

IAF SPACE EXPLORATION SYMPOSIUM (A3)
Moon Exploration – Part 3 (2C)

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DEVELOPMENT OF KEY TECHNOLOGIES ENABLING THE VALUE CHAIN OF SPACE
RESOURCES UTILISATION**Abstract**

The world's space agencies have been considering strategies, architectures and mission concepts to explore the solar system in the frame of international cooperation. Key principles are affordability, exploration value, partnerships, capability evolution, human/robotic partnership and robustness. Private sector interest in Lunar exploration and resource utilisation is also on the rise. In recent years, there has been a sharp increase in Space Resources Utilization (SRU) activity throughout Europe and in some cases worldwide, with ESA calling for the formation of an SRU community in Europe.

Space Applications Services (SA) is an active member in this community. The company has led international ISRU-related consortia totalling more than 28 different partners, and participates as consortium member in a number of other projects. The team provided a key contribution to a study for PwC/The Government of Luxembourg in the role of establishing the key SRU technologies and capabilities to be developed in the coming years, in line with relevant steps in the Space Resources Value Chain.

Prospecting is a first step of said value chain. A Lunar Rover platform (LUVMI) is being developed with the main goal of prospecting water and other resources on the Lunar surface, including determining the existence of exploitable reserves at the Lunar poles.

Extraction, handling and processing are being investigated by SA as prime contractor in three projects for the ESA ISRU Mission: a Phase 0 study and Phase A/B1 study (“ALCHEMIST”) of a demonstrator payload to produce 100 grams of water or oxygen on the Lunar surface by 2025, and an Earth-based demonstrator of the reduction of iron oxides from Lunar regolith.

A further important step in the SRU value chain over the medium to long term is construction of Lunar surface infrastructure to support more complex operations. The RegoLIGHT project developed prototypes of 3D printers using Lunar regolith that can be utilized to construct infrastructure on the Lunar surface. Also, in this context, the EC project PRO-ACT is to demonstrate robotic cooperation to construct key SRU Lunar infrastructure in an Earth-based analogue.

The team has also identified a key need for Mission Control solutions to support SRU and general lunar exploration activities. Leveraging experience gained from the ICE Cubes commercial service on the ISS, Space Applications are set to offer services to private and institutional customers in this growing market.

An outlook of the overall technology needs, and the technology and service developments outlined above is provided.