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CAVES 2019: ESA ASTRONAUT TRAINING IN SLOVENIA

Abstract

Long-term human space exploration is challenging, and requires significant preparation and planning to be successful. Recreating aspects of the space environment on the ground is essential for adequately preparing astronauts for space. Cave systems impose several stressors that are analogous to space exploration environments, such as the absence of natural light, isolation, confined spaces, limited hygiene and comforts, lack of common reference points, and three-dimensional progression requiring significant safety considerations. CAVES (Cooperative Adventure for Valuing and Exercising human behaviour and performance Skills) uses natural cave systems to train astronauts in expeditionary and human behavioural performance skills to help prepare them for space exploration. The course lasts approximately three weeks, including a six-day self-led expedition inside a cave system. Much like preparing for a space mission, trainees must learn new sets of mental and physical skills over a relatively short space of time, and then work together in a multicultural team to implement these skills in an environment with real-perceived risk. CAVES has been running since 2011, and has trained 34 astronauts from Europe, US, Japan, Russia and China. In 2019, the course ran for the first time using a new location in Slovenia's historic Karst region. Six astronauts took part in this edition of the course, one from ESA, two from NASA, one from CSA, one Roscosmos, and one from JAXA. During their six-day self-led expedition into the cave system, trainees successfully lived in, explored, mapped and documented a portion of the cave system. They also conducted real (non-simulated) scientific tasks, including collecting fauna from the cave system to examine biodiversity, sampling and analysing water, monitoring atmospheric gases and aerosols, collecting samples of microbial mats, and performing sampling to examine the extent of human contamination in the cave system through looking at micro-plastics. The scientific and mapping data was collected using a system called the Electronic FieldBook (EFB), which provides trainees with the ability to record science experiments and sampling sites, and then collect and associate images, notes and data from external sensors to those sites. Additionally, the system automatically distributes this information to the surface teams, which enabled them to examine science results, monitor exploration progress, and provide feedback to the trainees in the cave. The feedback provided by trainees on 2019's CAVES was very positive, and future iterations of the course will continue to be enhanced by including cutting-edge planetary exploration tools.