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TESTING FOR THE GROUND TEST AND ANALYSIS PROTOCOL FOR NASA'S NEXTSTEP
PHASE 2 HABITATION CONCEPTS

Abstract

The NASA Next Space Technologies for Exploration Partnerships (NextSTEP) program is a public/private partnership model that seeks commercial development of deep space exploration capabilities to support human spaceflight missions around and beyond cislunar space. NASA research engineers and subject matter experts developed the ground test protocol that will serve as the primary means by which these Phase 2 prototypes will be systematically evaluated. The purpose of a common ground test protocol for the Phase 2 Habitation Concepts is to consistently evaluate different commercial partner ground prototypes to provide data-driven, actionable recommendations for Phase 3. This paper describes the process by which the ground test protocol was validated through two internal human-in-the loop (HITL) habitation tests, subsystem standalone tests, and analyses conducted at NASA Johnson Space Center in 2018. HITL testing involved crews of four astronauts conducting multiday mission timelines that integrated all habitation operations (e.g., eating, sleeping, waste collection system operations, exercise), representative science and robotics tasks (e.g., low-latency teleoperations rover operations, sample return, life science, medical evaluations), and extravehicular activity, (e.g., airlock configuration, pre/post operations). Established subjective and objective metrics were collected and analyzed to validate the methods/techniques and provide an early indication of the types of data and actionable recommendations that can be made for Phase 3 of the NextSTEP program. This paper begins with a summary of NASA's deep space habitation plans, the goals of the NASA NextSTEP activity, and the process by which the ground test objectives were derived. It then details the strategic questions and hypotheses, and describes the HITL integrated tests that were conducted. Objective and subjective data collected from these assessments are presented with the intent of providing an example of the evaluation methodology that will be used for contractor habitation test article testing in 2019. Lessons learned for 2019 testing also are presented with the intent of improving the evaluations that will determine the acceptability of habitation element configurations and the combinations of capabilities that will result in the best habitation platform to be recommended by the test team for Phase 3.