MISSION OPERATIONS DIRECTORATE

EVA, ROBOTICS & CREW SYSTEMS

OPERATIONS DIVISION

Operations Support Officer In Space Inspection Experience and Needs

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Agenda

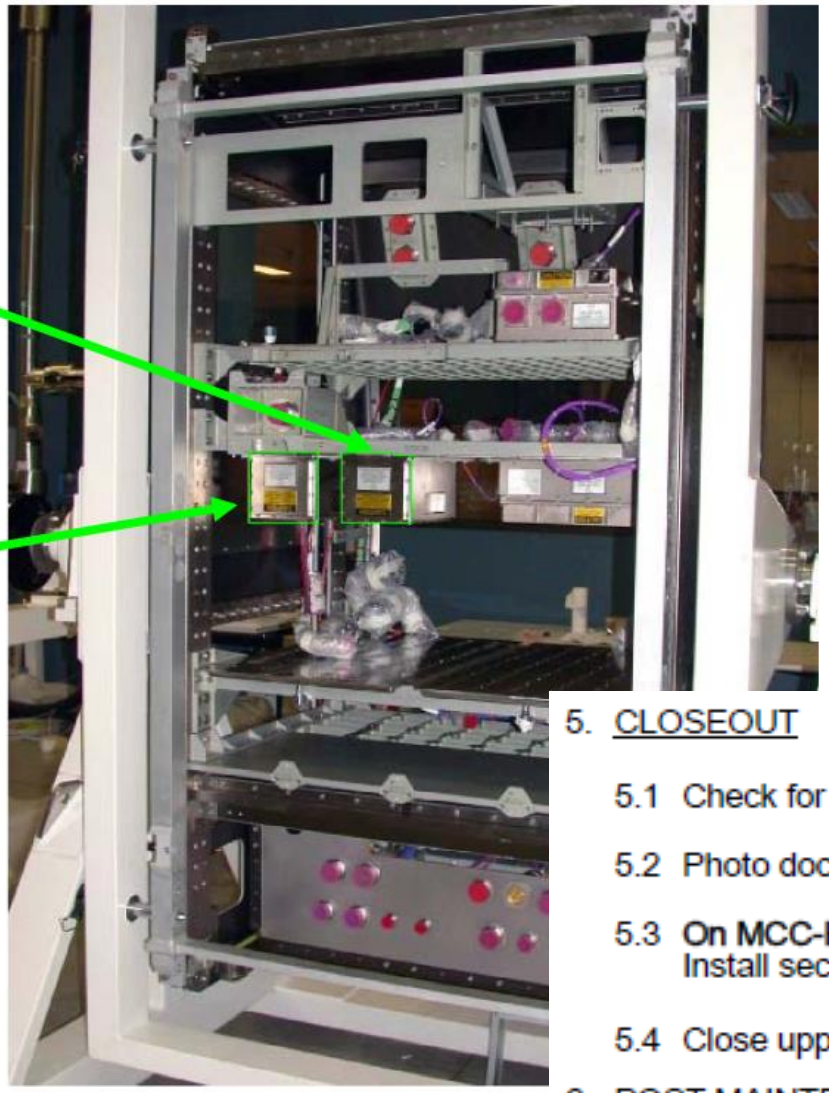
- The DX4/OSO Job
- Current imagery and inspection methods and tools
- Lessons Learned
- Current Needs
- Future Needs

The OSO Job

- Support On-Orbit Maintenance tasks for both the *preventive* maintenance schedule and *contingency/unplanned* maintenance due to failures
  - Provide **Real-time support** to crew as they execute
  - **Verify** and **Document** successful completion
- **Write procedures** for all internal volume maintenance

The OSO Job

- Conduct On-Orbit Maintenance **Training** for crew and flight controllers
- Common Berthing Mechanism **(CBM) operations**
- Support Atmosphere Leak response: **pinpoint** source, **install** pressure repair patch method, **document** damage for post-emergency engineering analysis



5. CLOSEOUT

5.1 Check for FOD around work area within 1 meter radius.

5.2 Photo document final configuration prior to closeout [Digital Camera].

5.3 **On MCC-H GO**
Install section of insulating blanket covering Gas Trap [Velcro].

5.4 Close upper **[Z]** faceplate of Rack **[Y]**.

6. POST MAINTENANCE

6.1 Stow tools, materials per stowage note.

6.2 Notify **MCC-H** of task completion, S/N of failed Gas Trap.

What does OSO do in MCC?

- More than just ORU level Remove and Replace
  - Aging vehicle means more internal component inspection and repair
  - Mod kit installation for vehicle reconfigs not initially in the designs (Node 3 relocation, PMM installation, etc.)
  - Inspections behind close-outs or inside an ORU to look for damage or tell-tale signs of failure
  - Inspections post-maintenance, to document resulting conditions
- OSO Console tries to be the SPECIALIST of the systems we repair
  - ISS crew cannot be as specialized as the people who train them, operate the vehicle, and design the equipment

Current inspection methods for maintenance and repair

- Real-time crew verbal descriptions
- Crew Notes, written descriptions
- Handheld digital camera (DSLR) imagery
- Downlinked digital video (not always real-time)

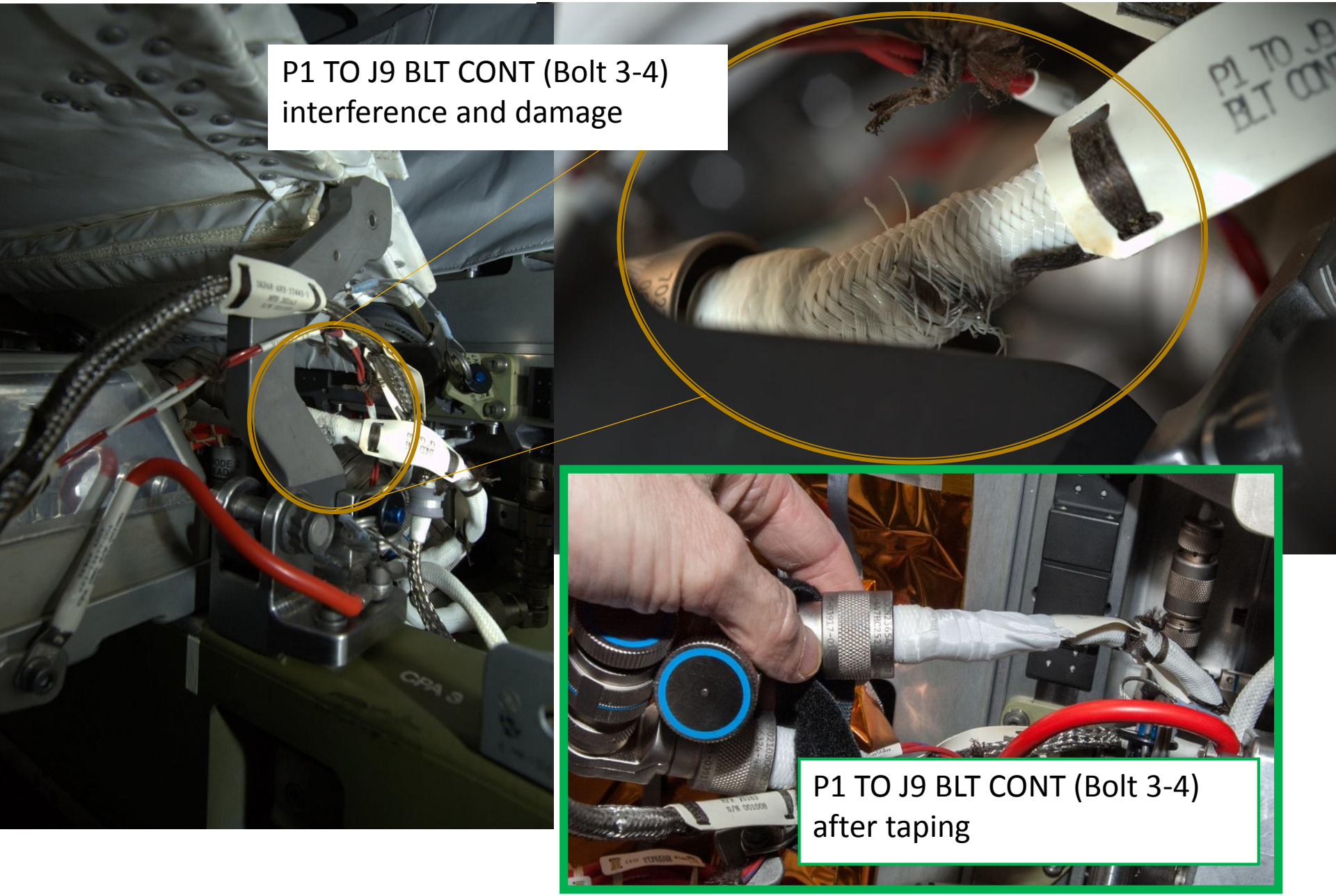
All procedures we write for crew execution include steps to document everything, during and after, using digital camera imagery.

Lessons Learned

- Importance of Imagery and Inspections to the OSO Console
  - Pre-flight configuration imagery and documentation
    - For writing procedures, conducting training, supporting real-time questions, and comparing to current config imagery
  - In-Flight configuration imagery
    - For writing procedures, planning operations
    - Example: Quick Look (invaluable tool for responding to real-time issues with configuration)
  - Post-maintenance closeout imagery
    - OSO console verifies the work completed on board, and passes as much data as we can to Engineering teams to do the same
  - Generally documenting the vehicle in as much detail as possible
    - Current config, changes, training tools, etc.

Examples

- Inspection Imagery finding otherwise unreported damage or contamination


P1 TO J9 BLT CONT (Bolt 3-4)
interference and damage
P1 TO J9 BLT CONT (Bolt 3-4)
after taping

11/6/2014

Example

- White debris reported by crew during an inspection before installing an ITCS line during maintenance.

Example

- Use of schematics and other engineering data in procedures.
- Techniques to provide scale to imagery of MMOD damage.

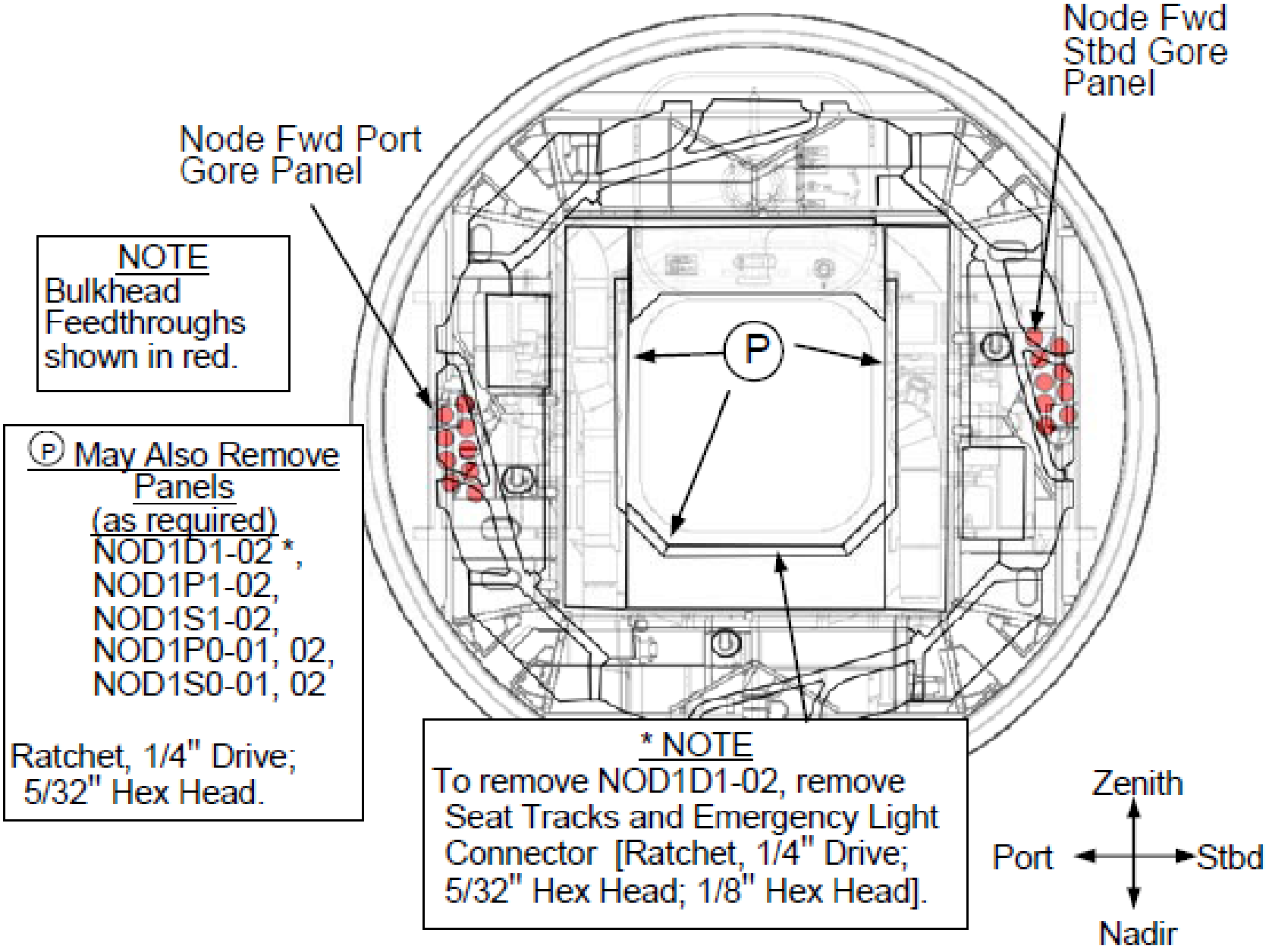
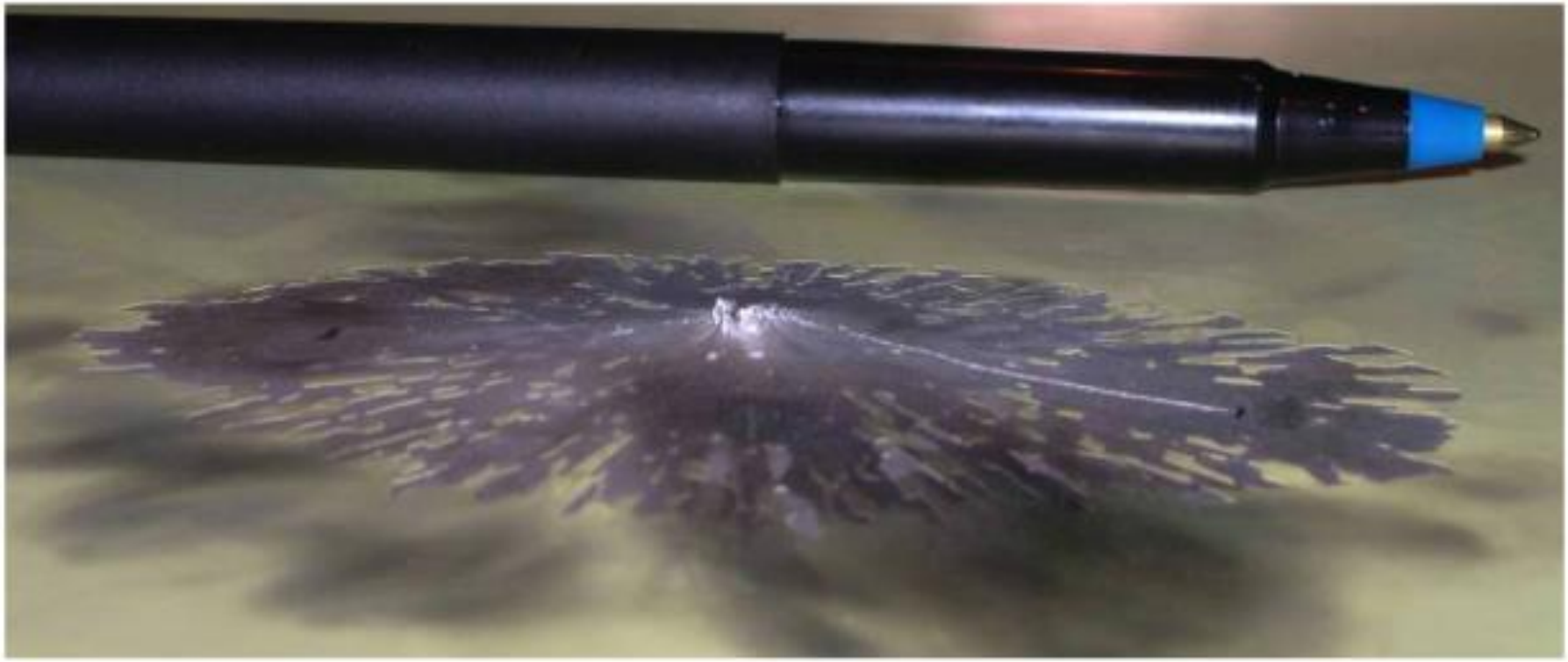


Figure 2.- Node 1 Fwd Endcone.



Current Needs

- Reliable, high resolution, in-focus, well-lit imagery of all ISS components and subsystems
  - Provides Situational Awareness for supporting real-time environment, as well as writing procedures
- Ability to inspect behind hard to reach areas, without a lot of crew time
  - Rack rotations can be time consuming considering the stowage situation. Crew Time for maintenance is a premium.
- Reliable Before/After imagery
  - Designated Safety Inspector role. Compare pre- and post-maintenance, to verify successful completion, have something to compare against after next failure.

You never know what you might find!

Future Needs/Suggestions

- Imagery of **everything** in Flight Configuration
  - Situation awareness
  - Needs to have spatial reference, scale dimensions, all labels clearly visible
- Imagery that is easy to access, view, and compare and **provides the best overall situational awareness** to the console team
- Enable autonomous/remote inspection or observation of the vehicle interior
  - Equipment that requires minimal crew interaction
  - Inspection devices that can get into hard to reach areas
  - A way to view and record crew during maintenance (over the shoulder, FPV, etc.)

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