ESA activities as support to ISRU technology development. A. Meurisse[1] and J. Carpenter[2], [1]Research Fellow, European Space Agency - ESTEC, Keplerlaan 1, 2201 AZ Noordwijk, Netherlands, alexandre.meurisse@esa.int, [2]Scientist, European Space Agency - ESTEC, Keplerlaan 1, 2201 AZ Noordwijk, Netherlands).

Introduction: Previous ad hoc funded projects [1-2], and PROSPECT activities [3] have raised an interest in lunar resources in Europe. Following the successful July 2018 ISRU workshop held at the European Space Research and Technology Centre (ESTEC), Noordwijk, The Netherlands, the European Space Agency (ESA) is now developing a space resources strategy, focusing on short, medium and long term rationales and addressing whether space resources can enable sustainable space exploration, having the Moon as a primary target.

In this endeavor, ESA has triggered a number of activities to develop ISRU technologies and processes: two terrestrial ISRU end-to-end demonstrators producing water and the phase A of an ISRU demonstrator mission.

Terrestrial ISRU demonstrators: By the end of 2019, ESA will own two end-to-end terrestrial demonstrators producing oxygen from different lunar regolith simulants. One demonstrator will reduce the material by hydrogen reduction when the second one will carry out a carbothermal reduction of the material. Several lunar simulants will be tested in order to observe the impact of mineral variations on the two processes. Both processes could handle batches of 1 kg of soil and will be further used for ISRU research in ESTEC premises.

ISRU demonstrator mission: ESA is also preparing an ISRU demonstration mission. The objective of the mission is to characterize the feedstock material at the landing site and test critical ISRU technologies to pave the way towards robust end-to-end lunar ISRU processes. This could be done as a single mission or as a campaign through several missions, having first feedstock characterization payloads, then technology maturation payloads and finally, end-to-end demonstrator payloads. ESA expects to make use of soon available commercial landers to bring the payloads onto the lunar surface.

The focus of the mission is going towards building water/oxygen production capability from lunar soil. The mission phase A which started in November 2018 is a feasibility study and aims at identifying which key technology could be ready before the launch date, expected in 2023. As for smaller secondary ISRU payloads, launch opportunities could be created as early as 2020.

References:

[1] Cesaretti G. et al. (2014), *Acta Astronautica*, 93, 430-450

[2] Meurisse et al. (2018), *Acta Astronautica*, 152, 800-810

[3] Carpenter et al. (2016), *Space Policy*, 37, II, 52-57