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# SPACE HABITAT DORMANCY TRANSITIONS: A SIMULATION-BASED INVESTIGATION OF ASSOCIATED CHALLENGES AND DESIGN CONSIDERATIONS

**Abstract**

With the success of the Artemis I mission and the planned future of the Artemis missions and beyond, NASA aims to reestablish a presence on the Moon. A sustainable lunar habitat will be a new horizon for mankind and a major stepping stone toward Mars exploration. This developing frontier will require a change in requirements from past lunar missions. With extended mission timelines, surface habitats and transit spacecraft will need to maintain operability through prolonged periods of uncrewed time. Reorganization and preparation of habitat assets during the transition between crewed and uncrewed states (and vice versa) will open up the habitat to previously unseen risks. In addition, establishing and confirming a livable interior environment and healthy system states prior to crew ingress will be essential steps in safe transition out of dormancy. In this paper, we leverage a computer space habitat model called the modular coupled virtual testbed (MCVT), developed for researchers and designers by the Resilient ExtraTerrestrial Habitats Institute (RETHi). Via simulations run in the MCVT, we investigate the unique challenges of habitat state transitions. Disruption scenarios such as fires inside the habitat and airlock failures are used to demonstrate how the conditions of transitions affect decision making in the response to hazardous states. We identify design requirements to ensure resilient transition protocol.