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LESSONS LEARNED FROM THE FIRST STUDENT-LED SAPIENZA GEA CAVE EXPLORATION ANALOG MISSION

Abstract

Future manned exploration missions on Moon or Mars will for sure consider the lava tube or underground environments on the explored celestial bodies for settling the future human bases. Among the rising number of analog missions, e.g. missions that replicate parts of a space exploration mission with focus on the human interactions with the mission environment and tools, the new concept of underground and cave exploration analog missions is set to exploit the capabilities in underground habitats.

It is of great importance to involve students in similar activities due to the skills that can be gained throughout the preparation and execution of an analog mission in the perspective of a potential future involvement in the engineering of a human space exploration mission in the future.

Sapienza GEA (Gruppo Esplorazioni Analoghe, Analog Explorations Group) is a cave analog mission project carried out by Sapienza University of Rome (S5Lab research group), together with CAI-Roma (Italian Alpine Club, Rome's chapter) for the development of a student-led analog exploration mission in the caves near Rome. The project aims at training twelve post-graduate students to develop sufficient capabilities for leading speleology activities and to succeed in a 72-hours analog mission in a cave. Several research groups are participating with small experiments developed and performed in the analog habitat by the participating students. Some of the experiments are related to habitat exploration and mapping, autonomous cultivation of vegetables, resources monitoring and human physiology.

The main lessons learned from the set-up of this project are related to the confidence gained by students with an extreme environment, where transporting resources and tools is complex and where even simple tasks are relatively hard to complete. Their first approach to clear writing of operational procedures and rehearsals of scientific operations is often difficult and it largely benefits from the experience of former missions participants or expert cavers. The participation in such a project of space engineering students can mark their first steps into operations that are largely conditioned by human factors and human interaction.

This paper will describe the lessons learned on the development of the first exploration mission of the Sapienza GEA project. Lessons learned from the operational framework, the selected analog mission habitat and the preparatory work on the mission and on the experiments to be performed will be described, as well as the perspectives for the future of a similar infrastructure for the future.