



EVA Technology Workshop: xEMU Demo Status

Spring 2019

Outline



This presentation provides a status of the xEMU ISS Demo project and the approach to requirements definition related to certification and extensibility considerations.

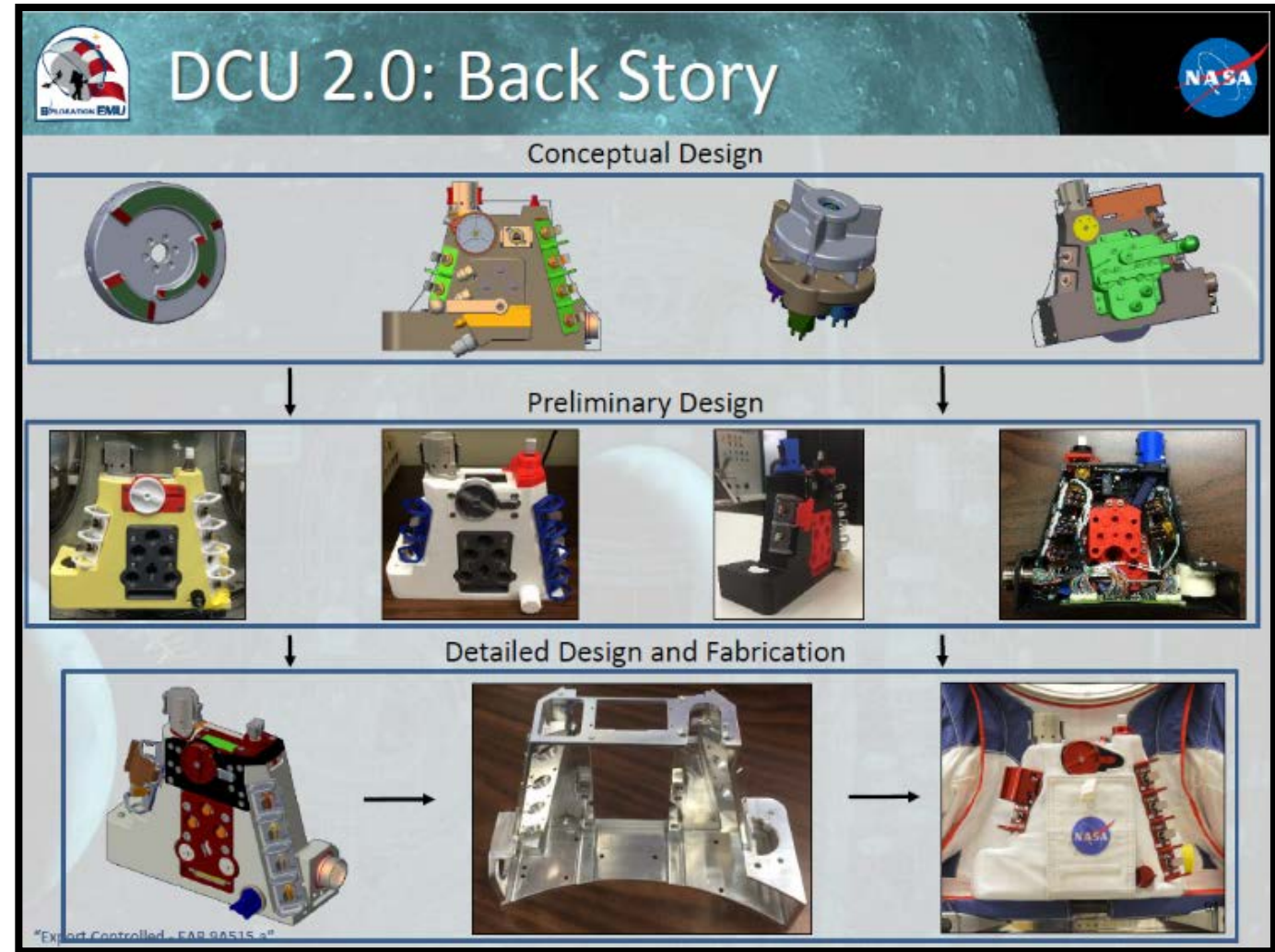
- **Hardware Progress**
- **Upcoming Milestone Schedule**
- **Requirements Structure**
- **Strategy for Requirements Tuning**
- **Extensibility**



Hardware Progress



- Extensive design, analysis, manufacturing and testing has been done to mature the xEMU Demo
- The hardware itself is far beyond classical PDR definition, as shown in prior slides components have been iterated several generations
- Significant focus for PDR is an effort to synchronize the expected analytical products such as stress reports, thermal analysis, etc
- For example, the evolution of the chest-mounted Display and Control Module is shown at right



Hardware Progress

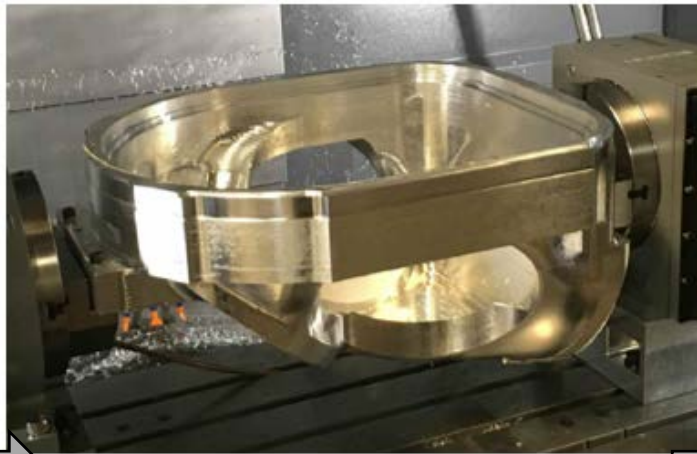
HUT Ground Unit Manufacturing



Z-2.5 Aluminum HUT Machining



Z-2.5 Aluminum Billets



Z-2.5 Suit AL HUT Roughing



Z-2.5 Suit AL HUT Finishing

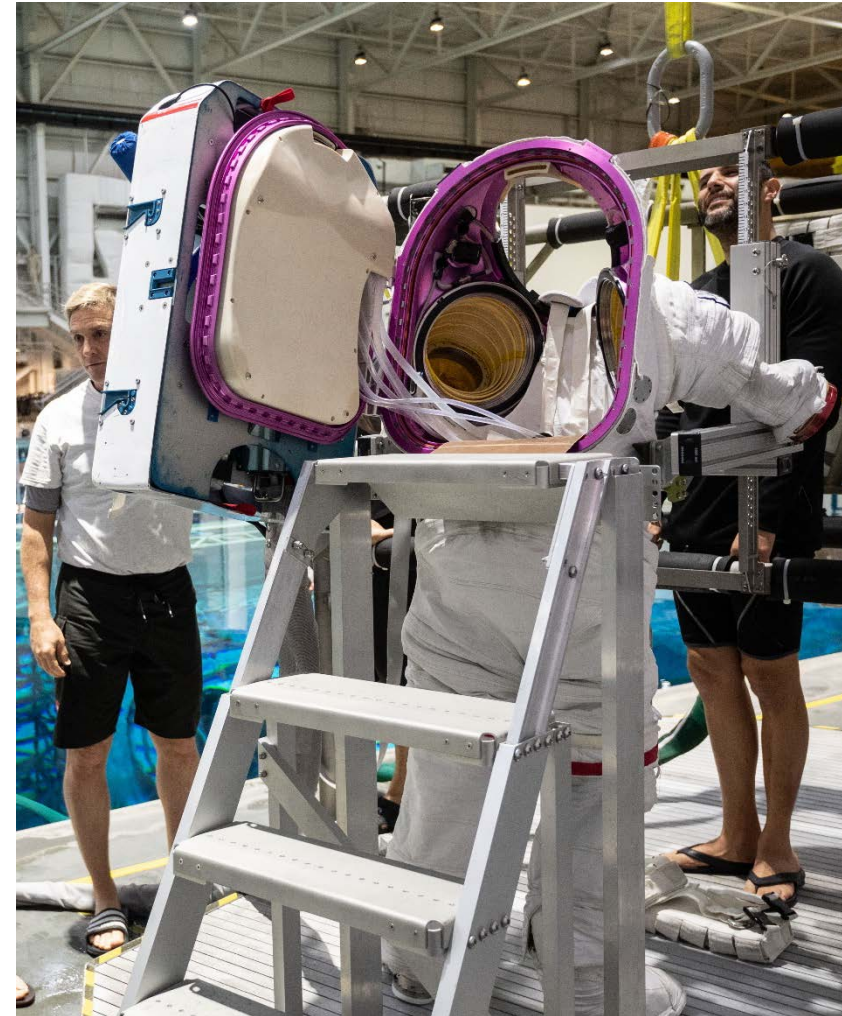


Assembly of Z-2.5 Hut and Associated Hardware

Hardware Progress: HUT Ground Unit Manufacturing



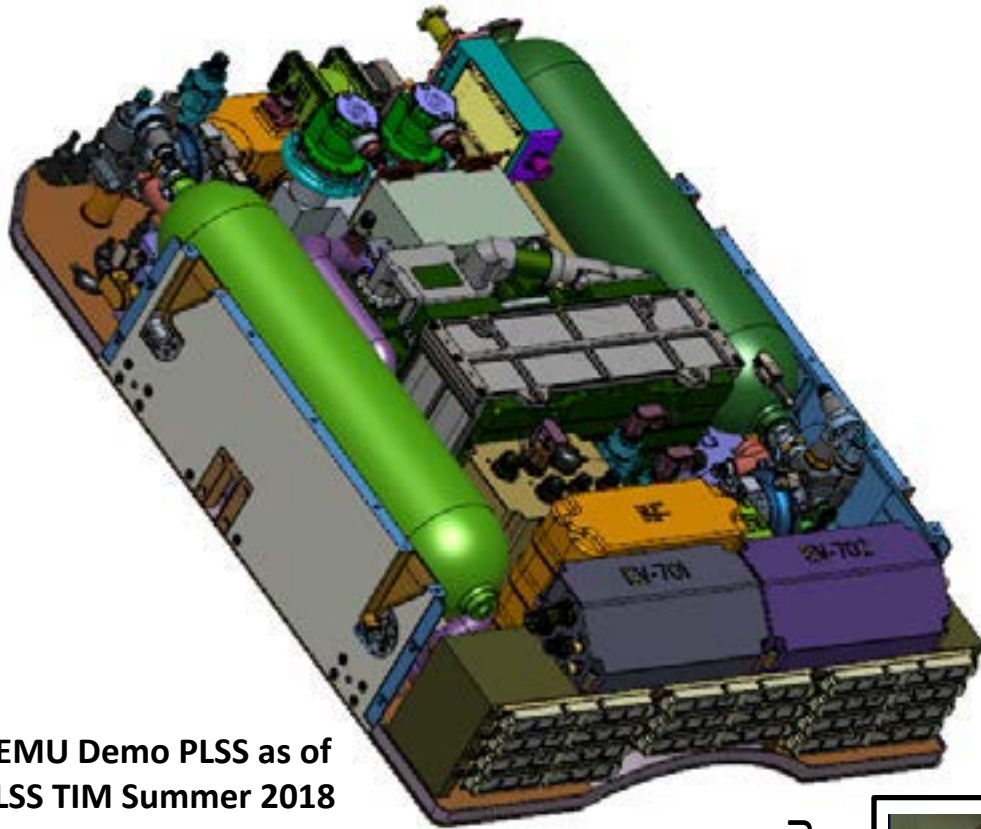
Hardware Progress: HUT Ground Assembly & Test Utilization



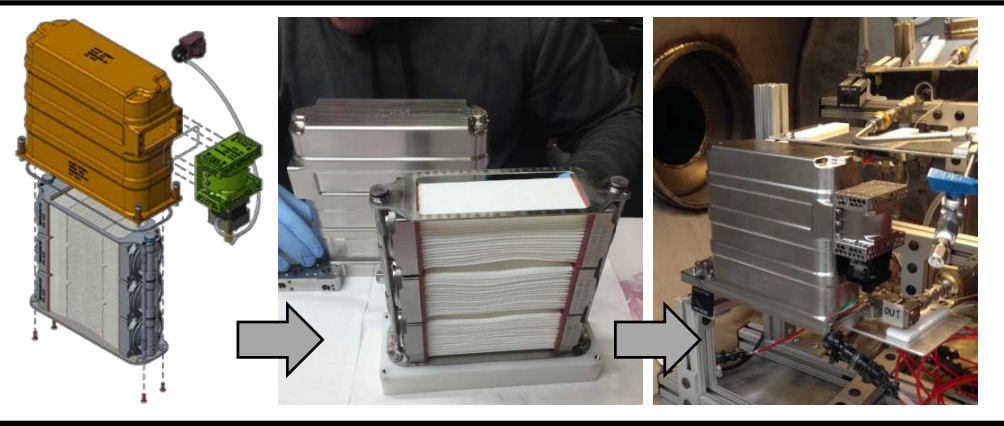
Hardware Progress



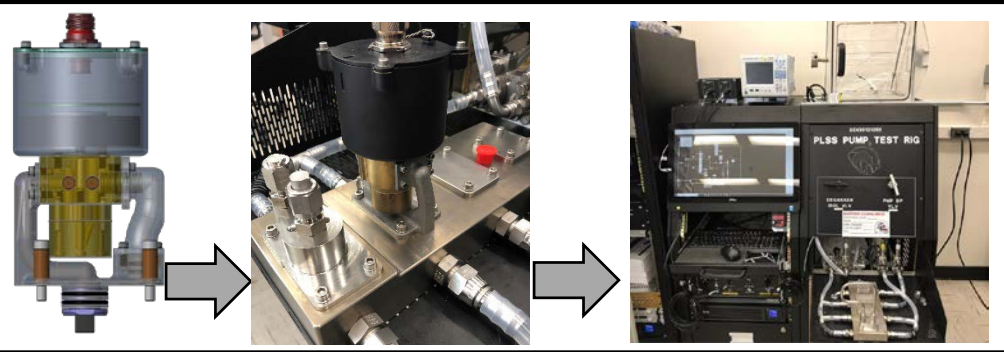
xEMU Demo PLSS as of
PLSS TIM Summer 2018



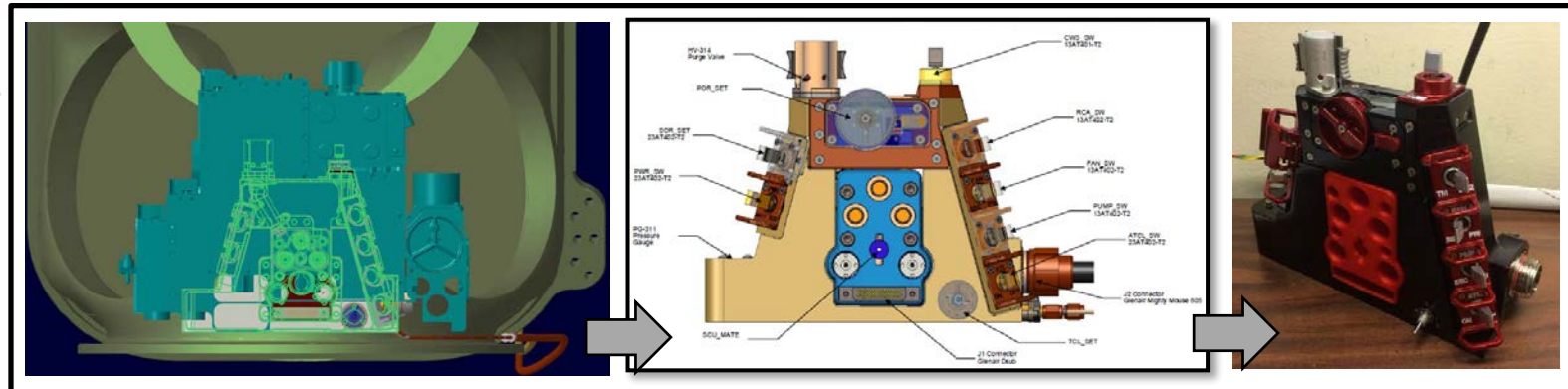
xEMU SWME
CAD, Assembly, Test



xEMU Pump (NASA)
CAD, Test Stand



xEMU DCU
Comparison with EMU
CAD and Mockups.



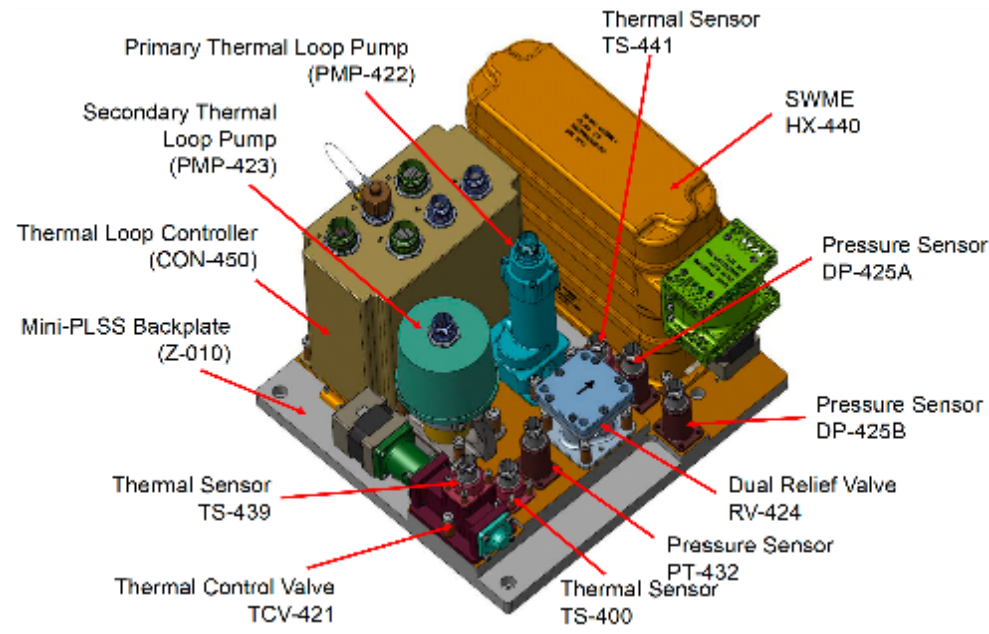
Hardware Progress - SERFE



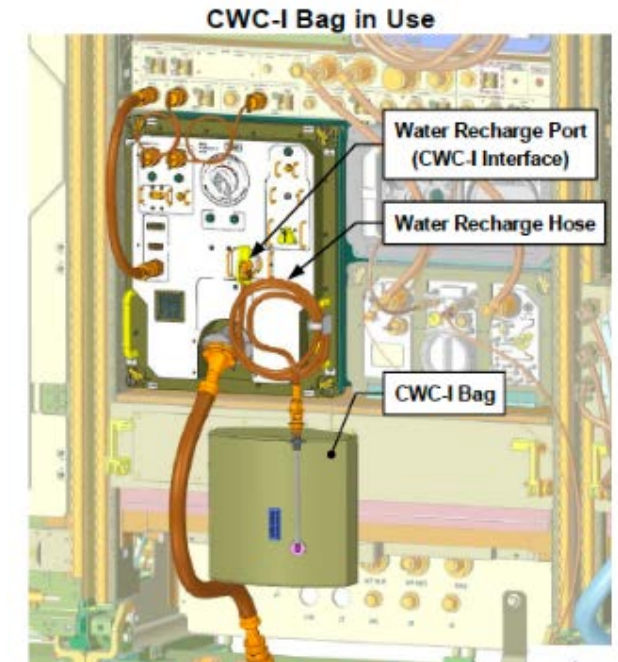
- **ISS SERFE Payload: delivering and launching this year**
 - SERFE is a high-fidelity representation of the xEMU PLSS Thermal Loop mounted in an ISS EXPRESS Rack
 - This ISS rack-mounted payload will test the entire xEMU Thermal Subsystem architecture
 - Will be installed in ISS EXPRESS Rack 1
 - Extensive test operations on ISS and ground test units are planned, with resources such as ISS Water set aside to simulate/test 25x 8-hr-long EVAs
 - This project has already paid dividends in reducing future schedule and technical risk for xEMU



SERFE Front Panel



SERFE Mini-xPLSS



SERFE installed in Lab Rack

Hardware Progress - xEMU ISS Demo DVT PLSS Backplate

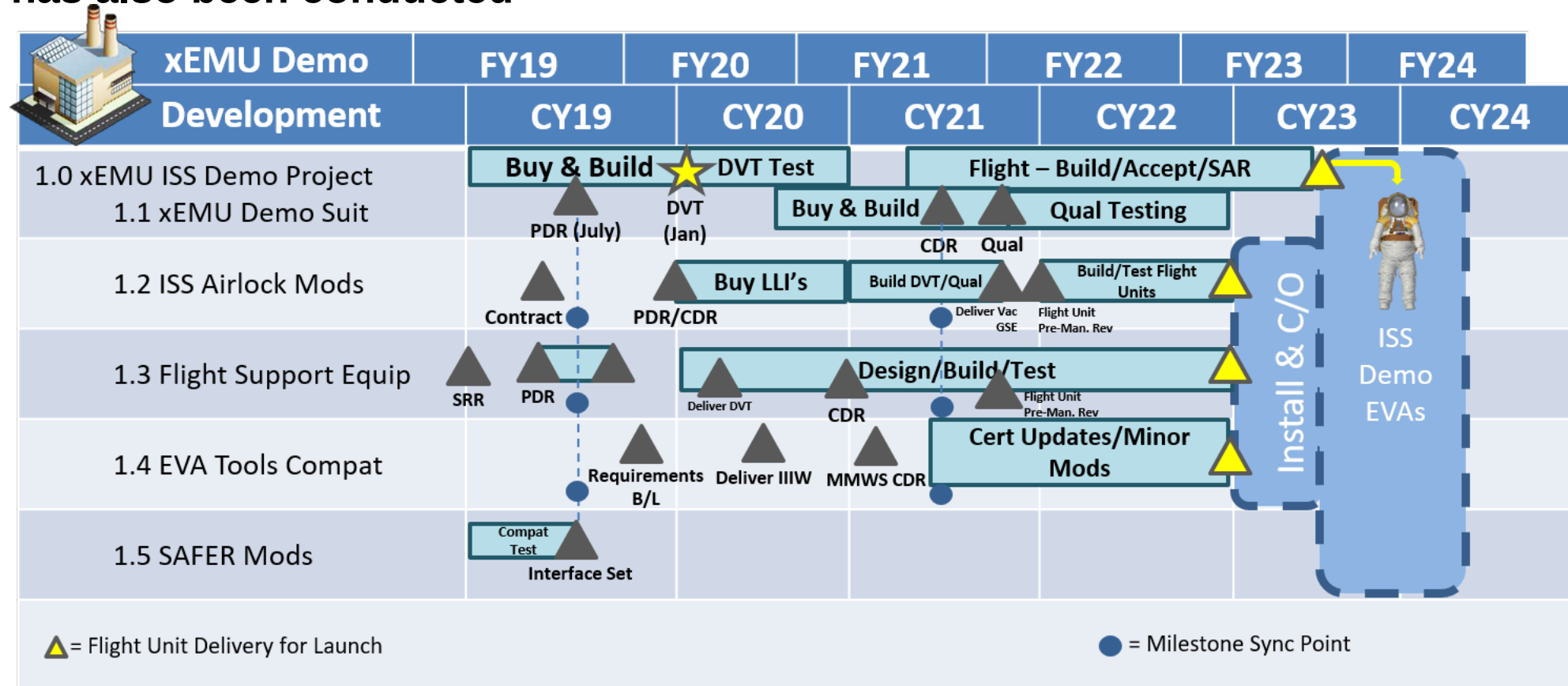


The xEMU uses a Titanium backplate with integral cooling lines and mounting ports to create a “motherboard” for the xEMU PLSS components. The DVT PLSS Backplate has been received from sub-vendors and is in final machining in JSC B10.

Upcoming Milestone Schedule



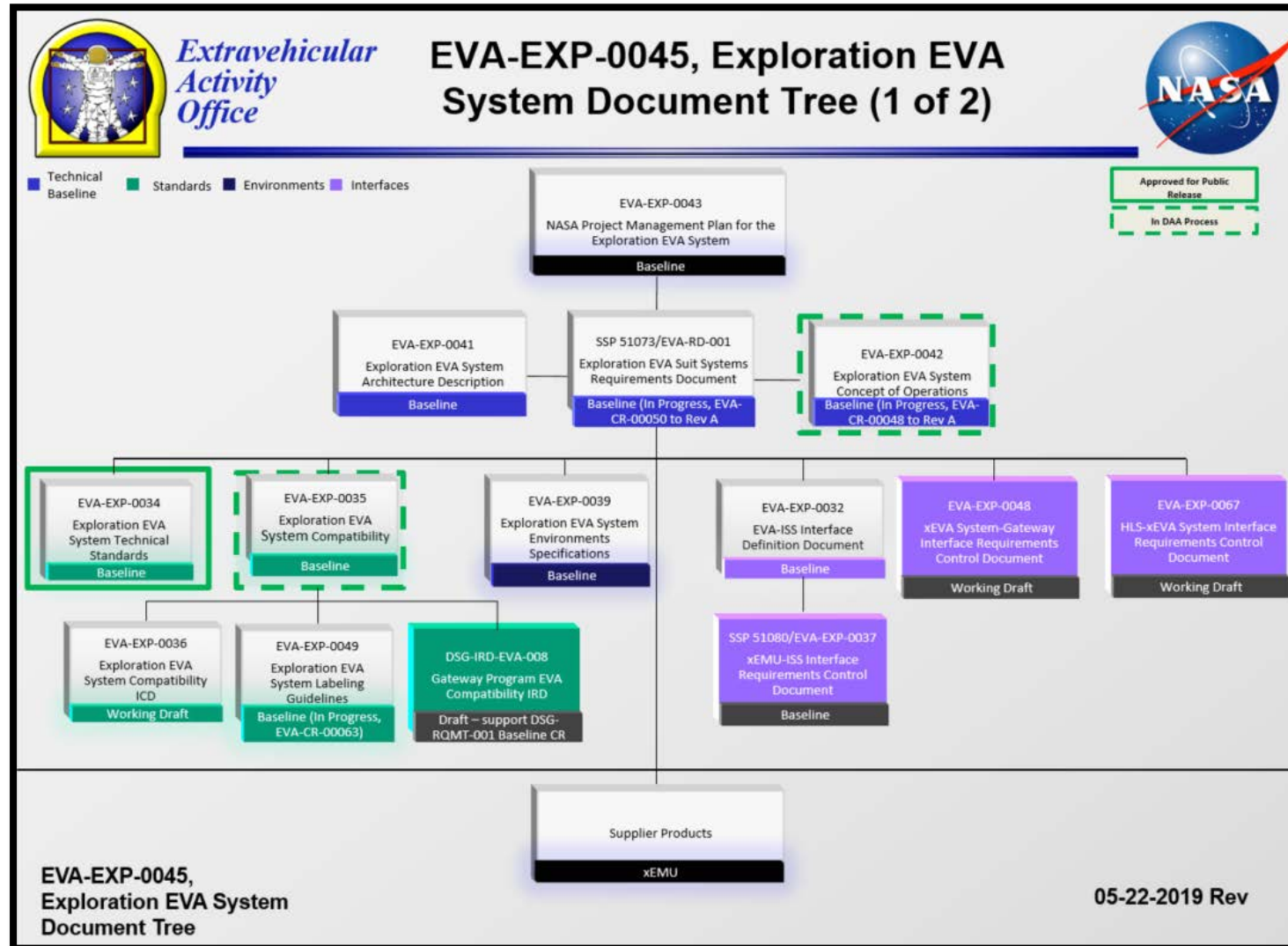
- The xEMU Demo team has recently began the Preliminary Design Review (PDR) process
- Several parallel supporting projects including modifications to the ISS Airlock for High-Pressure Oxygen and Vacuum Access are underway
- Initial compatibility assessments with the existing SAFER as well as existing ISS micro-g EVA Tools has also been conducted



Requirements Structure



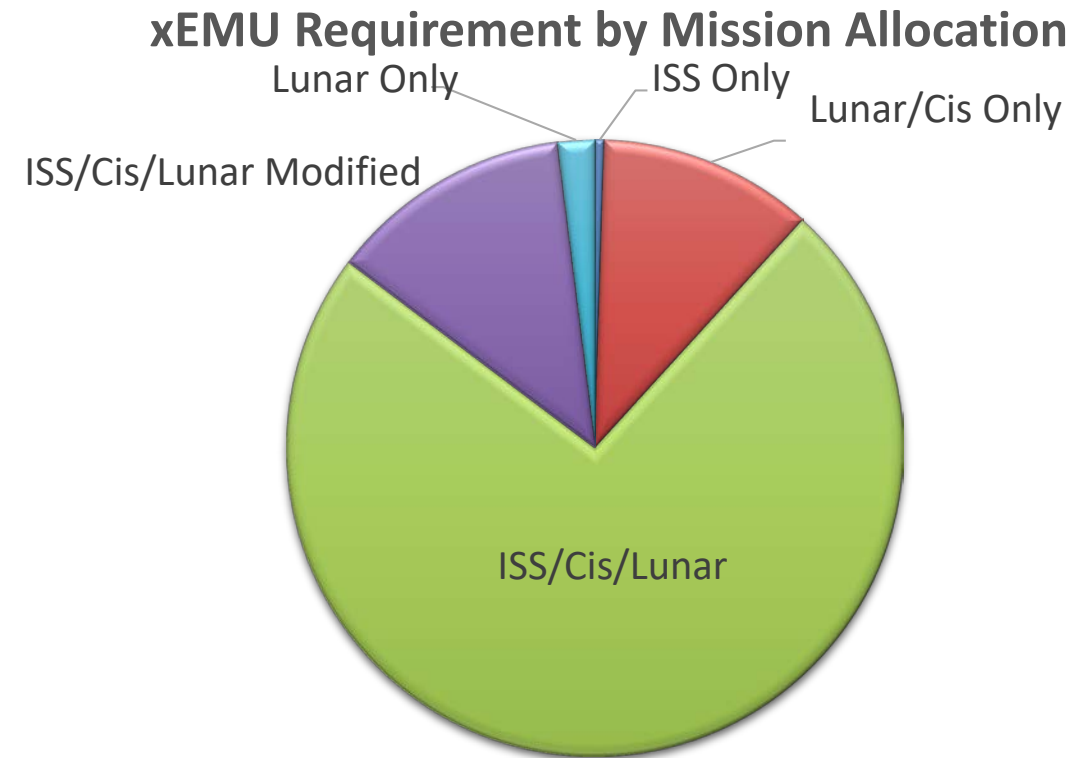
- The xEMU ISS Demo is built under the xEVA System Document Tree



Strategy for Requirements Tuning

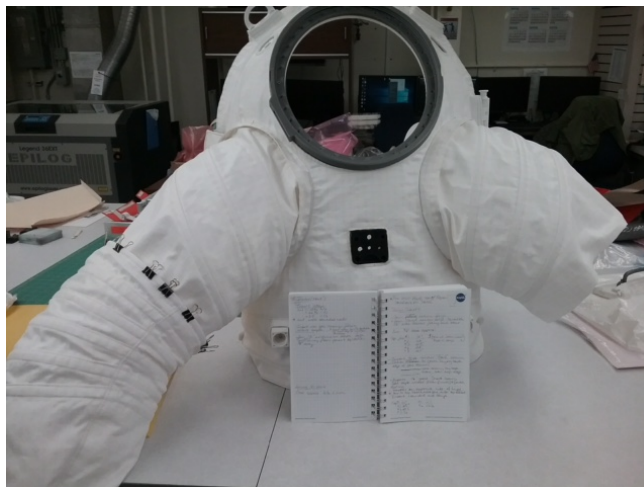


- The cert-to document for the xEMU ISS Demo is CTSD-ADV-1188, which is a Project Technical Requirements Specification (PTRS)
- The xEMU ISS Demo project tailors/scopes the parent requirements established by the EVA Office and parses out applicability for ISS Demo vs. “Full”
- This allows the team to compare/contrast what is being done for Demo vs Gateway, Lunar, etc
- The parent xEMU requirements set (SSP 50173) encompass Lunar Surface capability
- Approximately 80% of these requirements are imposed on the Demo config today



Extensibility

- NASA has used the term “Extensibility” to describe options and scars for future design evolution
 - The Orion Program has done significant extensibility assessments of the Orion vehicle
- The xEMU ISS Demo project has conducted extensibility assessments, charting a path from the design features planned for flight on ISS to those deltas expected for lunar surface compatibility
- An example of this is a concept for Dust Tolerance via “long sleeves” on the upper torso TMG:



xEMU Upper Torso & TMG Patterns

xEMU Demo EPG Prototype Long Sleeve Concept



“Long Sleeve” Assembly

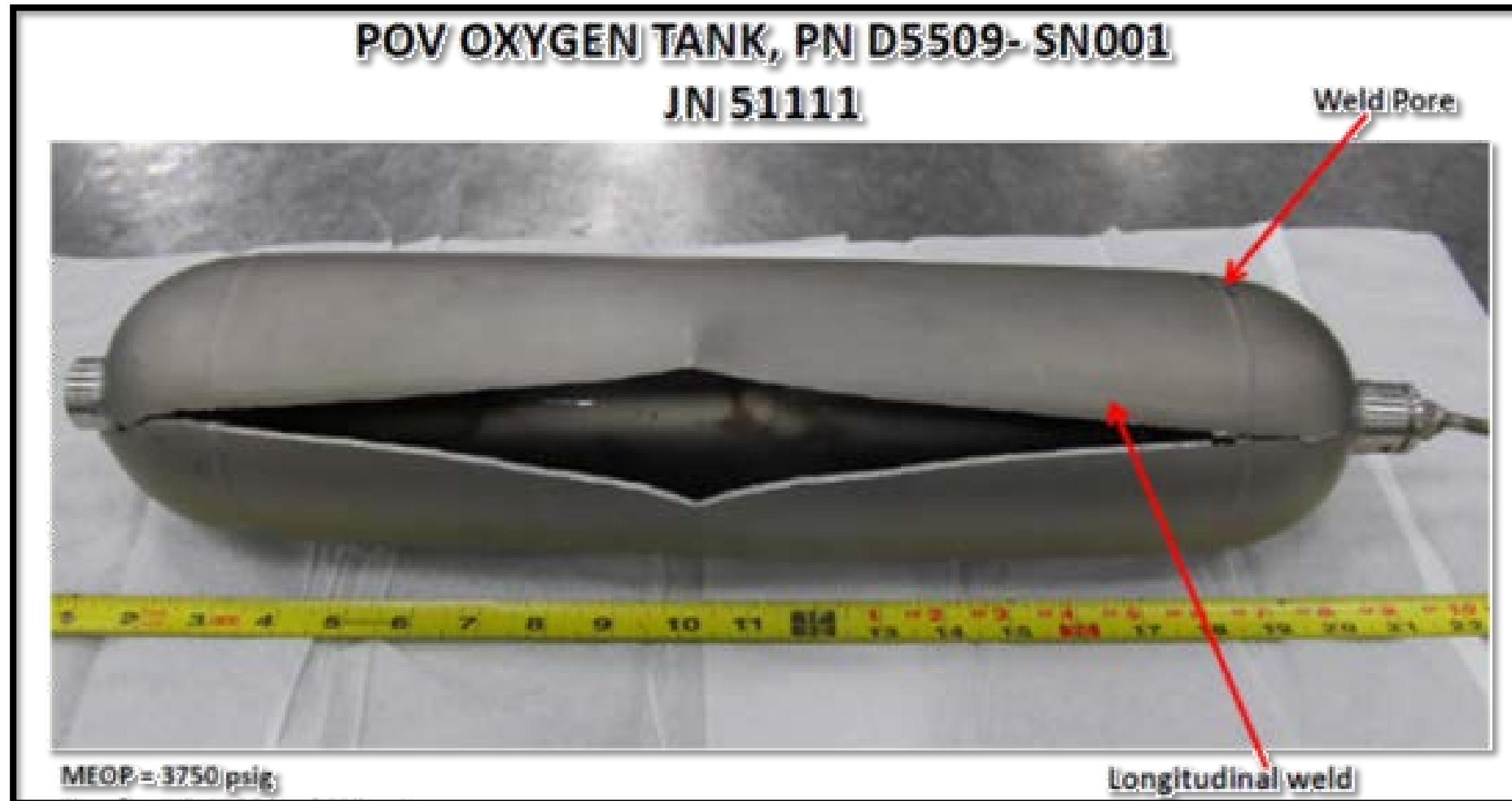


“Long Sleeve” Assembly



Questions?

Hardware Progress – Primary O2 Vessel Intentional Burst Testing



The xEMU Primary Oxygen Vessel successfully completed Qualification Burst and Rupture Testing. Rupture occurred at 9400 psi, well above the 7500 psi requirement which includes FOS 2.0 against Max Expected Operating Pressure (MEOP) of 3750.

NASA-STD-3001 Implimentation



- **NASA-STD-3001 Standards differences from Demo to lunar xEMU:**

NASA-STD-3001 V2 Requirements by Mission Allocation

