IAC-21,E5,1,7,x63597

**Growth as an Alternative Approach to the Construction of Extra-Terrestrial Habitats**

**Monika Brandić Lipińskaa**\*, **Martyn Dade-Robertsona, Chris Maurerb, Ruth Morrowa, Debbie G. Seneskyc, Magdalini Theodoridoua, Meng Zhangd, Lynn J. Rothschilde,**

a *Hub for Biotechnology in the Built Environment, Newcastle University, Devonshire Building, Newcastle upon Tyne NE1 7RU, UK,*monika@lipinscy.pl

b *redhouse studio, Ohio City Firehouse, 1455 W 29th St, Cleveland, OH 44113, United States*

c*Stanford University, 496 Lomita Mall Durand Building, #202, Stanford, CA 94305-4035, United States*

d*Hub for Biotechnology in the Built Environment, Northumbria University, Devonshire Building, Newcastle upon Tyne NE1 7RU, UK*

e*NASA Ames Research Center, Moffett Field, CA 94035, United States*

\* Corresponding Author

**Abstract**

A critical component of human space exploration and eventual settlement is the ability to construct habitats while minimizing payload mass launched from Earth. To respond to this challenge, we have proposed 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 high mass robotic operations and infrastructure preparations. Throughout human history, the construction of habits has used biologically produced materials, from bone and skins to wood and limestone.  Traditionally, the materials are used only after they die. Currently, the idea of working with living biological organisms, and the phenomenon of growth itself, is increasing in interest both, in architecture and space applications. Here we describe the use of mycelium-based composites as an alternative, biological approach for constructing regenerative and adaptive extraterrestrial habitats, a continuation of our research program initiated under the auspices of the ‘Myco-architecture Off Planet’ NASA NIAC Team. These composites, which are fire-resistant, insulating, do not consist of volatile organic compounds from petrochemical products and can be used independently or in conjunction with regolith, could employ the living biological growth in a controlled environment, for the process of material fabrication, assembly, maintenance, and repair, providing structures resilient to extra-terrestrial hazards. 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.