Space Suit Portable Life Support System (PLSS) 2.0 Pre-Installation Acceptance (PIA) Testing

Following successful completion of the space suit Portable Life Support System (PLSS) 1.0 development and testing in 2011, the second system-level prototype, PLSS 2.0, was developed in 2012 to continue the maturation of the advanced PLSS design which is intended to reduce consumables, improve reliability and robustness, and incorporate additional sensing and functional capabilities over the current Space Shuttle/International Space Station Extravehicular Mobility Unit (EMU) PLSS. PLSS 2.0 represents the first attempt at a packaged design comprising first generation or later component prototypes and medium fidelity interfaces within a flight-like representative volume.

Pre-Installation Acceptance (PIA) is carryover terminology from the Space Shuttle Program referring to the series of test sequences used to verify functionality of the EMU PLSS prior to installation into the Space Shuttle airlock for launch. As applied to the PLSS 2.0 development and testing effort, PIA testing designated the series of 27 independent test sequences devised to verify component and subsystem functionality, perform in situ instrument calibrations, generate mapping data to define set-points for control algorithms, evaluate hardware performance against advanced PLSS design requirements, and provide quantitative and qualitative feedback on evolving design requirements and performance specifications. PLSS 2.0 PIA testing was carried out from 3/20/13 – 3/15/14 using a variety of test configurations to perform test sequences that ranged from stand-alone component testing to system-level testing, with evaluations becoming increasingly integrated as the test series progressed. Each of the 27 test sequences was vetted independently, with verification of basic functionality required before completion. Because PLSS 2.0 design requirements were evolving concurrently with PLSS 2.0 PIA testing, the requirements were used as guidelines to assess performance during the tests; after the completion of PIA testing, test data served to improve the fidelity and maturity of design requirements as well as plans for future advanced PLSS functional testing.