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PRELIMINARY DESIGN STUDIES OF DEPLOYABLE SCAFFOLDING SYSTEM FOR ENABLING THE GROWTH OF MYCELIUM FOR CONSTRUCTION OF EXTRATERRESTRIAL HABITATS

Abstract

The construction of human habitation has always involved the use of biologically-produced materials from limestone to wood. Currently, the idea of growth itself, as an alternative construction method, is increasing in interest in architecture and space applications. NASA has recognized a key to space exploration is the ability to construct habitats with minimal payloads being launched from Earth. To respond to that call, we are proposing the use of bio-composites for 'growing' extraterrestrial structures, directly at the destination, which will significantly lower the upmass.

This paper presents the development and experiments results of preliminary design studies of the NASA Innovative Advanced Concepts (NIAC) 'Myco-architecture off-planet' project, which demonstrates a novel way to construct structures on the Moon or Mars, with a minimum of duty robotic operations and infrastructure preparations. By developing new, grown biological mycelium-based composites we are challenging traditional ideas of materials for constructing extraterrestrial habitats.

To enable the three-dimensional growth of the mycelium and to create a composite which has structural capabilities, at the same time eliminating dependence on high mass substrates, we propose a use of the lightweight, deployable mesh-like, compressible scaffolding, potentially acting as an assimilable substrate. The scaffolding structure will be coated with nutrients and seeded with mycelia. Growing mycelium would 'climb' on, and solidify the scaffolding, binding it all together. This novel approach enables mycelium growth into a structural system and minimizes the mass of structural materials that have to be brought from Earth, providing much cheaper and lighter material for design habitats for long-duration missions.