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

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LUNAR ICY SOIL SAMPLING

Abstract

After the confirmation of water ice presence in permanently shaded regions near to the Poles of the Moon (L-CROSS mission), the interest in future mission landing to Earth's satellite has grown stronger. One major objective in going back to the Moon is to investigate the presence of such resources that will become very important in scenarios of future exploration and for the establishment of a more sustainable human presence on the Moon. Those ices can be found at very high latitudes, where the lunar regolith could resemble an admixture of 'highland type' soil with entrapped volatiles/ices in different forms with temperature as low as 25 K. For this reasons, drill machinery, sampling tools and operational strategies need to take into account very stringent requirements regarding reduction and control of physical contamination and preservation of ice content. Specifically looking at in-situ analysis scenarios, it is very important to limit the amount of heat transferred into the soil and to the acquired sample up to and including the point where the sample is delivered to the scientific instruments. To reach this goal, classic rotary drilling may not be the correct strategy due to relative inefficiency of the drilling process and associated heating of the sample; instead, a drilling machine capable of penetrating the soil with the aid of a hammering actuator could guarantee the desired efficiency and advancing velocity. In the frame of ESA's Lunar exploration activities, Selex ES is leading the study and development of a specific drilling system and sampling tool which can address the above mentioned requirements. This paper will cover the thematics related to the development of such systems, starting from the recreation of a representative icy simulant (and methodologies tested), the design and testing of drill concepts (that can operate with and without hammering action) and the associated sampling tool mechanism.