Prospect: Key Aspects of Drilling and Collecting Samples at Moon Southpole for Luna Resurs Mission

Conference or Workshop Item

PROSPECT: KEY ASPECTS OF DRILLING AND COLLECTING SAMPLES AT MOON SOUTH POLE FOR LUNA RESURS MISSION. M. Savoia[1], A. Rusconi[1], F. Rizzi[1], A. Fumagalli[1], S. Barber[2], R. Fisackerly[3], J. Carpenter[3], M. Lavagna[4] .[1]Finmeccanica (matteo.savoia.ext@finmeccanica.com), [2]Open University, [3]ESA-ESTEC, [4]Politecnico di Milano.

Introduction: ESA is working together with ROSCOSMOS to establish a cooperative program of lunar exploration. Part of the European contribution for the Luna-27 mission, a major element of such collaboration, planned to fly in 2020, is the PROSPECT drilling and sample analysis package. PROSPECT (Package for Resource Observation, in-Situ analysis and Prospecting for Exploration Commercial exploitation and Transportation) is built upon important experience gained by European industries and institutes in particular on drilling, sample handling and sample analysis. PROSPECT is made up of two main elements: the ProSEED (PROSPECT Sample Excavation and Extraction Drill) and the ProSPA (PROSPECT Processing and Analysis) sample analysis instrument. ProSEED is the next step in Finmeccanica's development of planetary drilling and sampling robots and it is specifically designed to cope with lunar icy soil specimens. ProSEED baseline design is being developed at the time this abstract has been written. It is being defined based on experience and data collected by Finmeccanica during phase A of the Lunar Drill Development project, funded by ESA. Objectives of this phase of the project were: (1) the development of a 2m drill breaboard equipped with rotation and hammering actuator in the mandrel; (2) the development of a sampling tool mechanism compatible with the Lunar Drill Breadboard and its roto-hammering functionalities; (3) the characterization of lunar highland soil simulant (NU-LHT-2M) uniaxial compressive strength, with different amounts of water ice (up to saturation) at low temperature conditions; (4) testing of the integrated LDD breadboard on the lunar simulant conditioned at very low temperaturs (up to -170°C) and ambient pressure; (5) testing and comparison of different sampling tool concepts including micro-corers and tools deriving from Finmeccanica's heritage in interplanetary drilling; (6) the development of a Thermal Exchange Model (in collaboration with Politecnico di Milano) with the aim of predicting the drilling impact on soil characteristics (temperature increase) in order to define a proper mission operation profile. The proposed paper will present and discuss some important results achieved in the above mentioned activities and how those results will support the selection and definition of the PROSPECT technical baseline.