

IAF SPACE EXPLORATION SYMPOSIUM (A3)
Moon Exploration – Part 2 (2B)

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THE ORACLE ISRU DEMONSTRATOR PAYLOAD FOR OXYGEN EXTRACTION ON THE MOON

Abstract

Space agencies are focusing their interests in the robotic and human exploration of the inner Solar System. The main objective for the next decade, as evident from the Artemis program started by NASA and joined by many partner agencies, is the development of a sustainable human settlement on the Moon. The very short time delay in communications and the proximity to Earth make the Moon suitable to prove the human capability to adapt to extraterrestrial survival. Also, the reduced escape velocity would make the exploration of other planets – such as Mars – easier and cheaper. Nevertheless, technological advancements are required for the human base to survive on the lunar environment in terms of radiation shielding, power generation and supplies, to name a few. Regarding this last point, it is crucial to exploit local resources – ice deposits and dry lunar regolith – to extract oxygen and water without relying on those sent from Earth. In this context, many processes have been studied to obtain water – and thus oxygen after an electrolysis stage – from lunar regolith. The yield of extraction of some of these processes is directly linked to the composition of the regolith, which is highly dependent on the region where it is collected. Among the processes, the one involving a carbothermal stage developed by Politecnico di Milano, thanks to experimental tests run in lab, preliminarily confirmed to be independent on the composition on the lunar regolith, thus making it very promising to be used in different scenarios. Also, the temperature at which the process takes place is below the melting point of the regolith, thus simplifying the construction of the reactor and allowing easier discharge of the used sample. The process has been successfully tested in laboratory and the related ISRU technological demonstrator is planned to be delivered on the Moon through one of the landers developed under the Commercial Lunar Payload Services (CLPS) program started by NASA. Through CLPS, NASA aims at supporting the Artemis program by sending scientific payloads and technological demonstrators on the Moon to collect data, thus the developed ISRU demonstrator is an ideal candidate for the mission.