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THE ESA PROSPECT PAYLOAD FOR LUNA-27: DEVELOPMENT STATUS

Abstract

Introduction The Package for Resource Observation and in-Situ Prospecting for Exploration, Commercial exploitation and Transportation (PROSPECT) is a payload in development by ESA for use at the lunar surface. Current development is for flight on the Russian-led Luna-Resource Lander (Luna 27) mission, which will target the near-side of the south polar region of the Moon. Together with the overall package of scientific instrumentation on the platform, under responsibility of IKI, PROSPECT will perform an assessment of the volatile inventory in near surface regolith (down to 1 m), and elemental and isotopic analyses to determine the abundance and origin of any volatiles discovered. PROSPECT is comprised of the ProSEED drill module and the ProSPA analytical laboratory plus the Solids Inlet

System (SIS), a carousel of sealable ovens (for liberating volatiles from regolith). PROSPECT has a number of sensors and instruments (ion trap and magnetic sector mass spectrometers, imagers, and sensors for temperature, pressure, and permittivity) that form the basis for a range of scientific investigations that are (almost all) led by the PROSPECT Science Team. Development Status: PROSPECT Phase C, 'detailed definition', began in December 2019 following completion of the Preliminary Design Review. In parallel to the industrial schedule undertaken, an associated plan of research activities has been formulated to gain from and guide ongoing development, build strategic scientific knowledge, and to prepare for operation of the payload. A programme of tests has been completed on both the ProSEED Drill and the ProSPA Instrument Development Models (DMs). The Drill DM, developed by Leonardo S.p.A, has undergone drilling, sampling and sample transfer testing in ambient, low temperature and thermal vacuum conditions, using icy lunar regolith simulant. The ProSPA DM, developed at The Open University has been tested to demonstrate science performance against measurement requirements. Dedicated efforts focused on verification of evolved gas analysis (EGA) via measurement of meteorite standards, constraint of oxygen yield via demonstration of ISRU capabilities, improving understanding of sensitivity of science requirements to regolith volatile abundance and possible contamination, and understanding the performance of oven seal materials. Next Steps: The initiation of Phase C ensures the implementation of the detailed design. Delivery of interface models will progress through 2020, which will permit the first major verification of interfaces with Russian payloads and the Luna 27 platform. Work on PROSPECT in this context also offers possibilities for embarking similar payloads on other mission opportunities.