SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND DEVELOPMENT (D3)
Systems and Infrastructures to Implement Future Building Blocks in Space Exploration and Development (2)

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MODULAR INFRASTRUCTURES AS RESEARCH PLATFORMS FOR LUNAR EXPLORATION

Abstract

In late 2012, the German Helmholtz Alliance "Robotic Exploration in Extreme Environments - ROBEX " was initiated, thereby joining forces among deep sea and space (especially lunar exploration) scientists and engineers in order to work together toward solutions of outstanding technical problems of robotic exploration in harsh environments being common to both fields of research. Among the research topics are robotics-oriented problems such as navigation or autonomy, but also system infrastructures which are needed to setup long-duration scientific research networks in either environment. What has quickly become clear is that a common goal in both communities is to gain a higher operational flexibility during a scientific mission at lowered cost for system development, implementation and operation.

In the deep sea community this has already been partially achieved by using modularity, commonality and multi-mission capability. One example is the Modular Deep Sea Laboratory (MoLab) as it is developed and used by the German Helmholtz Center for Ocean Research (Geomar). MoLab consists of a set of different underwater research devices, such as stationary deep sea observatories and autonomous underwater vehicles that can be combined according to each specific scientific question, thereby providing the infrastructure for obtaining coherent scientific data from the ocean floor. Transferred to space this approach poses a great opportunity for achieving above mentioned goals also in the space exploration branch.

Within DLR Institute of Space Systems, we are figuring out how to advance the lunar exploration system infrastructure (LSI) in such a way. We have started by developing scientific scenarios which would

benefit from such an approach. One of them is the Active Seismic Network, a mission setup to investigate the lunar surface, its interior and the source mechanisms of moonquakes and other natural seismic events, which will serve as a reference scenario within ROBEX.

In this paper we will describe how lessons learned from the deep sea solution as well as the insight into the needs of lunar scientific infrastructures has resulted in the development of a promising and suitable modularity approach for lunar lander and rover systems. Our approach is based on the concept of bus modularity, where exchangeable modules are added to the baseline system bus according to the demands of the specific scenario. We will describe the approach more in detail including arising problems e.g. in the power or thermal domain and discuss required technological developments to put it into practical use.