A Multi-Purpose Modular Electronics Integration Node For Exploration Extravehicular Activity (EVA)

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As NASA works to develop an effective integrated portable life support system design for exploration Extravehicular activity (EVA), alternatives to the current system's electrical power and control architecture are needed to support new requirements for flexibility, maintainability, reliability, and reduced mass and volume. Experience with the current Extravehicular Mobility Unit (EMU) has demonstrated that the current architecture, based in a central power supply, monitoring and control unit, with dedicated analog wiring harness connections to active components in the system has a significant impact on system packaging and seriously constrains design flexibility in adapting to component obsolescence and changing system needs over time. An alternative architecture based in the use of a digital data bus offers possible wiring harness and system power savings, but risks significant penalties in component complexity and cost. A hybrid architecture that relies on a set of electronic and power interface nodes serving functional models within the Portable Life Support System (PLSS) is proposed to minimize both packaging and component level penalties. A common interface node hardware design can further reduce penalties by reducing the non-recurring development costs, making miniaturization more practical, maximizing opportunities for maturation and reliability growth, providing enhanced fault tolerance, and providing stable design interfaces for system components and a central control. Adaptation to varying specific module requirements can be achieved with modest changes in firmware code within the module. A preliminary design effort has developed a common set of hardware interface requirements and functional capabilities for such a node based on anticipated modules comprising an exploration PLSS, and a prototype node has been designed assembled, programmed, and tested. One instance of such a node has been adapted to support testing the swingbed carbon dioxide and humidity control element in NASA's advanced PLSS 2.0 test article. This paper will describe the common interface node design concept, results of the prototype development and test effort, and plans for use in NASA PLSS 2.0 integrated tests.