

Initial Testing the Exploration Extravehicular Mobility Unit (xEMU) in Lunar Environment Simulation at the Neutral Buoyancy Lab (NBL) in 2022

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Understanding how to effectively train for Extravehicular Activities (EVAs) for Artemis missions is critical. Tasked by the new Extravehicular Activity and Human Surface Mobility Program (EHP), a team of stakeholders from engineering and flight operations worked together to test the Exploration Extravehicular Mobility (xEMU) in the Neutral Buoyancy Lab (NBL) simulating the lunar environment. The NBL is a pool in which astronauts are typically trained to complete simulated International Space Station (ISS) EVA tasks in a neutral weigh-out. The overall focus for this test series was evaluating how well the NBL could be used as an effective simulated environment for Artemis lunar EVAs. New NBL support hardware was manufactured to support this test series and update the interfaces to be more representative of xEMU hardware such as a new NBL Portable Life Support System (PLSS) mock-up and umbilical, lights and cameras, and display and control unit (DCU). To simulate the 1/6th-gravity (1/6-g) environment, extra weights were added around the suit to create an accurate center of gravity representation. The Partial Gravity Weigh-out Stand (PGWS) predicted where and how much weight would be required for the 1/6th-G simulation and predicted the center of gravity placement. After the weigh-out attempt was completed, the suited participant would complete a set of directed tasks such as kneeling, object pick-up, and walking to evaluate the weigh-out. To create the lunar environment, sand, boulders, and ramps were added to the pool floor. If time allowed after weigh-out was determined acceptable, the flight operations team would direct the suited participants to complete simulated Artemis EVA tasks using flight-like tools and tool cart. The team also evaluated turning out the overhead lights in the NBL for a portion of some of the test runs and using a solar simulator to create a more realistic lunar south pole lighting environment. The test series completed one unmanned test and nine manned tests. With four of the tests, dual xEMU suited operations were completed with subjects in both the small and large xEMU sizes. Overall, the NBL was able to create an acceptable lunar landscape and ability to have two subjects work side by side in pressurized xEMUs which currently cannot be achieved in other test environments. Achieving a stable 1/6th-G lunar weigh-out and clear, consistent dual suit communications was a challenge for this series. Future work is planned to continue to improve this simulation environment.