IAF SPACE EXPLORATION SYMPOSIUM (A3)
Moon Exploration – Part 3 (2C)

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LUNAR ANALOGUE FACILITIES DEVELOPMENT AT EAC: STATUS OF THE LUNA PROJECT

Abstract

In view of the future missions to the Moon and in the framework of the Moon Village vision, the European Space Agency (ESA) and DLR (German Aerospace Centre) are increasingly focused on investigating on how to expand from LEO human spaceflight to planetary exploration. A new era of coordinated human and robotic exploration is expected to begin with the construction of the Lunar Orbital Platform-Gateway (LOP-G), which will lead to a return of humans to the lunar surface. In this context, the European Astronaut Centre (EAC) and DLR, co-situated in Cologne, Germany, are preparing for future manned exploration by conducting Earth-based analogue and preparatory activities. We focus herein on two lunar analogue facilities that are currently under development at the Cologne campus: LUNA and FLexible EXploration Habitat (FLEXHab), currently under development to complement existing campus analogue facilities such as :envihab and the Neutral Buoyancy Facility (NBF). LUNA is an artificial lunar analogue facility that consists of a hall-type structure containing a regolith testbed. A large volume regolith simulant, EAC-1, will be used to recreate facsimile of a lunar terrain, while illumination conditions can be varied to recreate different Moon conditions. Attendant to the LUNA facility is the habitation module FLEXHab, hosting up to 4 crewmembers for 1-day missions, and providing direct access to LUNA. It is planned that the FLEXHab will utilize a stand-alone power system built around hydrogen technology (fuel cells, electrolyzer, batteries and photovoltaics) for its energy supply. Strong synergies exist with current analogue facilities at DLR :envihab and the NBF. For example, the DLR :envihab provides an infrastructure in which astronauts can sleep, eat and work under environmentally controlled conditions, even possible under isolation. Within the LUNA testbed, specific mission scenarios can be simulated for astronaut training, including testing of geological/seismic regolith characterization techniques, In Situ Resource Utilization (ISRU) technologies, development of mining methods, rock formation mapping and storage, methods of biological and chemical analysis of soil samples, telerobotics,

and Extra Vehicular Activity (EVA) preparation. The LUNA facility will be a flexible, evolvable, and unique exploration enabling asset to address the hurdles posed by future manned and robotic exploration. Moreover, external partners such as European research centres, universities, and private companies will be welcome to use the facilities and propose their own experiments on a low barrier for entry basis. The full operational capability of LUNA and FLEXHab is expected for early 2021.