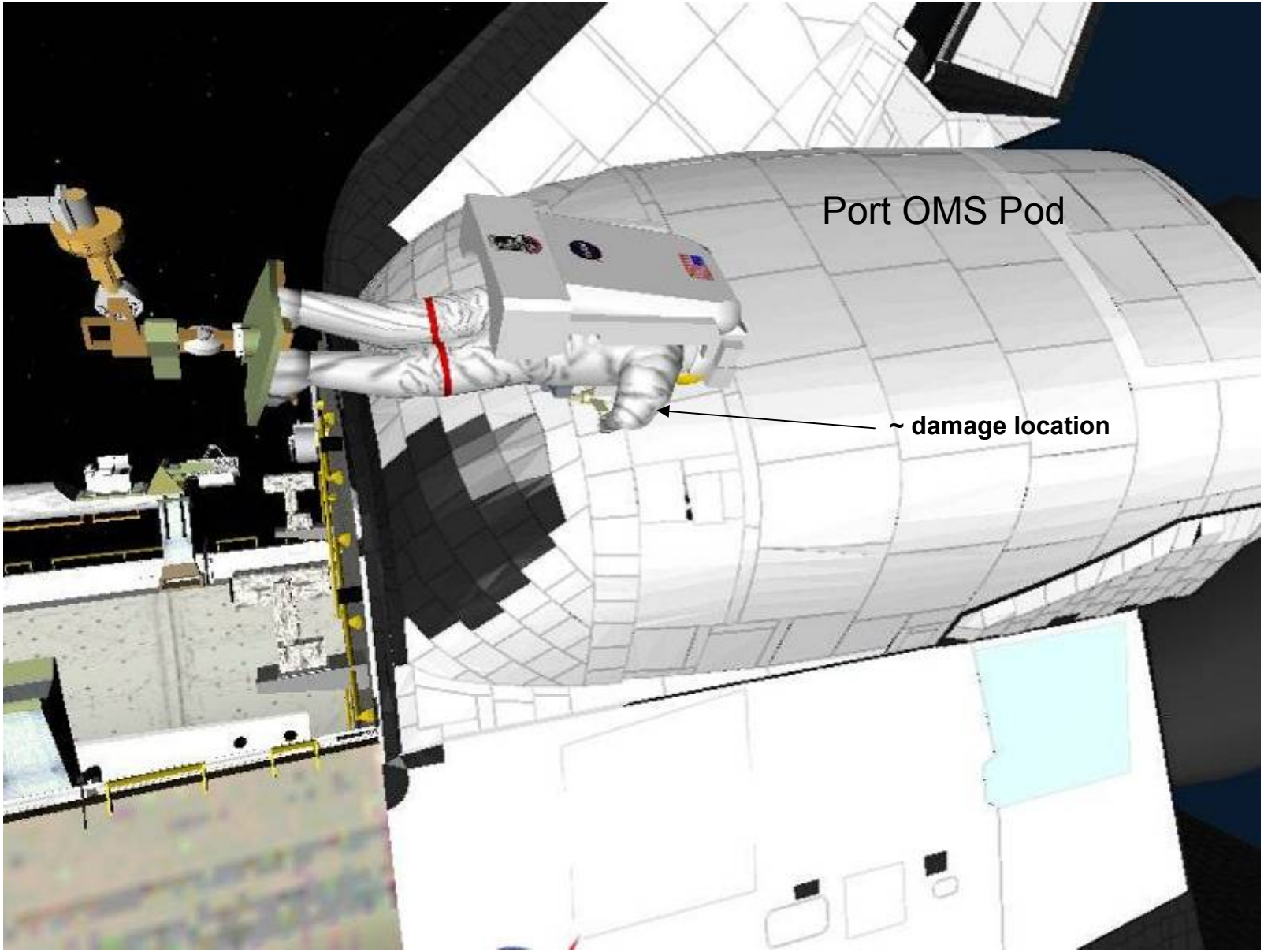
Can Use Lab handrails 239 and 232 for ingress



BLANKET REPAIR HOVER POSITION



BLANKET REPAIR POSITION



REPAIR DETAILS

1. Patting down adjacent blanket and damaged blanket
2. Stapling blankets
3. Pinning blankets

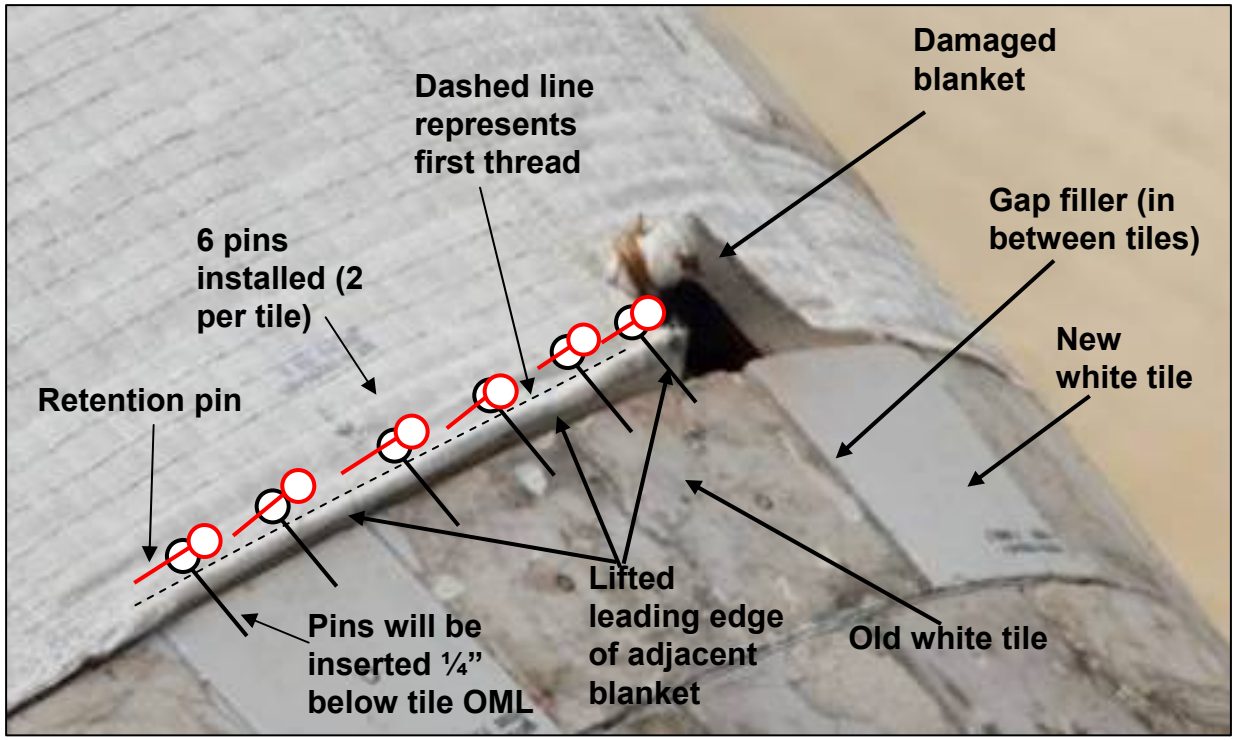
PART I: ADJACENT BLANKET PAT DOWN & PINNING

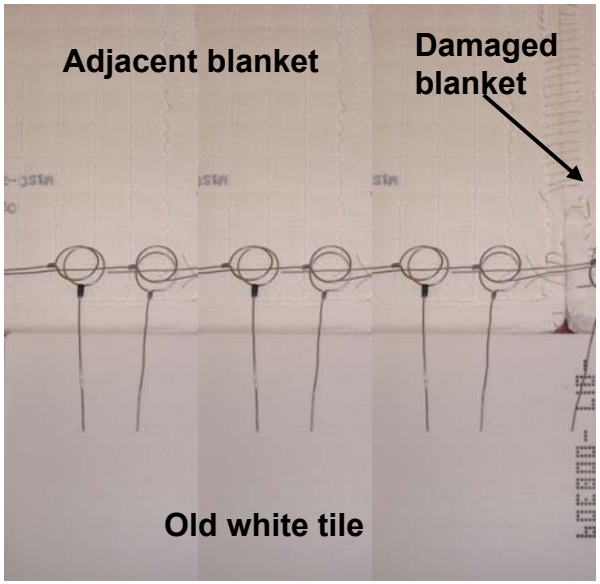
Prime Technique

1. Use gloved hand to pat lifted leading edge on adjacent blanket down flush or sub-flush to tile OML (TPS scraper can also be used)
2. Memory in blankets should hold them in place after initial pat-down
3. After patting down damaged blanket and stapling, retrieve tile pins from pin caddy as required (do not need to tether to pins):
   - A. Install 6 tile pins (black in picture) from leading edge blanket into white tile (2 pins per tile)
   - B. Pin should enter tile roughly ¼" below tile OML
   - C. Insert pin into blanket aft of first row of threads; push pin through blanket and tile until just pin loop is visible
   - D. Install retention pins (red in picture) through 6 original pin loops (through loop hole from right to left to tack down original pins
   - E. Slightly bend pin loops down so that they lay as flat as possible

Operational Recommendations

1. Don't worry about cracking coating on blankets
2. Be aware of MWS clearances to tile
3. Avoid bending pins prior to inserting into blanket; bent pins are difficult to precisely route and find side of tile
4. If it's too difficult to puncture blanket coating or tile with pin, attempt to hold pin lower on shaft or can use dental tool to get hole started. Can use one finger lower on pin shaft to prevent buckling
5. Once pin is almost fully inserted into tile, a slight bend at base of loop toward blanket will help maintain flush-ness and OML
6. When inserting pin into tile, it should feel smooth (only verification since we can't see it)





BLANKET PAT DOWN PHOTOS

Pat down lifted blanket with hand

Pat down lifted blanket with hand

Pat down lifted blanket with scraper

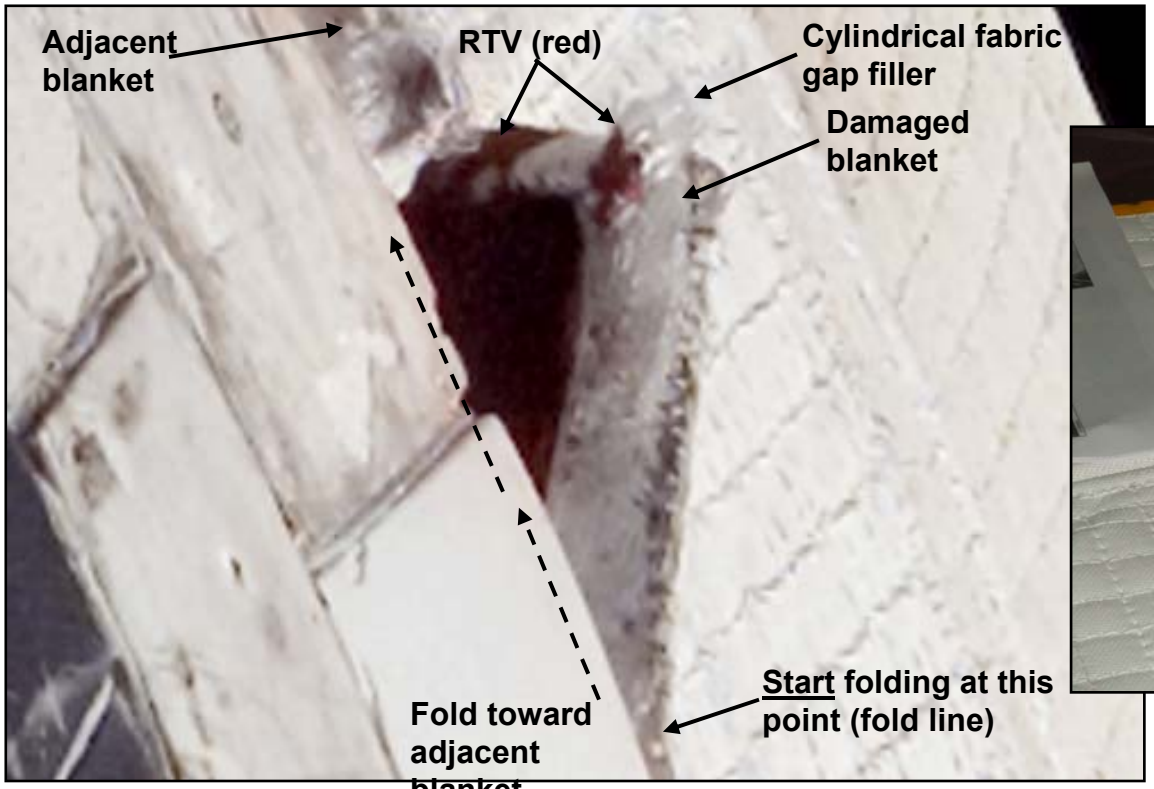
PART 2: DAMAGED BLANKET PAT DOWN

Prime Technique

1. Use gloved hand to pat damaged blanket down flush or sub-flush to tile OML (TPS scraper can also be used)
2. Starting from fold line and working toward the lifted/damaged corner, flatten blanket flush or sub-flush to tile OML along tile edge using gloved hand
3. Memory in blankets should hold them in place after initial pat-down
4. Massage blanket into place to close gap

Operational Recommendations

1. Don't worry about cracking coating on blankets
2. Be aware of MWS clearances to tile



PART 3: DAMAGED BLANKET STAPLING

Prime Technique

1. Use tip of RET hook to open gap between blankets in order to create space for lower row of staples (can also use fingers or TPS scraper)

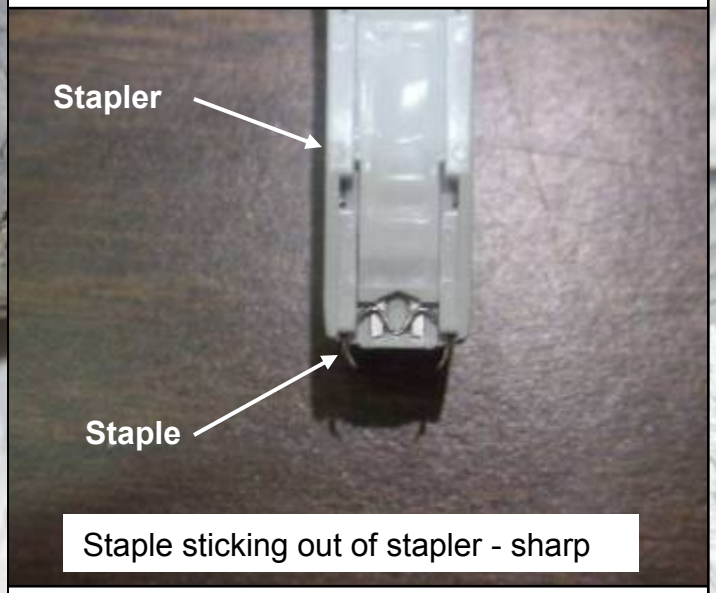
   Note: Two rows of staples are needed – one lower and one upper

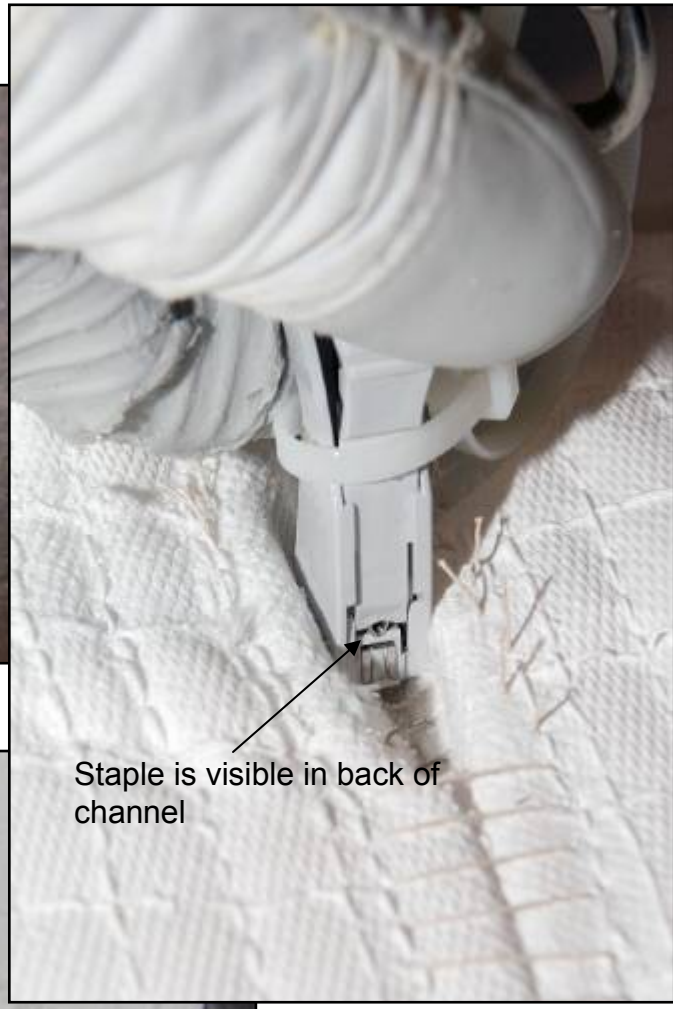
2. Use stapler to attach damaged AFRSI blanket to adjacent blanket.
   - Attempt a lower row of staples near IML, massage blankets to close the gap, and then add an upper row of staples at the OML
   - Start stapling away from tile, and then work toward tile
   - Utilize ~ 3 staples per inch (2 staples in between threads, and 1 staple in line with each thread)
   - --- stitching rows on blankets are ~ 1 inch apart thread to thread
   - There should be a minimum of 8 lower staples and 10 upper staples
   - **WARNING**: If a staple becomes stuck in the glove, do NOT attempt to remove the staple; the idea is that it will seal the bladder
   - **OPS CONSTRANT:** Keep staples at least 1 inch away from fingers
   - **OPS CONSTRANT:** If a staple is not fully stuck in a blanket, do not attempt to remove

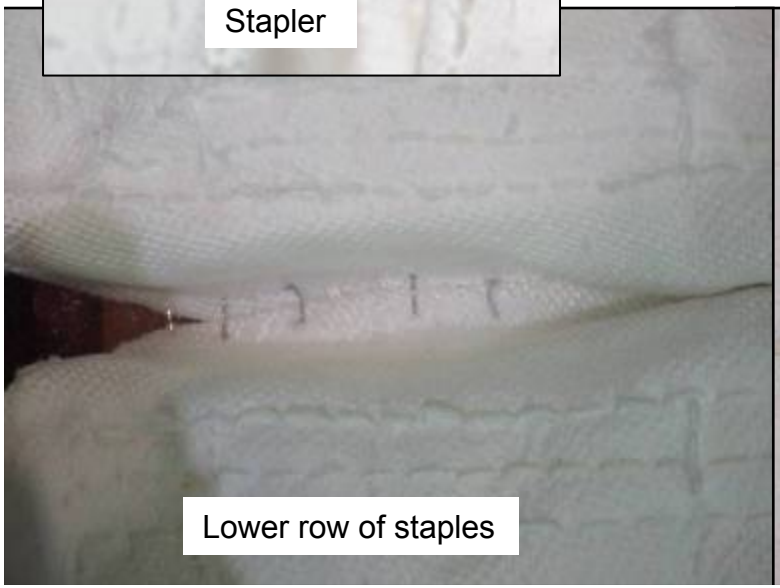
Operational Recommendations

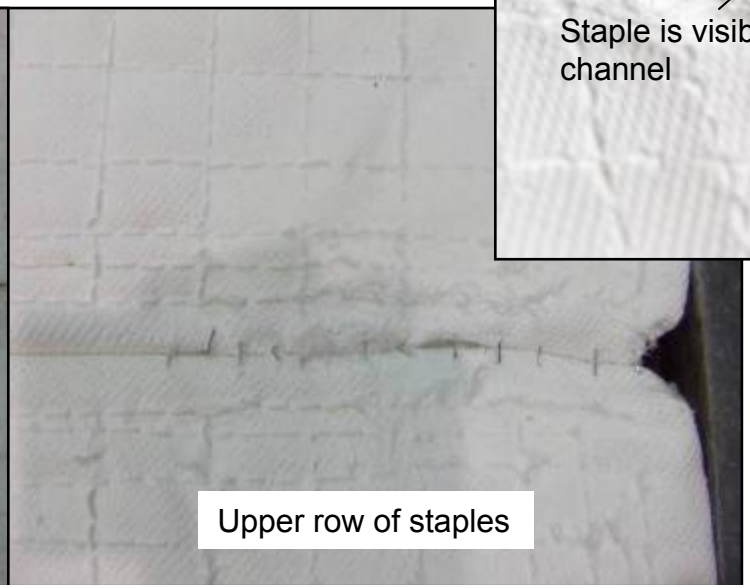
1. Stapler is an IV medical tool made by 3M
2. Somewhat difficult to see staples entering blanket
3. Ensure staple is visible in back of channel (lever has fully sprung back)
4. Orient stapler lever front to back as required to assist with seeing deployed staples
5. Rock the stapler “left to right” in order to see staple teeth grab each side of the blanket
6. Avoid stapling gloves
7. Be careful when stapling blankets adjacent to tile; avoid cracking good tile coating
8. Once staples are installed, don’t push down hard on top of them; the material begins tearing
9. Staplers will have a zip tie tether point attached to stapler body using kapton tape, and will be carried out to worksite in empty wire tie caddy slots
10. Will carry 4 staplers in wire tie caddy, 1 spare in crewlock bag individually tethered
11. Staples have sharp edges; they can be partially deployed and become an IV inhalation hazard
12. If staple doesn’t release, roll stapler forward

BLANKET STAPLING PHOTOS

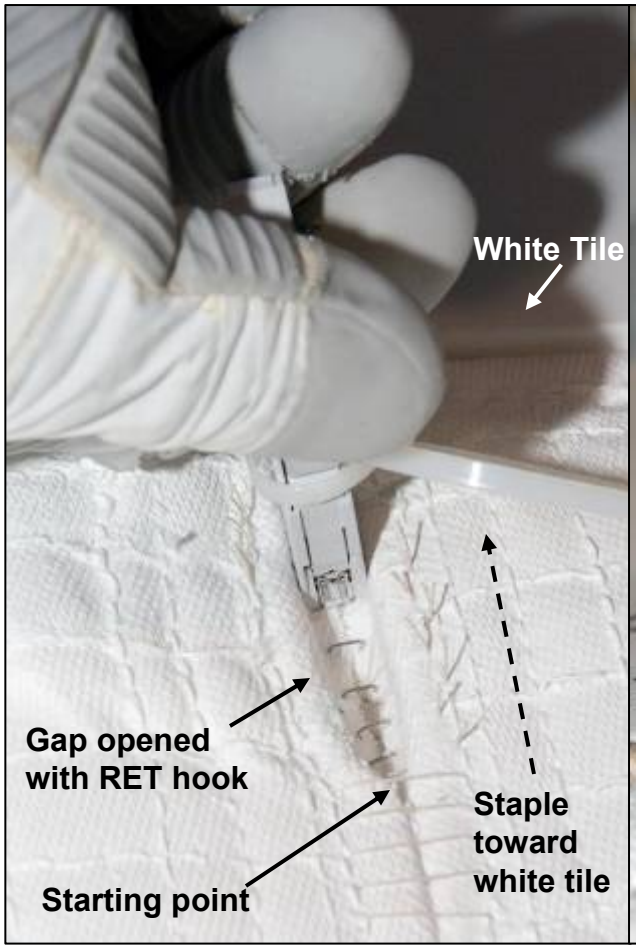






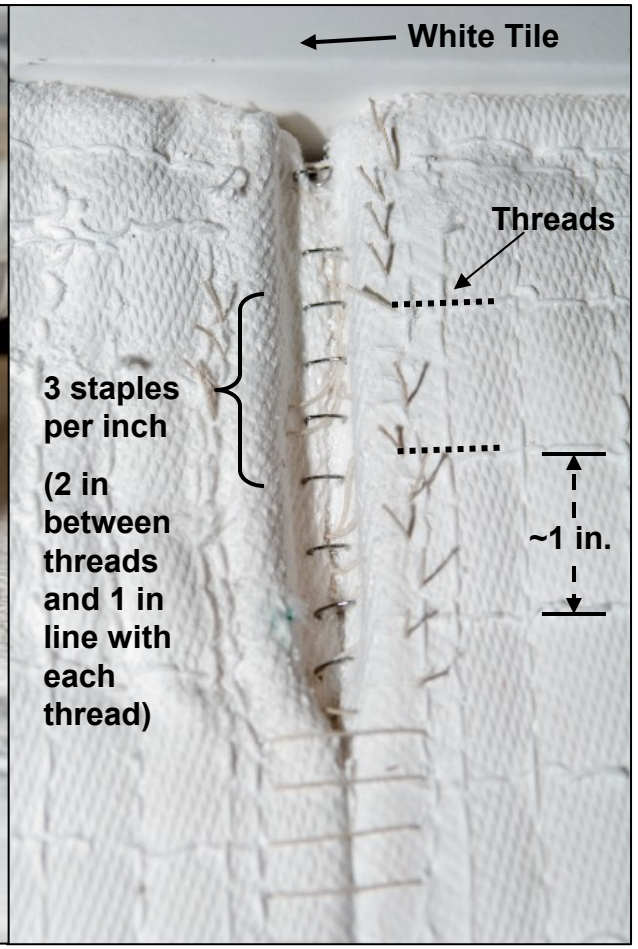


BLANKET STAPLING PHOTOS
Inserting Lower Row



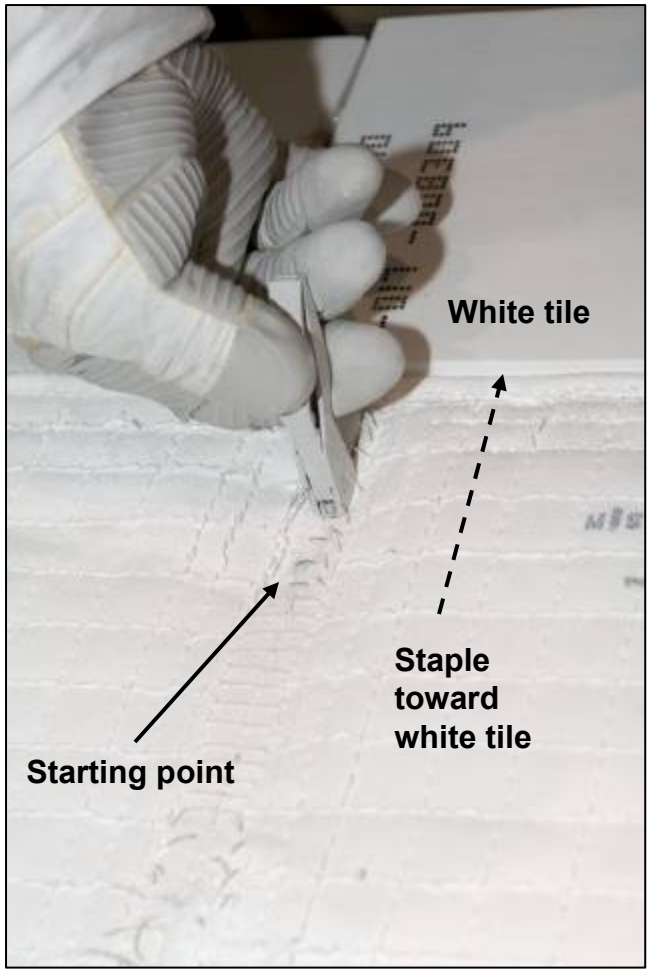
Inserting lower row of staples

Holding stapler

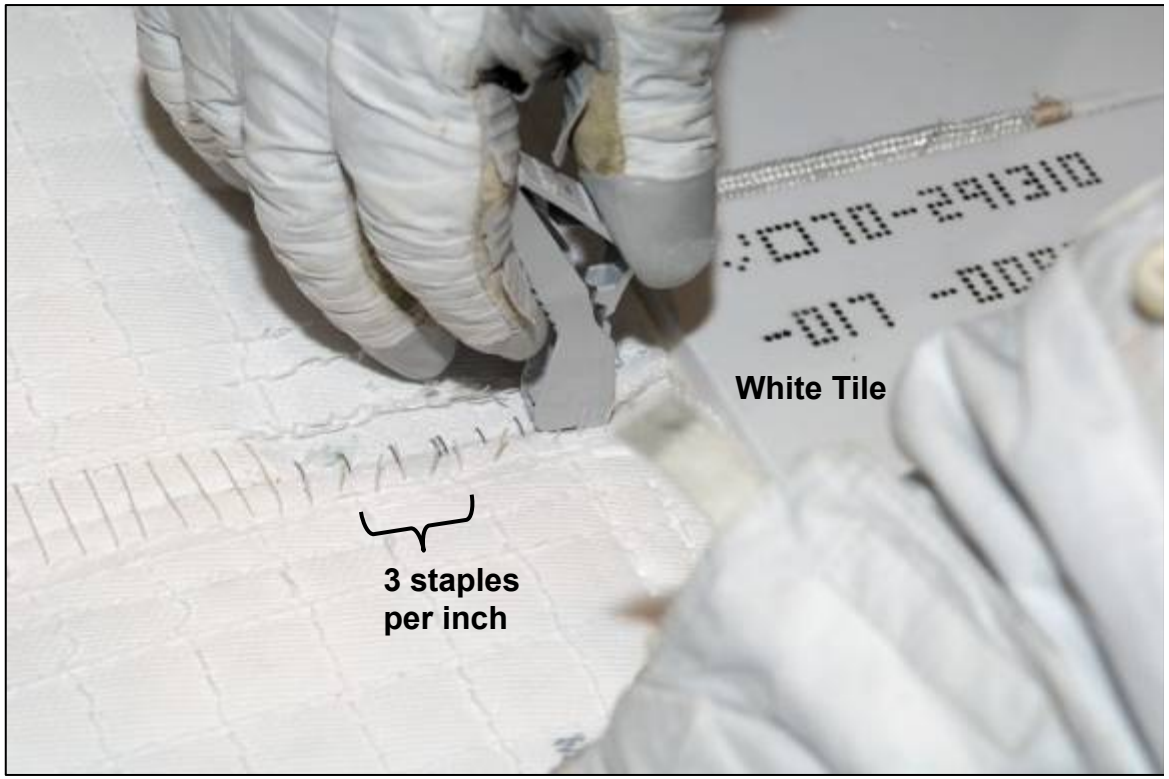


Lower row of staples

BLANKET STAPLING PHOTOS
Inserting Upper Row



Inserting upper row of staples

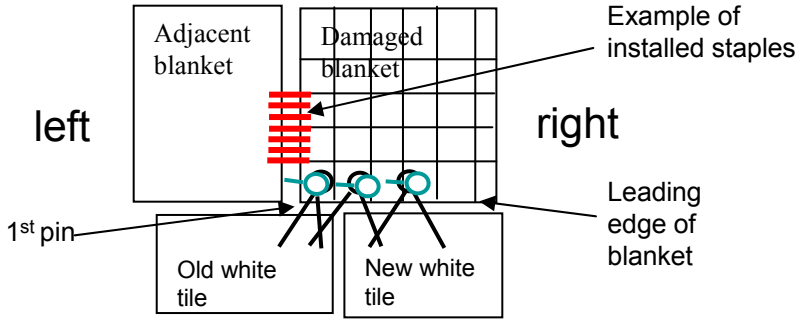


Upper row of staples

PART 4: DAMAGED BLANKET PINNING

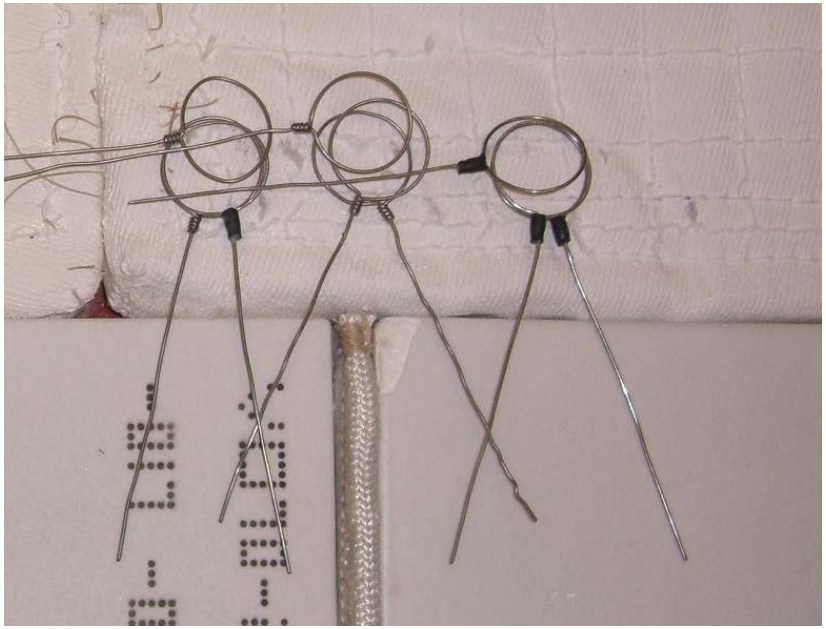
Prime Technique

1. After staples are installed and adjacent blanket leading edge is pinned into tile, damaged blanket leading edge must be pinned into tile, and then pins must be tacked down using additional retention pins
2. Install a total of 9 tile pins (for damaged blanket only, adjacent blanket requires 12 more) per the following requirements (don't need to tether to pins):
   - A. Starting from left to right, install 1st tile pin at 45 degrees to the left with respect to leading edge of blanket (pin should exit lower left hand corner of damaged blanket and enter old (left) white tile)
   - B. Install 2nd tile pin at 45 degrees to the right with respect to leading edge of blanket (pin should exit lower right hand corner of damaged blanket and enter old white tile)
     Note: Be sure to overlap the pin loops
   - C. Secure these two pins with a retention pin installed through the pin loops, with the pin oriented with the loop on the right (install right to left) and parallel to the tile sidewall
   - D. Repeat this procedure approximately 1.5 inches to the right, with one pin 45 degrees to the left (entering old white tile) and one pin 45 degrees to the right (entering new white tile)
     Note: Be sure the gap filler is not breached during the pin install
   - E. Repeat once more approximately 1.5 inches to the right
   - F. Pin should enter tile roughly ¼" below tile OML (deeper is better)
   - G. Tile pin insertion point should be immediately behind first thread (aft of thread); push pin all the way through until just pin loop is visible
   - H. Install 3 retention pins (blue in picture) through 6 original overlapped pin loops (through loop hole from right to left to tack down original pins)



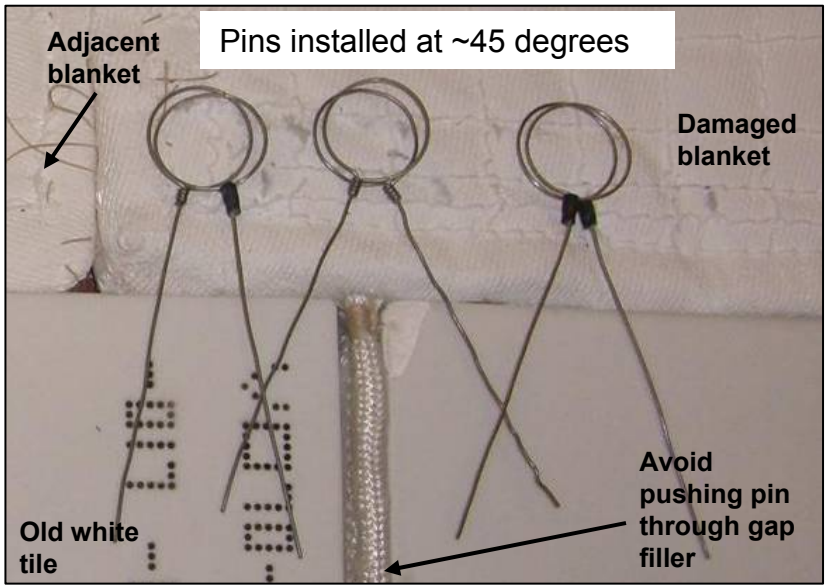
Operational Recommendations

1. May be difficult to crack white tile coating with pin itself. Can use dental tool to push through blanket and into coating on side of tile; creates easy path for pin to follow
2. Must keep pin as straight as possible to ease in insertion into blanket; if pin is bent or twisted, very difficult to guide it to a specific position; use dental tool to assist if necessary.
3. Pins do not have to be tethered, RET hook gets in the way and gets too close to tile
4. Pin FEP tabs will be removed per IV procedure prior to EVA
5. When inserting pin into tile, it should feel smooth (only verification since we can't see it)

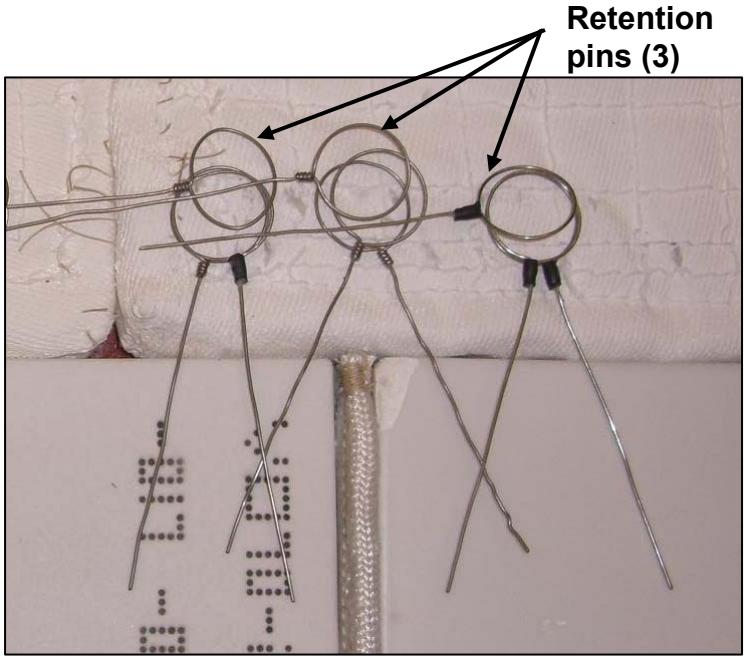


Tile Pin Layout

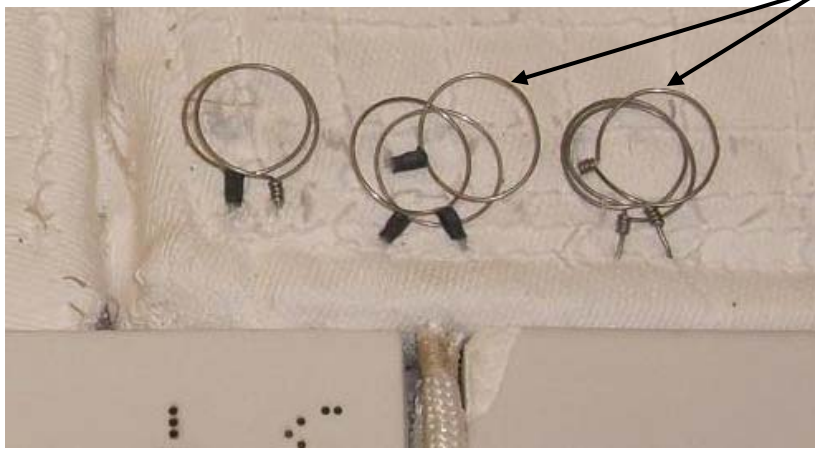
DAMAGED BLANKET PINNING PHOTOS



Tile Pins Shown (6); not installed yet



Retention Pins (3) shown with Tile Pins (6); not installed yet



Tile Pins (6) Installed In Tile with Retention Pins Installed (2 of 3 shown)

TOOL CONFIG INFO

HIGH LEVELTOOL CONFIG INFO

RMS EV

MWS

- Rt swingarm: empty
- Inner bayonet fitting: small trash bag (shuttle)

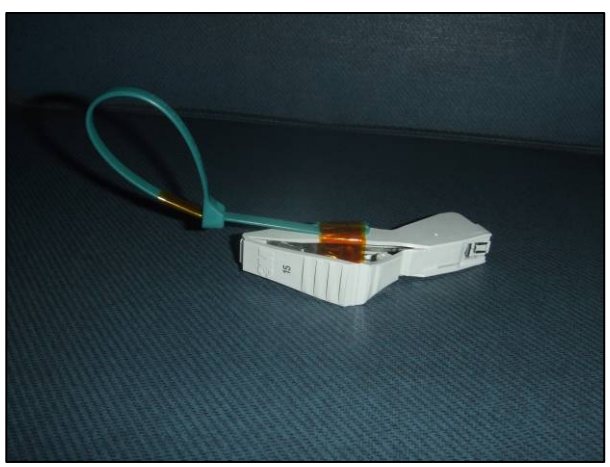
Crewlock Bag (on BRT):

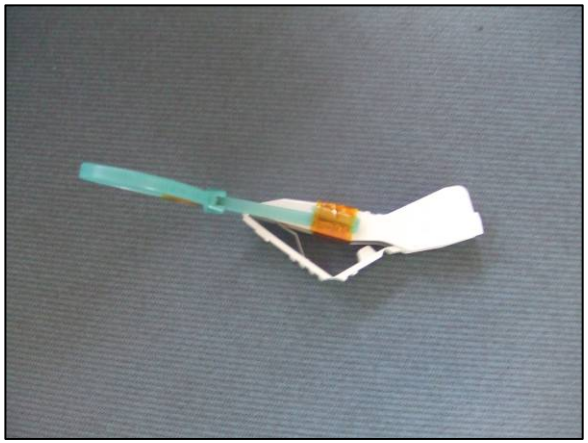
- NN pliers and compound cutters in ISS caddy
- Dental tool and spare stapler in shuttle caddy
- Digital camera (no flash)
- Modified Wire tie caddy (4 staplers) – inside bayonet; this is only here for egress and translation
- Scraper tool
- Pin cushion in ISS GP caddy (30 pins)

FF EVA

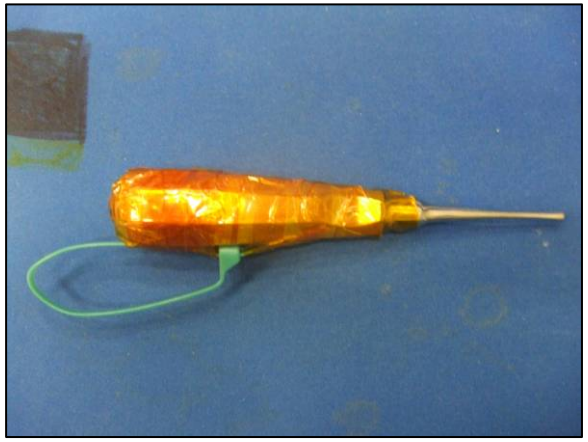
- PAD and WIF adapter

HIGH LEVELTOOL CONFIG INFO





Stapler with kapton tape and zip tie tether point



Dental tool with kapton tape and zip tie tether point

HIGH LEVEL TOOL CONFIG INFO - CONT

Pin cushion with tile and retention pins

Wire-tie caddy with staplers and dental tool

Location for digital camera

Crewlock bag with all tools installed (digital camera not shown)