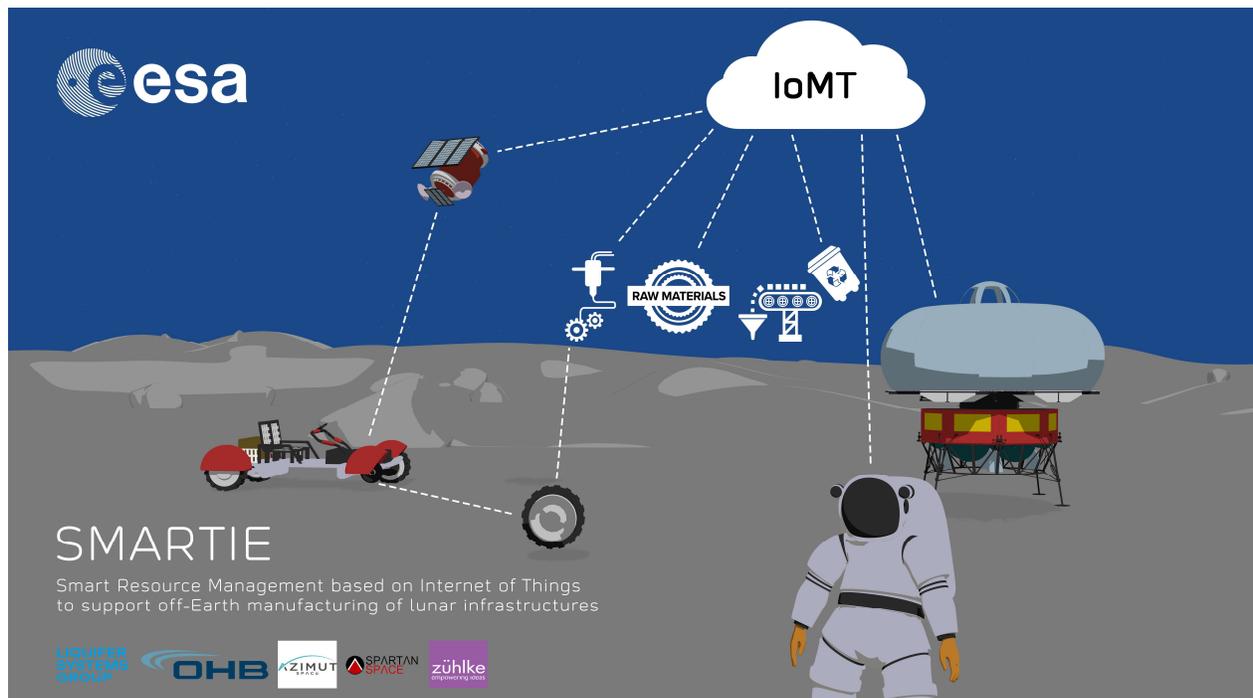


# SMARTIE

Smart Resource Management based on Internet of Things to support Off-Earth Manufacturing of Lunar Infrastructures

## Executive Summary



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### Executive Summary

SMARTIE (Smart Resource Management based on Internet of Things to support Off-Earth Manufacturing of Lunar Infrastructures) is an ESA study to assess the requirements, architecture, hardware and software needs and costs for implementation of an Internet of Manufacturing Things (IoMT) for a lunar human base and associated infrastructure. The study was performed under ESA Contract nr.4000133701/21/NL/GLC “OSIP SMARTIE: Smart Resource Management based on Internet of Things to support off-Earth manufacturing of lunar infrastructures”.

# SMARTIE

## Smart Resource Management based on Internet of Things to support Off-Earth Manufacturing of Lunar Infrastructures

### Executive Summary

IoMT is now considered to be at the heart of the 4<sup>th</sup> industrial revolution on Earth. The application of a smart cloud-based system using the Internet of Manufacturing Things (IoMT) that automatically collects and analyses data from sensors embedded in manufacturing machines allows for improved efficiency of the manufacturing process by controlling raw material utilization, timely response to customer needs, and significantly reducing or even eliminating the need for human intervention.

For a lunar human base, the implementation of IoMT coupled with Additive Manufacturing (AM) machines and using in-situ ISRU and recycled waste material potentially provides for a reduction of transport costs from Earth and response times for maintaining many components at a lunar base and frees up astronaut time in monitoring the maintenance of such a lunar base. Further the use of in-situ and recycled materials will be central to developing an autonomous human base. The IoMT cloud system envisioned in this study automatically monitors the lunar base infrastructure with respect to life-times and parts failures and initiates corrective action where necessary by determining how best to manufacture replacement parts using a combination of AM technology and feedstock from either ISRU or recycled waste or determining that a part has to be brought from Earth. At all times the crew can call up specialized reports from the IoMT cloud status and initiate appropriate manual action if necessary.

The study shows that the IoMT architecture proposed can be implemented for only a modest cost of about 14.5M€ which considering the benefits of implementing such a system is a solid and high value investment. Also, an IoMT system will probably be the only way forward for human deep space exploration to Mars and beyond.