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Suitport Feasibility - Human Pressurized Space Suit Donning Tests with the Marmon Clamp and Pneumatic Flipper Suitport Concepts

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The suitport concept has been recently implemented as part of the small pressurized lunar rover (Currently the Space Exploration vehicle, or SEV) and the Multi-Mission Space Exploration Vehicle (MMSEV) concept demonstrator vehicle. Suitport replaces or augments the traditional airlock function of a spacecraft by providing a bulkhead opening, capture mechanism, and sealing system to allow ingress and egress of a space suit while the space suit remains outside of the pressurized volume of the spacecraft. This presents significant new opportunities to EVA exploration in both microgravity and surface environments. The suitport concept will enable three main improvements in EVA by providing reductions in: pre-EVA time from hours to less than thirty minutes; airlock consumables; contamination returned to the cabin with the EVA crewmember. Two second generation suitports were designed and tested. The previously reported second generation Marman Clamp suitport and a newer concept, the Pneumatic Flipper Suitport. These second generation suitports demonstrated human donning and doffing of the Z1 spacesuit with an 8.3 psi pressure differential across the spacesuit. Testing was performed using the JSC B32 Chamber B, a human rated vacuum chamber. The test included human rated suitports, the suitport compatible prototype suit, and chamber modifications. This test brought these three elements together in the first ever pressurized donning of a rear entry suit through a suitport. This paper presents the results of the testing, including unexpected difficulties with doffing, and engineering solutions implemented to ease the difficulties. A review of suitport functions, including a discussion of the need to doff a pressurized suit in earth gravity, is included. Recommendations for future design and testing are documented.

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