SPACE EXPLORATION SYMPOSIUM (A3)
Moon Exploration – Part 2 (2B)

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INTEGRATING ADVANCED MOBILITY INTO LUNAR SURFACE EXPLORATION

Abstract

In recent years, the Institute of Space System (IRS) of the University of Stuttgart has developed a comprehensive and capable conceptual design environment for human lunar surface missions. With a more detailed knowledge of the lunar surface environment, further assessment of human lunar infrastructures and operational aspects for surface exploration become possible. This is of particular interest for the integration of advanced mobility assets, where path planning, balanced energy provision and consumption as well as communication coverage grow in importance with the excursion distance.

The existing modelling and simulation tools for the lunar surface environment have therefore been revisited and extended to incorporate aspects of mobile exploration. An extended analysis of the lunar topographic models from past and ongoing lunar orbital missions has resulted in the creation of a tool to calculate and visualize slope angles in selected lunar regions. This allows for the identification of traversable terrain with respect to the mobile system capabilities. In a next step, the solar illumination conditions throughout this terrain can be assessed to inform system energy budgets in terms of electrical power availability and thermal control requirements. The combination of the traversability analysis together with a time distributed energy budget assessment then allows for a path planning and optimization for long range lunar surface mobility assets, including manned excursions as well as un-crewed relocation activities.

The above mentioned tools are used for a conceptual analysis of the international lunar reference architecture, currently developed in the frame of the International Architecture Working Group (IAWG) of the International Space Exploration Coordination Group (ISECG). Its systems capabilities are evaluated together with the planned surface exploration range and paths in order to analyse feasibility of the architecture and to identify potential areas of optimization with respect to time-based and location-based integration of activities.