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Author: Ms. Priyanka Das Rajkakati
ISAE-Supaero University of Toulouse, France

Mr. Marc Heemskerk
VU Amsterdam, The Netherlands
Dr. Michaela Musilova
International MoonBase Alliance, United States
Prof. Bernard Foing
ESA/ESTEC, ILEWG & VU Amsterdam, The Netherlands

EMMIHS-III: EUROMOONMARS- INTERNATIONAL MOONBASE ALLIANCE-HI-SEAS SIMULATION CAMPAIGN

Abstract

The present abstract presents the results and discussions of the EMMIHS-III campaign, which took place between 18th January – 1st February 2020 at the HI-SEAS Habitat on the Northern slope of the Mauna Loa Volcano (Hawai'i, USA).

The International Lunar Exploration Working Group (ILEWG) is a public forum sponsored by the world's space agencies (including NASA and ESA) to support international cooperation towards the exploration and utilization of the Moon. As part of research efforts towards the colonization of the Moon and creation of a Moon Village, ILEWG founded the EuroMoonMars initiative, which comprises of field campaigns in Moon-Mars analogue environments. The EMMIHS campaigns are a collaboration between EuroMoonMars, the International Moonbase Alliance (IMA) and the Hawaii - Space Exploration Analog and Simulation (HI-SEAS) and consist of scientific research, field tests, training and outreach activities.

EMMIHS-III is the third mission in the program and consisted of a crew of 6 (3 males and 3 females, all under the age of 32). The mission focussed on scientific research on robotics and lava-cave exploration techniques. Firstly, a magnetometer from GeoMetrics was used to read the magnetic profile of the subsurface, notably mapping the absence of magnetic conductors in the iron-rich basalts of Mauna Loa, which was then used to deduce the structure of the lava tubes. This was then verified through analogue-astronaut-style expeditions inside the lava tubes, and several new lava tubes were hence discovered and successfully mapped. An RGBD-D (depth-sensor) camera was tested for usability inside the low-light environment of lava tubes. Other studies regarding metallic material sciences in inter- and intra-habitat conditions, as well as sintering basalt at high altitudes to test the viability of sintering on the Moon and Mars, were also conducted.

Furthermore, the crew tested three rovers for studies on autonomous navigation and experimental human-robot interface: notably, a rover loaned by the Pacific International Space Center for Exploration Systems (PISCES), the Rover of EuroMoonMars (REMM) and the Zebro rover developed at the TU Delft. In addition, several human-factor experiments and tests on crew psychology and crew dynamics were implemented, including medical wellbeing of the crew derived by basic body measurements such as heart rate and blood pressure. Finally, the crew performed outreach activities and proposed novel methods of water conservation (officially termed as the most water-efficient crew at HI-SEAS), emergency protocols and waste-limitation, which are active areas of research towards developing a sustainable Moon Village.