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RESEARCH OVERVIEW OF THE CHILL-ICE 2 CAMPAIGN, AUGUST 2022, HALLMUNDARHRAUN, ICELAND

Abstract

Space missions, especially those with a human component, tend to be prohibitively expensive, involving high risk, and therefore requiring multiple years of intensive preparation. This makes human space missions often unreachable for smaller space-faring nations, research organisations, or universities. Analogue astronautic missions on Earth sprung out to be an alternative to recreate astronauts' extra-terrestrial living conditions and to develop future research methods to be conducted in space. Three such research objectives were envisioned for the CHILL-ICE 2 (Construction of a Habitat Inside a Lunar-analogue Lava tube in ICEland) mission, organised by ICEE.Space. Experiments in geology, infrastructure development, and technological innovations were successfully conducted as part of a seven-day simulation mission, inside the Surtshellir lava tube in Iceland. The overall aim of CHILL-ICE 2 was to assess the suitability of the lava tube for long-term settlement. Seven community experiments and two internal experiments were conducted by a crew of three analogue astronauts (AAs), two reserve AAs, and the mission control centre (MCC) team. The community experiments of ENTRANT, PORIS, Search-and-Rescue, High performance teams, Vigilance, ANICE, and Lunar Zebro were geared towards specific research objectives. The ICEE.Space experiments were put in place for in-situ assessment for the modified ECHO habitat and BORP analogue space suits. ENTRANT measured the Stress Entropic Load (Zlámal et al., 2018). The PORIS instrument incorporates a microbolometer imaging array as a detector, which can be used to find silicate minerals and carbonates and do a scan of its surroundings, even in low-light environments. The Search-and-Rescue mission was a simulation of an emergency scenario to analyse the psychological, cognitive, and social performance aspects of the astronauts' behaviour. High performance teams was a

psychological experiment to assess emotional intelligence as an ability and analyse the role of cognitive and affective empathy under stress. Vigilance testing was done multiple times a day to test the vigilance levels of the AAs. ANICE was a dietary research to assess the physiological and psychological impact of AA's food intake. Lunar ZEBRO brought in a lunar exploration rover for each of the AAs, to assist them in their routine tasks. The modified ECHO habitat was tested for its in-situ sustainability for extreme humid and cold environmental conditions, and the BORP suits were tested for their improved ventilation, ergonomics, and the SCOUT HID on HoloLens2. All experiments were conducted successfully, with results presented in the internal mission report, and in the full paper of this abstract.