Development of the PROSPECT Payload Package for Subsurface Sample Acquisition and Analysis of Lunar Volatiles. R. Trautner[1], S. J. Barber[2], J. Carpenter[1], R. Fisackerly[1], B. Houdou[1], M. Leese[2], A. Rusconi[3], E. Sefton-Nash[1], A. Zamboni[3], [1]European Space Agency, ESA/ESTEC, Keplerlaan 1, 2200AG Noordwijk, The Netherlands, Roland.Trautner@esa.int, [2]School of Physical Sciences, The Open University, Milton Keynes, MK7 6AA, United Kingdom, [3]Leonardo SPA, Airborne & Space Systems Division, Viale Europa s.n.c. (MI), Nerviano, Italy.

Introduction: PROSPECT is a novel payload package for in-situ exploration of lunar resources, with a focus on volatiles. As part of the new Russian Lunar Exploration Programme [1], the Russian Luna-27 spacecraft (Luna-Resource lander) is scheduled to land in the lunar south pole region in 2023. Among its payloads, it will carry a complex package called PROSPECT [2] provided by the European Space Agency which will support the extraction and analysis of lunar surface and subsurface samples as well as acquisition of data from additional environmental sensors. The key elements of PROSPECT are the ProSEED drill and the ProSPA analytical laboratory. ProSEED will enable the acquisition of samples from depths of ca. 1m and deliver them either to ProSPA or to Russian instruments. ProSPA will receive samples, seal them in miniaturized ovens, and process them via heating, physical and chemical processing of released volatiles, and analysis of the obtained constituents via mass spectrometry. Additional sensors are foreseen to provide contextual information, such as cameras for the acquisition of multi-spectral images of drill working area and acquired samples, as well as temperature sensors and a permittivity sensor that are integrated in the drill rod. A Central Electronics Unit (CEU) provides control and data management for the drill, and also manages sensors as well as the ProSPA instrument operations. PROSPECT is a modular system with high re-use potential on subsystem and subassembly level, with flight hardware expected to be available in 2021 for contribution to a variety of lunar platforms including landers, rovers and surface-deployed packages.

In early 2019, the project will transition into Phase C, and proceed towards its Critical Design Review.

In our paper, we will present the PROSPECT design and expected drill, instrument and sensor performances. Re-usable elements will be highlighted, and a project status update will be provided.

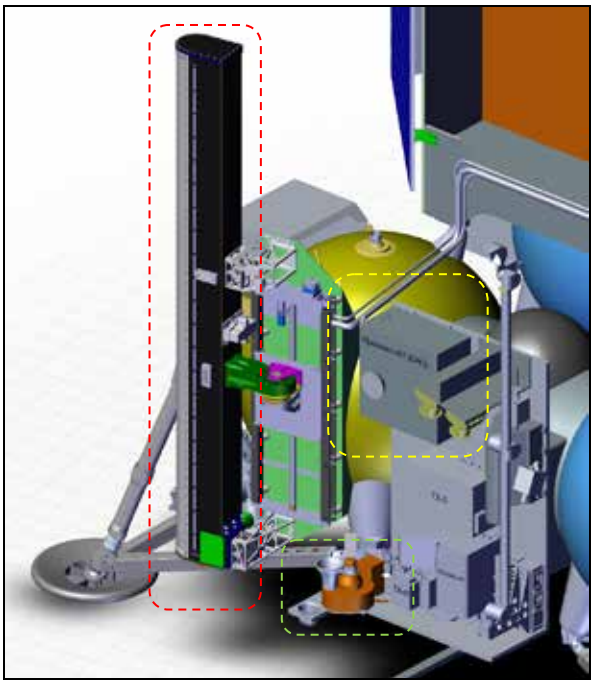

Fig. 1. Accommodation of PROSPECT elements on the base structure of the Luna-27 spacecraft (ProSEED box: red, ProSPA Solids Inlet System: green, Science Laboratory: yellow, CEU not shown).

References: [1] Russian Moon Exploration Program, http://www.iki.rssi.ru/eng/moon.htm (accessed 03.08. 2018). [2] PROSPECT: A Novel Package for Subsurface Sample Acquisition and Analysis of Lunar Volatiles, paper IAC-18,A3,2B,2,x42773, presented at IAC 2018, Bremen, Germany, 1-5 October 2018.