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Concepts, Technologies, Infrastructures and Systems for the Exploration and Utilisation of Space (2)

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CONCEPT FOR A RECONFIGURABLE MODULAR LUNAR LAB

Abstract

Science of the Moon and Science on the Moon are big research topics in the field of space exploration. Several missions to the moon since Apollo, have either been planned or carried out. Realized missions are SMART-1 (ESA, launched in 2003), which was comparatively cheap and successful, the Chinese mission Chang'e-1(2007) the Japanese Kaguya/Selene-1 (2007), Chandrayaan-1 (India, 2008), LRO/LCROSS (USA, 2009) and Chang'e-2 (China, 2010). Proposed missions are GRAIL (USA, 2011), Luna-Glob (Russia, 2012), Selene-2 (Japan, 2012), LADEE (USA, 2013) and Chandrayaan-2 (India, 2013).

In the recent past, the ratio of orbital missions to landing missions swaps more towards landing missions, where it is planned to bring either instruments and/or rovers to the lunar surface. Future missions to the moon could gain from standardized platforms, which would be planned as reconfigurable modules or building blocks to serve either as a support for landing missions or to perform its own science with a dedicated payload on board. In this talk, the idea of such a possible infrastructure will be presented. Modules for many different tasks are conceivable: Power distribution, Power storage, Power generation, Communication, Computing or Avionics, Storage (Rovers, Samples, etc.), RIPS nodes (Radio interferometric Positioning System), absolute position modules (e.g. with star trackers), payload protection modules (for long time research), etc. The idea is to build up those modules in a very generic manner with a high degree of autonomy. It should ensure that such an infrastructure can support a variety of possible future missions, especially those on the nightside of the moon, deep craters and those with rare relay times. Therefore, the arrangement of the modules needs to be reconfigurable, to be tailored for the special needs of each mission. Therefore, the modules need also to have certain degree of mobility.

Such an infrastructural base could be realized in a timeframe of several years. The modules could be set up piecewise, to allocate the costs to several years and reduce yearly expenses. Together with new landing technologies, which should make it possible to land within a radius of about 100 metres, the module which is to be added will find autonomously its own way from the landing site to the already placed modules. Due to its efficient and cost-effective characteristics, the concept is an affordable alternative and can also serve as an initial point and pathfinder for future lunar infrastructures.