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Space Architecture: Habitats, Habitability, and Bases (1)

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GROWTH AS AN ALTERNATIVE APPROACH TO THE CONSTRUCTION OF  
EXTRA-TERRESTRIAL HABITATS**Abstract**

One critical element to space exploration is the ability to construct habitats while minimizing payload mass launched from Earth. To respond to this challenge, we propose the use of fungal bio-composites for ‘growing’ extra-terrestrial structures, directly at the destination, significantly lowering the mass of structural materials transported from Earth and minimizing the need for heavy-duty robotic operations and infrastructure preparations.

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. In parallel with research on insitu resource utilization methods, here we present a new, biological approach for constructing regenerative and adaptive habitats, resilient to extra-terrestrial hazards.

Based on the idea of engineered living materials (ELMs), we present the use of mycelium-based composites - which are fire-resistant, insulating, do not outgas, and can be used independently or in conjunction with regolith, enhancing composite ductility - employing the living biological growth in a controlled environment, for the process of material fabrication, assembly and maintenance. Our concept is that, similarly to a seed of a tree, the deployable growing habitation system will contain all the essential information needed to grow the desired structure.

The paper will outline the potential and challenges of using bio-composites for space applications and will present how these might be addressed, in order to make this biological approach feasible, providing new, growing materials for design habitats on long-duration missions.