SPACE EXPLORATION SYMPOSIUM (A3)
Moon Exploration – Part 1 (2A)

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MOBILE PAYLOAD ELEMENT (MPE): CONCEPT STUDY OF A SMALL, AUTONOMOUS AND INNOVATIVE SAMPLE FETCHING ROVER

Abstract

In early 2011 the German Space Agency DLR commissioned Kayser-Threde with the feasibility study of a Mobile Payload Element (MPE). As industrial prime, Kayser-Threde has assembled relevant German industrial and institutional competences in space robotics and lunar science for this study. The Mobile Payload Element is designed to be a small, autonomous and innovative rover of 14kg for exploration of the environment and sampling in the vicinity of the envisaged landing site at the lunar south pole. Although the ESA Lunar Lander served as reference scenario for the MPE development, it is compatible to any alternative landing mission with a similar mission profile.

MPE's novel capability will be to acquire clearly documented samples from controlled surface as well as subsurface locations, define their geological context and bring them back to a stationary lander for analyses with the on-board instruments. Furthermore, MPE is able to take samples from shaded areas, which e.g. increases the chances of detecting lunar volatiles. With an operating range of more than 100m,

it will provide access to a vast area of scientific interesting objects and locations.

The rover concept comprises a four-wheeled active suspension which allows a compact stowage of the MPE on the spacecraft as well as a precise alignment of solar generators and scientific instruments. The vertical mounted solar generators charge a secondary battery, which powers the MPE. Tele-operation from earth and autonomous navigation are foreseen as operational modes. In the tele-operated driving mode all driving commands are transmitted via the lander by a UHF- and S-band communication link. In the autonomous navigation mode the rover autonomously performs all necessary steps to drive to a commanded target location. In the event of a communication loss, it will autonomously reinitiate communication by changing its position and driving towards the lander.

Based on the results of the MPE phase 0/A study, the current developments continue within a Delta Phase A. Major objectives are to assess adaptions for other possible flight opportunities. The work focusses on the further development of major MPE sub-subsystems and payloads. In addition a concept for an Autonomy Payload Experiment (APE) is being established as an option to enhance the MPE's autonomy functions. This paper describes the MPE rover concept with emphasis on the latest results at the time of the congress and provides an outlook for potential future activities. Kayser-Threde acknowledges funding for MPE under contract 50JR1212 by DLR.