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Author: Mr. Benjamin Lehner
TU Delft, The Netherlands, B.Lehner@tudelft.nl

Dr. Aidan Cowley
ESA european space agency, Germany, aidan.cowley@esa.int
Dr. Stan Brouns
TU Delft, The Netherlands, stanbrouns@gmail.com
Dr. Anne Meyer
TU Delft, The Netherlands, A.S.Meyer@tudelft.nl

ADVANTAGES AND LIMITATIONS OF BIOLOGICAL IN SITU RESOURCE UTILIZATION FOR LUNAR EXPLORATION

Abstract

In situ resource utilization (ISRU) is increasingly acknowledged as an important part of sustainable space exploration. Even with the current trend of decreased launching costs and reusable rockets, the ultimate goal of planetary exploration must be the usage of resources found at the destination. Typical approaches towards ISRU are often constrained by the mass and energy requirements of transporting processing machinery, such as rovers and massive reactors, and the large amount of consumables needed. A self-reproducing biological ISRU system with minimal requirements would avoid or complement many crucial issues. Microbiological systems are promising candidates for several approaches including the purification, alteration, and extraction of materials from the lunar regolith. After a short introduction to promising materials produced by bacteria, concrete examples of bacterial ISRU including lunar bioleaching, regolith alteration, and bacterial gas production are described and compared with non-biological approaches. Limitations due to biological contamination and the need for a constant nutrient supply are discussed, finally concluding that the development of biological ISRU techniques can be an effective new means of promoting more efficient, sustainable space exploration.