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HUMAN EXPLORATION OF THE SOLAR SYSTEM SYMPOSIUM (A5)
Human Exploration of Mars (2)

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PERFORMANCE AND DESIGN REVIEW OF AN INTEGRATED INFLATABLE LUNAR MARTIAN ANALOG HABITAT (LMAH): TEN DAY INITIAL FEASIBILITY STUDY

Abstract

With funding provided under a NASA grant and encompassing three years of research and development, the University of North Dakota's (UND) Human Spaceflight Laboratory (HSL) completed an analog planetary prototype base including an inflatable habitat, a pressurized electric rover, and two full pressure space suits. This integrated system was fully designed, constructed, and tested by faculty and graduate students at the University of North Dakota. An initial ten day habitation study was executed with three crew members selected among the graduate students of UND's School of Aerospace Sciences to test the feasibility for long duration use of this integrated planetary exploration system. This paper reviews the development of the habitat and associated elements, as well as findings from this initial study highlighting the habitability, overall system performance, and current research capabilities. This planetary analog system has been developed to allow for easy crew access to the various components within the system while maximizing the performance capabilities. Continuity of pressurization throughout the habitat, electric rover, and planetary suits is maintained through various port and airlock systems. These systems provide a level of protection against outside contamination and decrease preparation times for extra vehicular activities (EVA). The inflatable module is composed of a pressurizable membrane, and an internal rigid frame that provides structural support for the living quarters and sustains the habitat's structure during depressurization events. Based on the results from this initial study the system is now ready to undergo a thirty day closure test with some minor modifications to increase the habitat's habitability for long duration missions. The habitat's mobility is a unique attribute and allows for the testing of multiple planetary analog environments. Through this mobility, multiple opportunities exist for extended research in analog human planetary exploration. These opportunities range from human factors to engineering to planetary technologies and are vital components to developing a sustainable presence beyond LEO. Planetary exploration will require extensive research into the effects on humans during long duration analog simulations. During the initial study, the LMAH modular nature provided an increase in EVA capabilities while also increasing protection measures for crew safety. This work will include preliminary results from the ten day simulation and overviews of the entire system, as well as cooperative research opportunities.