

Geological field activities at the HI-SEAS planetary surface analog mission simulation in Hawai'i

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Abstract. The Hawai'i Space Exploration Analog and Simulation (HI-SEAS.org) program studies team function and performance on long duration exploration missions conducted in a remote habitat located on Mauna Loa, Hawai'i. The basaltic terrain and sparse vegetation of the site make it a good geologic analog to the Moon or Mars, and since the site is accessible year-round, it allows for longer-term isolation studies than other analog locations. HI-SEAS missions are comprised of six crewmembers who live in the habitat and interact with a mission support team remotely via an imposed 20-minute communications delay to provide Mars-like operational latencies. After a successful first mission lasting four months in 2013, NASA awarded HI-SEAS three years of additional funding to explore themes surrounding crew autonomy on missions of increasingly longer durations up to twelve months. The second four-month mission began on 28 March 2014.

HI-SEAS crewmembers spend their time taking part in a number of research studies. Some of these activities require them to leave the habitat and conduct pedestrian extra-vehicular activities (EVAs) while wearing simulated space suits to approximate the encumbrances astronauts would face while conducting such excursions. One goal of HI-SEAS is to compare crew performance as missions increase in length, and to meet this objective a team of geologists works with a team of psychologists to develop geology-related tasks for the crew to complete in the area surrounding the habitat. The team-oriented tasks are designed to be gradable with quantifiable metrics so that meaningful conclusions about crew performance can be drawn.

The tasks, which are given in the context of resource exploration and environment characterization, are presented in a progressive fashion so that each activity builds upon the previous one. First, features or areas of interest are identified in aerial imagery. The crew is then asked to scout these features on the ground and characterize their properties. This could take the form of measuring dimensions of a skylight, mapping flow units, collecting rock samples, or analyzing the samples using equipment in the habitat's laboratory. The HI-SEAS geology team evaluates how accurately the crew is able to accomplish these tasks compared with known values.