

LUVMI Rover to Characterise Volatile Content in Lunar Polar Regions

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The low inclination of the lunar orbit allows areas in high and low latitudes to remain in eternal darkness. These Permanently Shadowed Regions (PSR) are never illuminated by sunlight and are some of the coldest places in the Solar System and could contain vast deposits of water and other volatiles. In-situ measurements are required as a 'ground-truth' measurement to determine the existence volatiles in these regions.

The LUAr Volatiles Mobile Instrumentation (LUVMI) is an autonomous, low mass, modular rover concept consisting of surface and subsurface sensing instruments with an in-situ sampling and analysis technology capable of depth resolved volatile extraction and characterisation. Volatile extraction from the lunar regolith will be carried out by the Volatiles Sampler (VS), which will sample the subsurface up to a depth of 20 cm, extract water and other loosely bound volatiles through heating. The design of the VS provides efficient volatile sample transfer and minimizes sample handling requirements. Evolved volatile characterisation will be performed by the Volatiles Analyser (VA) which is a miniature ion trap mass spectrometer based on the Ptolemy mass spectrometer instrument on-board Philae, the ESA Rosetta Lander. LUVMI-X (eXtended) will add the capability of allowing direct access to a PSR(s) via a miniature instrumented low velocity projectile that will be launched from the rover platform into areas of interest that are inaccessible to the rover.

We will discuss the LUVMI test campaign conducted in December 2018, the current LUVMI-X configuration, the design of the mass spectrometer extraction systems and recent laboratory results obtained with volatile doped regolith simulant.