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Moon, Mars and Beyond: Analogues, Habitation and Spin-Offs (2)

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ASSESSING HABITAT DESIGN: THE HABITABILITY FACTOR OF CURRENT MARS ANALOGUE ENVIRONMENTS

Abstract

Introduction: Habitat design is even more important today as private and government sectors pursuing space exploration progress towards long duration and interplanetary space missions. However, there is a gap in the research that assesses the design of habitats already in use or future designs. An objective assessment tool is needed for the benefit of future human spaceflight development. The purpose of this study was to evaluate the effect of a habitat's design on a crew member's well-being and their perception of the habitat environment. This assessment focused solely on the interior features of the habitat and the following habitability factors were examined: environmental factors, interior design, and habitat architecture.

Method: A seven-person team conducted a simulation mission early in the 2013 field season of the Mars Society's Mars Desert Research Station in Utah, USA. Six crew members participated in assessing the design of the habitat by completing the Habitability Assessment Questionnaire (HAQ) and submitting to flexible interviews discussing their perception of the habitat environment. The HAQ was created for this study using environmental descriptive adjectives collected from previous research and thought to be representative of the conditions found in the habitat. Verbal and non-verbal commentary, and self-reported observations made by the team about the habitat environment were also recorded. Participants were also administered the Profile of Mood States (POMS) metric to detect fluctuations in emotional state as the mission progressed.

Results: Significant differences were found in the ratings of environmental factors using non-parametric approaches. Elements such as temperature, odor, sound, lighting, and ventilation were shown to have a detrimental impact on habitability. Even though color did not result in a significant effect, crew member reports revealed negative observations about the colors of the habitat, specifically in crew quarters. Items not included in the HAQ, such as an assessment of the sleeping compartments, surfaced at the end of the mission. The POMS profile has shown variability among individual crew members.

Conclusions: Differences in perception of the Mars simulation environment are discussed including design recommendations for future habitats. The inclusion of an expanded HAQ as an objective assessment tool is explored for future simulations and long duration space mission design. Results of this research are beneficial to the interdisciplinary effort of human factors specialists, engineers, and architects for the successful development of human habitats.