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LAUNCH, ENTRY, LANDING AND EMERGENCY CREW SURVIVABILITY BEYOND THE SPACE SHUTTLE

Abstract

The term "crew survivability" in regards to spaceflight is a general term that includes everything that keeps a spacefarer alive mainly during launch, entry, landing, and emergency mission scenarios. Survival pressure suits and life support hardware directly interfacing with them make up this critical field. NASA has amassed a wealth of knowledge and lessons learned in crew survivability in the last fifty years of manned spaceflight, which has included tough lessons from three fatal accidents (Apollo 1 and the Space Shuttles Challenger and Columbia).

In response to the Challenger disaster in 1986, NASA implemented the Launch and Entry Suit (LES) for emergency survival protection in the Space Shuttle. This was replaced by the Advanced Crew Escape Suit (ACES) in 1995. The ACES is a full pressure suit that provides emergency survival protection for Space Shuttle astronauts during launch, entry, and landing phases of spaceflight. It provides open-loop life support for the crew during potential cabin depressurizations, pre-launch or post-landing egress, and orbiter bailout scenarios. The suit and ancillary support equipment provides liquid cooling, emergency breathing, and escape hardware to aid survivability through bailout and land/water egress events.

With the retirement of the Space Shuttle fleet and the expanded arena of space-access vehicles, both suborbital and orbital, as well as commercial and international, the demand for hardware and expertise in launch/entry/emergency crew survivability will see a massive increase in the coming years. An effort underway by NASA's Shuttle Crew Escape Engineering team has developed a modified-ACES prototype for potential utilization on future launch vehicles. The prototype includes novel modifications to the ventilation system, which turns the current open-loop life support system into a closed-loop system for oxygen resource savings. It also includes modifications to the Emergency Oxygen System, moving two high pressure oxygen cylinders from the crewmembers' backs to locations mounted to their legs for flexible integration with multiple seat platforms.

This paper will present the modifications specifically to the Advanced Crew Escape Suit, potential areas for technology development for future launch and entry suits based on lessons learned in the Shuttle Program and a strategy for applying existing NASA-certified crew survivability hardware to emerging space access organizations.