Return to the Moon (02)
Concepts for Robotic and Human Missions to the Moon (3)

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CONCEPTS FOR ROBOTIC LUNAR INFRASTRUCTURES

Abstract

Currently, the ratio of orbital missions to landing missions shifts more towards landing missions, where it is planned to bring instruments either on stationary landers or rovers to the lunar surface (Selene-2, Chandrayaan-2, Luna-Glob). Future missions to the Moon will gain from standardized platforms, which would be designed 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. Modules (with a proposed standardized volume of 0,125 m) for many different tasks are conceivable: power distribution, power storage, power generation, communication, computing or avionics, storage (rovers, samples, caches etc.), RIPS nodes (radio interferometric positioning system), absolute position modules (e.g. with star trackers), payload protection modules (for long time research), etc. The goal is to build up those modules in a generic

manner with a high degree of autonomy. This will ensure that such an infrastructure can support a variety of possible future missions, in particular those with limited relay opportunities like e.g. on the far side or such placed in a challenging terrain like in craters etc. Therefore, the arrangement of the modules needs to be reconfigurable, to be tailored for the special needs of each mission. The modules also might need to have an adjustable degree of mobility. Moreover, providing capacities to autonomously pick up samples by manipulators accommodated on vehicles and equipped with special grippers or tools, and return them to fixed landing station for processing, is a must in this future challenging scenario. Additionally, we may think of direct or in-situ processing at the vehicle site as is envisaged now for the MSL mission.

Such an infrastructural base could be realized in a timeframe of several years. The modules could be set up in steps, to allocate the costs to several years and reduce yearly expenses. Together with new landing technologies, allowing precision landing, only limited mobility is required to place any new module to the already set-up cluster. 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. Besides Moon and Mars, such systems will also apply to terrestrial regions like Antarctica or in the oceans, for example building up robotic maintenance infrastructure for oil drilling platforms or upcoming large offshore windparks.