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HABITAT DESIGN CONSIDERATIONS FOR PROMOTING CREW HEALTH AND INTERACTIONS

Abstract

Human settlement beyond Earth will require significant consideration of habitat design and mission architecture. As a result, several analog projects have been developed to study the effects of living and working in a habitat to develop best design practices. One of these analogs, the Hawaiian Space Exploration Research Analog (HI-SEAS), recently completed their fifth mission. Two Mission V participants collected first-hand observations rooted in crew perspectives to evaluate how habitat design choices may affect crew interactions. Subtleties in structures, systems, and schedules can affect crew-crew and crew-ground interactions. This paper explores habitat design aspects, analyzes their perceived effects, and suggests improvements and considerations for future analog projects.

HI-SEAS Mission V was an 8-month analog Mars mission conducted on the slopes of the Mauna Loa volcano. HI-SEAS is primarily a psychological study conducted to understand challenges that future Mars astronauts may face in order to better select crews and to create mitigations for potential issues. During the mission, 6 volunteers acted as astronauts to run experiments, conduct geological research, and collect stress data. Crewmembers lived isolated and communicated with 20-minute delays. EVAs were conducted with suits, power was generated with dedicated solar panels, and food was comprised of shelf-stable and dehydrated foodstuffs. This paper focuses specifically on observations made in this analog, which is limited to approximation of an actual extraplanetary environment.

Organization of habitat structures and schedules appear to have an impact on crew by influencing environmental perception, feelings of security, and encouraging crew interactions. These design considerations are worth investigating, given their potential utility in passively encouraging positive crew interactions and promoting health.

Partitioning space can change perception of an environment's size and accessibility. Variety of areas encourage compartmentalization of mental spaces within physical ones, and private quarters allow for a sense of privacy. Sound isolation enables crewmembers to speak openly with family and medical support.

Occupation of physical space is intertwined with schedules and tasks. Tasks influence crew proximity and directly open and close opportunities for crew conversations that may build relationships or allow time for conflict resolution. Scheduling time with ground support and family is equally important in being able to solve issues efficiently given communication delays, and to protect personal and family interaction time.

This paper explores these various design considerations in organization of habitat space and schedule from an analog crew's perspective, and make suggestions for future habitats and analogs.