

IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM (A1)
Interactive Presentations - IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM (IP)

Author: Dr. Francesco Sauro
University of Padova, Italy

CAVE EXPLORATION AS ANALOGUE FOR HUMAN SPACEFLIGHT: THE ESA CAVES
TRAINING PROGRAMME

Abstract

Caves represent one of the last exploration frontiers on planet Earth. Like human spaceflight, speleological exploration imposes isolation, confinement, minimal privacy, technical challenges, limited equipment and supplies, a sense of disconnect from the surface and regular life, a lack of diurnal cycles, and the constant presence of risk. Leveraging these analogies, since 2011 the European Space Agency (ESA) started an astronaut training programme named CAVES (Cooperative Adventure for Valuing and Exercising human behaviour and performance Skills), using cave exploration as an analogue to space mission. During six editions of CAVES, from 2011 to 2019, 34 astronauts from 6 different space agencies (ESA, NASA, JAXA, ROSCOSMOS, CSA, and CNSA) have taken part in the training. The primary objective of CAVES is to enhance astronaut behavioural competencies for improved individual and team performance by exposing them to the challenges of a real mission into an unknown and potentially dangerous environment. To achieve this, the course's training activities are based around a real expedition focused on cave exploration and science. The programme leverages cave exploration to create situations that are analogous to spaceflight in terms of safety protocols, perception and management of risk, crew composition and role assignments, group living, isolation, and confinement. The scientific and exploration aspects of the course are real (not simulated), enhancing the training by motivating the crew and contributing to human knowledge of cave environments. CAVES employs modern tools such as the Electronic Fieldbook to enable high quality scientific information to be gathered and shared with a remotely located support team for feedback during the mission, enhancing the simulation aspects of the training. Despite its complexity, CAVES maintains a strong focus on cave conservation, ensuring the natural environments used for its activities are preserved. Feedback on CAVES from participating astronauts from different international agencies has assessed the course as one of the best space analogue experiences available. The benefits of the training are applicable to both future orbital and surface spaceflight missions.