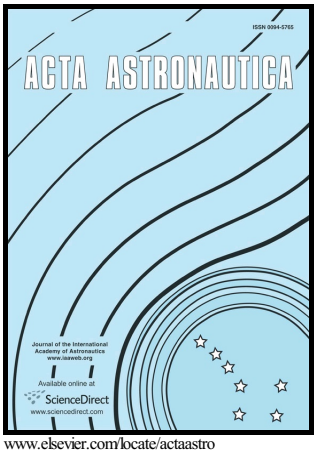

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A Seismic-Network Mission Proposal as an Example for Modular Robotic Lunar Exploration Missions

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Abstract

In this paper it is intended to discuss an approach to reduce design costs for subsequent missions by introducing modularity, commonality and multi-mission capability and thereby reuse of mission individual investments into the design of lunar exploration infrastructural systems. The presented approach has been developed within the German Helmholtz-Alliance on Robotic Exploration of Extreme Environments (ROBEX), a research alliance bringing together deep-sea and space research to jointly develop technologies and investigate problems for the exploration of highly inaccessible terrain - be it in the deep sea and polar regions or on the Moon and other planets. Although overall costs are much smaller for deep sea missions as compared to lunar missions, a lot can be learned from modularity approaches in deep sea research infrastructure design, which allows a high operational flexibility in the planning phase of a mission as well as during its implementation. The research presented here is based on a review of existing modular solutions in Earth orbiting satellites as well as science and exploration systems. This is followed by an investigation of lunar exploration scenarios from which we derive requirements for a multi-mission modular architecture. After analysing possible options, an approach using a bus modular architecture for dedicated subsystems is presented. The approach is based on exchangeable modules e.g. incorporating instruments, which are added to the baseline system platform according to the demands of the specic scenario. It will be described in more detail, including arising problems e.g. in the power or thermal domain. Finally, technological building blocks to put the architecture into practical use will be described more in detail.

Keywords: modularity, robotic exploration, lunar lander, reuse

1. Introduction

Robotic planetary exploration, be it from orbit or by landing vehicles, is a complex and cost intense endeavour. The system design and development has to factor in environmental constraints and has to support the chosen instruments in their strive to answer the missions scientific objectives. This requires

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