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SIERRA NEVADA CORPORATION'S MARS TRANSIT HABITAT

Abstract

Sierra Nevada Corporation (SNC) is developing a Mars transit habitat under NASA's Next Space Technologies for Exploration Partnerships-2 (NextSTEP-2) Habitat Systems contract. The centerpiece of our transit habitat is the Large Inflatable Fabric Environment (LIFE), an inflatable softgoods habitat that is designed for long duration, crewed Mars missions. The LIFE habitat provides over 300 cubic meters of volume for flight systems, crew habitation outfitting, and cargo. It includes a center core that enables ground integration and launch of critical systems such as power, avionics and life support. Once on-orbit the habitat is inflated, floors are autonomously deployed, and life support systems create a shirt-sleeve environment to prepare the habitat for crewed missions. SNC's transit habitat concept also includes the safe haven module, a separate pressurized module that provides backup life support systems, extravehicular activity (EVA) capabilities, and cargo for a week of crewed operations. It features an internal bulkhead and hatch that divide the pressurized volume into independent EVA equipment lock and crew lock sections. The safe haven also acts as a node, providing docking ports to attach a Mars-class propulsion module, logistics module and the Mars ascent and descent vehicle, supporting integration and outfitting of the transit habitat and Mars surface missions. SNC's completely outfitted habitat provides all required functionality for the long-duration Mars mission and meets all NASA Human Integration Design Handbook guidelines for crew task volumes. After outfitting, our habitat provides over 145 cubic meters of habitable volume, ensuring the crew has adequate space to work and live comfortably during the roughly 1000-day Mars mission. SNC has completed extensive testing of our softgoods habitat design, including coupon level testing of the structural restraint layer, hypervelocity impact testing of the micrometeoroid shield, and burst and creep testing of one-third scale inflatable habitats. SNC has also developed a full-scale ground prototype of the LIFE habitat. The LIFE habitat prototype features a softgoods restraint layer, inner air bladder and outer micrometeoroid shield made of flight materials to demonstrate softgoods habitat construction techniques, habitat inflation and pressurized operations. The interior of the LIFE habitat consists of two fully functional floors that are outfitted with robotic workstations, life support systems, crew quarters, exercise equipment, galley, payloads and cargo to allow for crewed mission demonstrations. SNC and NASA performed day-in-the-life crew testing to evaluate the utility of the internal layout for expected crewed activities during a long-duration lunar or Mars mission.