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POWER USAGE OPTIMIZATION ALONG THE ISRU VALUE CHAIN USING A LUNAR ROVER

Abstract

The return to the Moon is the first step to deep human space exploration. On the way to Mars, the Moon resources offer a wealth of possibilities. Indeed the regolith has many interests for in-situ resource utilization, construction materials, geological studies, scientific exploration, space mining, energy production and environmental shielding against the radiation. At first, the extraction of the regolith will answer the need of the first Moon base. But later, it will provide the essential resources such as water, oxygen and propellant for the long way to Mars.

Before providing resources to the future mission, the Lunar ISRU value chain will need to sustain its activity with a limited power infrastructure in an arch environment. On this aspect, the rover would need to be optimized its power usage for the operation to collect the regolith.

The target of this study is to evaluate the different solutions in order to optimize the power usage. Based on a South Pole mission, it will explore three axes: traction system, navigation system and the collection of the regolith. The traction system will explore the different wheel design as well as the traction control to optimize the power usage according to the different surface. Terrains which can be "sandy" places or with high slopes. The navigation system will consider different solutions to find the most optimized way focusing on the power usage over the distance. It will request the rover to be autonomous on the shadow areas due to potential loss of communication where AI can play a key role. And then, the analysis will consider the different solutions for the regolith collection based on a weight / power ratio.

The methods combine the latest requirements from the different key space actors and the scientific community. The paper will conclude with a trade off from the different solutions studied.