

EGU21-16189

<https://doi.org/10.5194/egusphere-egu21-16189>

EGU General Assembly 2021

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CHILL-ICE: On-site Preparation for an Analogue Mission in Iceland

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CHILL-ICE (Construction of a Habitat Inside a Lunar-analogue Lava tub - Iceland Campaign EuroMoonMars) is focused on a safe and efficient preparation for future lunar human settlement for research, communication, and commercial purposes. In order to do so, a team of Early Career Scientists from EuroMoonMars will set up an analogue mission in the Stefánshellir lava tube on Iceland. The goal is to develop a prototype space habitat that can be transported into and set up in the lava tube by three (3) analogue astronauts; this means that they will be limited in their field of vision, have limited movement, have more momentum and a 'bigger body' to work with, and they will have limited amounts of time (in sim: 'Oxygen') available. Within eight (8) hours, they will need to set up the habitat and communication systems to give Mission Control (MC) the all-good. Failure to do so results in the termination of the mission and the analogue astronauts will be picked up again and transported back to MC.

In the scenario where the crew has complied with these mission objectives, they will spend two consecutive nights in the base and focus the rest of their time on research EVA's. These EVA objectives include: Robotics and rover operations, solar system observations, telecommunications, (RAMAN-)spectrometry, astrobiology, lava tube flow stratigraphy, and UAV-protocolling. To ensure an overall campaign success, there will be two of these short analogue astronaut campaigns, with a period of two days in between to adjust protocols where necessary and exchange information and lessons learned.

As a preparation for CHILL-ICE, there have been two earlier EuroMoonMars missions to Iceland to investigate the possibility and feasibility of an Icelandic lava tube campaign. In September 2018, we have scouted several locations to see what lava tube or lava field would be the optimal fit in terms of size, reachability, tourists or remoteness, medical support locations, earlier damage to the natural environment, and proper entrances. The decision was made to go to the Hallmundarhraun lava field, a 2-hour drive towards the Northeast of Reykjavik, the capital of Iceland. During an envoy mission in June 2020, we focused on specific lava tubes within this lava field, including Vidgelmir, Surtshellir, and Stefánshellir, where the choice was eventually made for the latter. The easternmost gallery of the Stefánshellir lava tube proved to be both wide and high enough to construct a habitat in, with a relative safe entrance via the skylight, reasonable natural lighting and airflow, connection to a larger subsurface system for astronomical and robotic exploration, and previous damage to the cave made it easier to get permits.

The current field campaign is planned from the 24th of May until the 6th of June and will also focus on (inter)national outreach and act as a basis for the national Icelandic space sector and their international relations.

We would like to thank the previous EuroMoonMars teams for their support during this and the previous missions, as well as Spacelceland, the IcelandicSpeleologicalSociety and our many other partners.