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APICES (ASTROLAND PROJECT INSIDE CAVES FOR EARTH-BASED SPACE EXPLORATION): A 130-HOUR SUBSURFACE ANALOGUE ASTRONAUT MISSION

Abstract

Exploration – and specifically human exploration – of the Moon and Mars has been of interest for many years. However, these missions possess significant risks which might be mitigated through testing the technology in terrestrial space analogues. One such analogue is the Ares station of the Astroland Interplanetary Agency in Santander, Spain coordinated by European Moon and Mars. The station serves as a scientific lab, training facility, and analogue of Mars.

The overarching objective of APICES is to assess and expand the in-house competencies of the ESA BIC Czech Republic based start-up ICEE.Space, with the goal to create standard and adaptable missions at new sites with a range of diverse natural environments. ICEE.Space mostly focused on subsurface analogue missions in lava tubes, such as the CHILL-ICE mission campaigns (three analogue missions in 2021 and 2022), with several publications already online. The APICES mission will have the advantage of an existing infrastructure, habitat, equipment, control center, and ongoing legacy missions in the cave. A key difference to previous missions and campaigns hosted by ICEE.Space is the greatly reduced on-site Mission Control Centre (MCC) crew of 6, that will be responsible for the execution of the tasks and accomplishing on-site mission objectives involving 7 Analogue Astronauts (AA) - versus a ratio of 25:3 (MCC:AA) for CHILL-ICE missions. Assessing and comparing the large and completely in-house CHILL-ICE missions with the reduced collaborated APICES mission, will give a good baseline for future optimization of processes, reusability, and scalability for ICEE.Space. The research objectives of APICES will be threefold and presented at the IAC 2023: Geobiological and Microbiological Research,

Infrastructure Tests Human Research, and Technological and Protocol Innovations. The mission will assess the influence of human presence on the microbiome of the karst caves near Arredondo, where the Astroland missions take place. These experiments have the long-term goal to be repeated in future ICEE.Space campaign locations, to help optimize the protocols that ICEE.Space plans to use it for geobiological and microbiological research - and for preservation and anti-contamination procedures of future lunar and Martian lava tubes. Infrastructure and human research tests will include testing the updated version of the EXTAR communication platform, along with using the communication content for psychosocial aspects and team dynamics assessment. Lastly, Technological and Protocol Inventions will include adding additional functionalities to the existing Astroland suits to test new visual and interactive technologies and brain-computer-interface (BCI) with Lunar Zebro rovers.