

Phase VI Glove Durability Testing

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The current state-of-the-art space suit gloves, the Phase VI gloves, have an operational life of 25 – 8 hour Extravehicular Activities (EVAs) in a clean, controlled ISS environment. Future planetary outpost missions create the need for space suit gloves which can endure up to 90 – 8 hour traditional EVAs or 576 – 45 minute suit port-based EVAs in a dirty, uncontrolled planetary environment. Prior to developing improved space suit gloves for use in planetary environments, it is necessary to understand how the current state-of-the-art performs in these environments. The Phase VI glove operational life has traditionally been certified through cycle testing consisting of ISS-based tasks in a clean environment, and glove durability while performing planetary EVA tasks in a dirty environment has not previously been characterized.

Testing was performed in the spring of 2010 by the NASA Johnson Space Center Crew and Thermal Systems Division to characterize the durability of the Phase VI Glove and identify areas of the glove design which need improvement to meet the requirements of future NASA missions. Lunar simulant was used in this test to help replicate the dirty lunar environment, and generic planetary surface EVA tasks were performed during testing. A total of 50 manned, pressurized test sessions were completed in the Extravehicular Mobility Unit (EMU) using one pair of Phase VI gloves as the test article. The 50 test sessions were designed to mimic the total amount of pressurized cycling the gloves would experience over a 6 month planetary outpost mission. The gloves were inspected at periodic intervals throughout testing, to assess their condition at various stages in the test and to monitor the gloves for failures. Additionally, motion capture and force data were collected during 18 of the 50 test sessions to assess the accuracy of the cycle model predictions used in testing and to feed into the development of improved cycle model tables.

This paper provides a detailed description of the test hardware and methodology, shares the results of the testing, and provides recommendations for future work.