LUWEX

Validation of Lunar Water Extraction and Purification Technologies for In-Situ Propellant and Consumables Production

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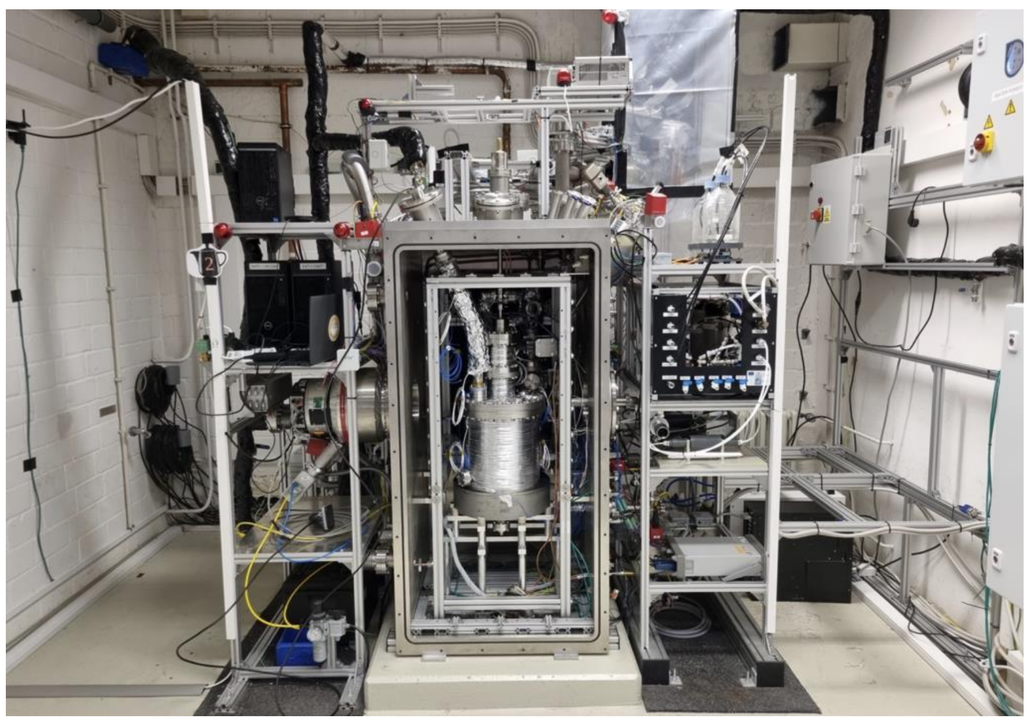
LUWEX develops a pioneering system that enables the extraction of water from lunar regolith, a crucial step in advancing space exploration and sustaining human presence on the Moon. Under the lead of the German Aerospace Center Bremen, LUWEX has engineered a comprehensive process that not only extracts water from icy regolith but also purifies it to supply rocket fuel and drinking water for astronauts stationed on the lunar surface. These groundbreaking tests will unfold at the TU Braunschweig (Institute of Geophysics and Extraterrestrial Physics). Central to these tests is a meticulously implemented laboratory setup that mirrors the conditions found in the shadowed regions of the moon's south pole using icy lunar regolith simulant.

The laboratory setup includes both components inside a vacuum chamber as well as components placed outside:

- **Inlet** for moon-like regolith (regolith simulant with a 5% ice content),
- Ice and **Regolith Separation** Crucible (through stirring and heating, water ice is converted into water vapour and can escape from the regolith),



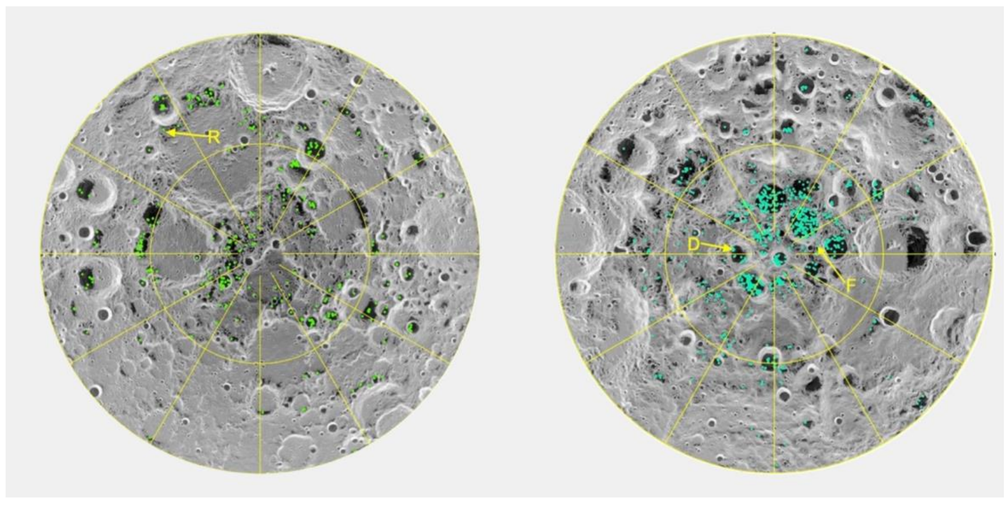
LUWEX laboratory, TU Braunschweig, photo: LUWEX consortium

- Dry **Regolith Removal**: the remaining regolith is removed and stored for resource usage (mineral extraction, habitat contruction),
- **Cold Trap**: the water vapour is cooled and frozen again into water ice to capture it,
- **Liquefaction**: water ice is being heated up again to provide liquid water.

The components outside the vacuum chamber include:

- Water **purification** subsystem,
- Water condition **monitoring** – including **L**aser **I**nduced **B**reakdown **S**pectrosopy and standard probes for on-line quality measurements.

Water is by far most versatile and needed resource in space exploration. Apart from being stored and direcly used by astronauts, it is a priceless substrate for techological purposes like radiation shielding and consumable for living organisms (algae, plants). Indirectly, by means of oxygen and hydrogen created during water electrolysis, the field of applications broadens up to: spacecraft propellant, decomposition agent (CO_2, regolith, waste treatment). In-Situ Resource Utilization (ISRU) technologies allow to utilize locally available resources to generate valuable products for human and robotic space exploration. Once reaching sufficinetly high TRL, ISRU systems greatly decrease the required resupply from Earth and allow humanity to establish a permanent presence on Moon, Mars and in other locations of the solar system.



Water on the Moon.
Ice exposure constrained by M3, LOLA and Diviner and LAMP

What was once a conceptual idea has now been transformed into a fully operational demonstrator system, thanks to the collaborative efforts of six European partners from Germany, Italy, Poland, and Austria. This initiative pioneers the whole process chain to extract water from lunar regolith simulant and thus revolutionizes our understanding of lunar resource utilization.

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For more information visit:
https://luwex.space/