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SELENE III: CHALLENGES AND LESSONS LEARNED DURING AN ANALOG LUNAR MISSION
AT THE HI-SEAS RESEARCH STATION.

Abstract

The Selene III mission was a two-week lunar analog mission in 2021 at the HI-SEAS simulated space research station. HI-SEAS consists of a 12-meter dome with private, research and technological workspaces on the Mauna Loa volcano in Hawai'i, at an elevation of 2500 meters. Missions at HI-SEAS are run by the International MoonBase Alliance. The Selene III analog study consisted of a six-person crew living in a simulated lunar environment. Crewmembers came from a variety of backgrounds, including engineering, scientific and humanities areas of expertise. They are all also of nationalities and in different stages of their professional careers. The individual scientific projects of the crewmembers were focused on studying bioregenerative life support systems, human connectivity, topographical characterization and other impromptu projects that became relevant during the crew's stay at HI-SEAS. Throughout the mission, the crew's experience was communicated to the public, underscoring the parallels of the experience with the future human space exploration. Each project had to be performed with inherent restrictions related to the architecture of the station and specific challenges presented to the crew during the mission. Some of these restrictions were the availability of power, water usage, specific research supplies, food in quantity and diversity, as well as the access and availability of information and communication from Earth. Due to its location, more extreme weather conditions in terms of humidity and temperature were present. For the Selene III mission, the major challenges outside of the inherent ones was the unfavorable weather, which reduced the solar power generation and prevented some of the research activities to take place as scheduled, such as the extra-vehicular activities. The station also posed challenges related to human factors for the crewmembers. Due to its remote location, the station enforced both physical and social isolation from external sources, as well as confinement, which reduced privacy. The resource allocation introduced challenges related to hygiene, communication restrictions and time management, which highlighted the need for crew collaboration. In conclusion, analog missions provide valuable experiences to help better understand and prepare for the future human space exploration. The lessons learned can be grouped in three categories. First, as individuals, a better appreciation of resources and social accessibility. Second, as professionals, the requirement for additional planning, time and material management, as

well as adaptability for efficacious outcomes. Lastly, as a crew, diversity and open mindedness was key for the success of Selene III mission.