

## EMM IMA HI-SEAS campaign February 2019

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### Abstract

The Hawaii - Space Exploration Analog and Simulation (HI-SEAS) habitat is located at 8,200' (2,500 meters) in elevation on the largest mountain in the world, Mauna Loa, on the Big Island of Hawai'i. As of 2018, the International Moonbase Alliance (IMA), an organization dedicated to building sustainable settlements on the Moon, has been organising regular simulated missions to the Moon, Mars or other planetary bodies at HI-SEAS. The constraints for these missions depend on which planetary body the mission is simulating to be on. For instance, for lunar missions the time delay in communications is only of a few seconds, which is nearly negligible for EVAs and other activities. In 2019, the EuroMoonMars campaign was launched at HI-SEAS, bringing together researchers from the European Space Agency, VU Amsterdam, the International Lunar Exploration Working Group (ILEWG) and IMA. Six scientists, engineers, journalists and photographers spent two weeks at the HI-SEAS station performing research relevant to both the Moon and Mars there. The campaign aims to increase the awareness about the research and technology testing that can be performed in analogue environments, in order to help humans become multiplanetary species. Furthermore, the research and technological experiments conducted at HI-SEAS are going to be used to help build a Moonbase in Hawai'i, and ultimately to create an actual Moonbase on the Moon, as part of IMA's major goals.

### 1. Introduction

HI-SEAS has been the home to five successful long duration (4 to 12 month) NASA Mars simulation missions since 2013. A HI-SEAS Mars mission involved six person crews being isolated from the

rest of humanity for long periods of time. While in the simulation, communications with "Earth" were delayed by up to 20 minutes each way to simulate Mars being on other side of the Sun from Earth. When the crew left the HI-SEAS habitat, they wore analog space-suits and they went through full extra vehicular activity (EVA) protocols to perform their research in the simulated Martian terrain. HI-SEAS has also been used to perform multiple shorter duration lunar simulated missions, in collaboration with diverse organisations and companies worldwide.



Figure 1: The EMM IMA HI-SEAS campaign crew before the mission start on February 20th 2019.

### 2. Transition to Moon missions

IMA has been organising simulated missions to the Moon at HI-SEAS since 2018. These missions can be of shorter duration, from several days to several weeks, depending on the needs of the researchers. They are open to space agencies, organisations and companies worldwide to take part in, provided their research will help contribute to the exploration of the

Moon and Mars. The research can involve scientific experiments, human based studies and technology testing. The crews will be supported by a mission control centre based in Hawai'i as well.

### **3. EuroMoonMars IMA HI-SEAS campaigns**

As of 2019, a series of EuroMoonMars IMA HI-SEAS missions will be taking place at HI-SEAS. These missions are under the EuroMoonMars initiative, led by the International Lunar Exploration Working Group (ILEWG) of the European Space Agency (ESA), in collaboration with IMA, European Space Research and Technology Centre (ESTEC) and Vrije Universiteit (VU) Amsterdam. These missions involve performing geological research, technological tests using drones and several outreach and educational projects. This includes an experiment designed by high school students in Slovakia, organized by HI-SEAS director Dr. Michaela Musilova, focused on fertilising soils using human hair from the crew.

### **4. Future plans**

The results of the research and technological experiments conducted at HI-SEAS are going to be used to help build a Moonbase in Hawai'i, and ultimately to create an actual Moonbase on the Moon. Future missions at HI-SEAS include more EuroMoonMars IMA HI-SEAS missions, collaborative missions with ESA, NASA, University of Hawai'i, University of South Florida and with companies, such as SIFT and Ketone Technologies.



Figure 2: The EMM IMA HI-SEAS I crew performing geological research.

### **5. Getting involved**

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