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Systems and Infrastructures to Implement Future Building Blocks in Space Exploration and Development (2)

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A BIOLOGICAL NUTRIENT CYCLE FOR A PARTIALLY SELF-SUFFICIENT COLONY

Abstract

All biological systems, including bioreactors, humans, plants, algae, require a basic amount of nutrients primarily based on carbon and nitrogen in the form of sugars and amino acids. To establish an autarkic colony on another celestial body, a critical mass of these nutrients will have to be supplied, and good recycling systems must be installed to reuse them. This manuscript presents calculations and models evaluating different recycling, resupplying, and consumption methods in a bio-based colony. It will explain why a human presence in outer space will have to focus more on biological systems to be sustainable and earth-independent. A short review will discuss the impact of current technologies such as life-support systems, in situ resource utilization, energy storage and additive manufacturing. Heuristics and experimental data are used to minimize the amount of cargo needed and optimize the efficiency of such a bio-based colony. Finally, this work reveals how mechanochemical and biological solutions in conjunction might pave the way for future human exploration.