

Abstract for 42nd International Conference on Environmental Systems

Title: Spacesuit Portable Life Support System Breadboard (PLSS 1.0) Development and Test Results

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A multi-year effort has been carried out at NASA-JSC to develop an advanced Extravehicular Activity (EVA) PLSS design intended to further the current state of the art by increasing operational flexibility, reducing consumables, and increasing robustness. Previous efforts have focused on modeling and analyzing the advanced PLSS architecture, as well as developing key enabling technologies. Like the current International Space Station (ISS) Extravehicular Mobility Unit (EMU) PLSS, the advanced PLSS comprises of three subsystems required to sustain the crew during EVA including the Thermal, Ventilation, and Oxygen Subsystems. This multi-year effort has culminated in the construction and operation of PLSS 1.0, a test rig that simulates full functionality of the advanced PLSS design. PLSS 1.0 integrates commercial off the shelf hardware with prototype technology development components, including the primary and secondary oxygen regulators, ventilation loop fan, Rapid Cycle Amine (RCA) swingbed, and Spacesuit Water Membrane Evaporator (SWME).

Testing accumulated 239 hours over 45 days, while executing 172 test points. Specific PLSS 1.0 test objectives assessed during this testing include:

- Confirming key individual components perform in a system level test as they have performed during component level testing
- Identifying unexpected system-level interactions
- Operating PLSS 1.0 in nominal steady-state EVA modes to baseline subsystem performance with respect to metabolic rate, ventilation loop pressure and flow rate, and environmental conditions
- Simulating nominal transient EVA operational scenarios
- Simulating contingency EVA operational scenarios
- Further evaluating individual technology development components

Successful testing of the PLSS 1.0 provided a large database of test results that characterize system level and component performance. With the exception of several minor anomalies, the PLSS 1.0 test rig performed as expected; furthermore, many system responses trended in accordance with pre-test predictions.