LUNAR OXYGEN PRODUCTION SYSTEM STUDY AND EQUIPMENT BREADBOARDING.

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Abstract. The near-term Moon exploration scenario will see a significant increase in missions to the lunar orbit and surface, with a scheduled return of astronauts on the lunar surface by 2025. The capability of making an effective use of local lunar resources is an important factor in view of a continuous, cost effective, and increasing presence on the lunar surface, with robotic and manned missions. In particular, the extraction of water and oxygen from the lunar soil represents one of the major enabling technologies, both in terms of life support systems, and in situ propellant production. Water ice is abundant in some regions such as at the lunar south pole, nevertheless, oxygen is present in high quantity all over the Moon in the form of oxides constituting the lunar regolith minerals.

OHB Italia and Politecnico di Milano have developed a technology for in situ production of water and oxygen on the lunar surface, which is robust for operating against most of the lunar soil types and that can be implemented in the majority of the areas of interest. This paper presents the current development status, including payload studies, prototype developments, test campaigns and the oxygen extraction process results.

Pre-development studies have been completed for investigating the accommodation of end-to-end oxygen extraction systems within different commercial lunar landers and complying with different interfaces. Breadboarding test activities have also been completed for different equipment, including regolith handling systems, process reactors, reactor sealing mechanisms, and process systems.

The test campaigns allowed to improve the knowledge on regolith properties, by using selected regolith simulant aggregates, the implementation of the carbothermal process for the reduction of the regolith minerals, the design and integration of high temperature process reactors, of the process system, and the definition of the process power and control system. In particular, the test campaigns have demonstrated the capability of extracting water and oxygen from a regolith simulant granular feedstock and to determine the process yield capacity. This paper will focus on the results of breadboarding activities performed on regolith handling systems, process reactors and reactor sealing mechanisms.