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OHB INSTRUMENTS EVELOPMENT FOR VOLATILE SCOUTING ON THE MOON

Abstract

For several years already, OHB has been working on instruments for Moon lander and roving missions that are capable of detecting and characterizing volatile species and deposits, representing a potentially extractable resource.

Following earlier concept work, OHB Munich and the Technical University of Munich (Chair of Astronautics), along with other partners, in 2016 have started the pre-development of the so-called "Lunar Volatiles Scout" (LVS) instrumented drill as part of the LUVMI and LUVMI-X projects. LUVMI stands for "Lunar Volatiles Mobile Instrumentation" and is a technology development effort led by Space Applications Services NV from Belgium under a grant awarded by the EU's Horizon 2020 technology programme (grant numbers 727220 822018).

The LVS is a drill-like instrument tailored to lunar surface missions that does not sample but emplaces an electric heater into the lunar regolith to shallow depth of down to 20 cm. Through in-place heating, embedded volatiles are evolved into gases which in turn are analysed by a miniature ion trap mass spectrometer (being developed by the Open University). To enable 'scouting-type' measurements across a larger area, the LUVMI mission scenario envisions a small rover carrying the LVS and other instruments. End-to-end demonstrators of the LVS have been developed and tested in simulated lunar conditions, allowing to reach a TRL of 5. Currently, the LVS is going through a formal PDR process with the European Space Agency ESA, with the expectation that it could be ready for flight by late 2023.

Under the current LUVMI-X grant, OHB with partners DLR and LZH are pre-developing a second instrument for lunar volatiles detection which conceptually would also be carried by the LUVMI lunar polar rover. This is a compact optical instrument using the LIBS technique (Laser-Induced Plasma

Breakdown Spectroscopy) and is referred to as VOILA (Volatiles Identification by Laser Analysis). LIBS allows for rapid elemental analysis of a target sample by spectroscopically analyzing the emitted light of a plasma plume from ablated target material in response to high-energy laser pulses emitted by the instrument. VOILA is optimized for the detection of the light elements H and O as proxies for water ice, but the major rock-forming elements are detectable with good signal-to-noise ratio as well. The VOILA preliminary flight design has been completed and laboratory pre-tests under vacuum conditions have confirmed the concept's viability for detection of volatiles in the lunar regolith.