Paper ID: 39892
oral
student

SPACE LIFE SCIENCES SYMPOSIUM (A1)
Life Support, habitats and EVA Systems (7)

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CONSTRUCTING A FULLY FUNCTIONAL PLANETARY BASE ON EARTH

Abstract

In today's era of the expanding opportunities for space exploration and the influx of new technology development, inexpensive and readily available testing and training facilities are a necessity. Analog facilities operated by government space agencies offer the necessary lab equipment, but current systems are more suited for deep space travel simulations without extravehicular activities (EVAs). Although private or academy-owned space analogs like HI-SEAS or the MDRS offer unique analog environments, they do not have available space for extensive scientific experimentation and are based on the same vertical design, which may be ineffective for planetary surface exploration.

Faculty and graduate students of the Department of Space Studies at the University of North Dakota have paired up with NASA and the Experimental Program to Stimulate Competitive Research (EPSCoR) to design and build a multipurpose planetary research facility. The project began with the construction of the Inflatable Lunar/Mars Analog Habitat (ILMAH) in 2013 with the capability to house four crewmembers for 30-day simulated missions with EVA exploration capabilities. Past research projects investigated microbial succession, plant growth, and crewmember stress/mental health, among others.

Due to its fairly isolated location in a frigid climate, the ILMAH has proven to be an appropriate Earth-based equivalent to a Moon/Mars mission. Therefore, four additional modules are being added to support new scientific initiatives, and increase simulated mission durations up to six months. These new centers will support plant growth, EVA preparation, human health and performance, and geology experimentation.

The plant production module will be available for crewmembers to grow and consume vegetables during their stays. Researchers will be able to alter the environmental conditions and monitor them remotely. The EVA module will allow for testing of new spacesuit designs and life support equipment. The exercise and human performance module will be available to keep researchers healthy throughout their stay, but will also serve as an area for testing of new physiological or biological solutions to support life on a planetary surface. The geology module will provide additional space for testing of new sample analysis methods or maintenance of sampling tools.

Students at the university have been assisting in the design and construction of the additional modules while conducting continuous structural stress and safety analyses. With the additional installments to be completed in 2018, the UND Space Studies department plans to provide continuous simulations to support a myriad of experiments and make full use of the complete analog facility.