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LUNA AND THE NEXT GENERATION OF GROUND SEGMENT TECHNOLOGIES

Abstract

The LUNA – European Exploration Laboratory is a joined project of ESA (EAC) and DLR (Raumflugbetrieb) with the aim to build a moon analog environment for test and simulation of future extraterrestrial exploration missions and technologies.

The design of the building has been completed and construction work is expected to start in spring 2022 with an expected completion end of 2022.

At the IAC 2019 we presented principal ideas and requirements for a LUNA ground segment with the paper *LUNA – Considerations For An European Ground Segment for ESA's And DLR's Test Bed For Exploration*. This current paper will, based on the conclusions from 2019, present further details and envisaged solutions.

The LUNA ground segment will consist of the technical infrastructure for the different physical and logical LUNA components: the facility itself, the network infrastructure for semi-external components like the Flexhab habitat, a greenhouse, a dust chamber, an interface for external experimenters and the connection to EAC (European Astronaut Center, Cologne/ESA), GSOC (German Space Operations Center, Oberpfaffenhofen/DLR) and MUSC (Microgravity User Support Center, Cologne/DLR)

All three centers are main facilities within the Human Spaceflight network for ISS operations. It is imperative to profit from their existing expertise and knowledge, as well as to utilize the existing infrastructure at these sites to the maximum extent. However, in combination with this state-of-the-art technology LUNA will also serve as a test bed for new and future technologies. We intentionally evaluate and plan the usage of EGS-CC (European Ground Segment Common Core) as MCS (Mission Control System) system for the ground segment as well as for experiments. This will complement the lately started implementation of EGS-CC as new MCS for the Columbus module. The GSOC's HCC protocol layer will be used. We evaluate to extend the core voice communication system (VoCS) used for ISS with DLR's new Open VoCS as remote and mobile front-end interface. Finally, LUNA will serve as one of the Delay Tolerant Network (DTN) test bed end nodes.

This paper will focus on the capability to use these new technologies together with the well-established operational systems. This will provide us with the chance to develop, test and qualify future technologies also for the ISS operations and – more important - to migrate to new exploration missions like Gateway. By this LUNA becomes a central simulation and test facility in an international network of human exploration facilities and complements.