

## 21st SYMPOSIUM ON SPACE ACTIVITY AND SOCIETY (E5)

Future and current space missions: including and expanding all aspects of human life on-board and in other worlds (1)

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## SINTERHAB – SINTERED LUNAR OUTPOST CORE MODULE

**Abstract**

This project describes a design study for a core module on a Lunar South Pole outpost, constructed with the use of in-situ resources and equipped with a bio-regenerative life support system. The module would be a hybrid of CLASS II and III structures, combining membrane structures and pre-integrated rigid elements with a sintered regolith shell for enhanced radiation and micrometeorite shielding.

The main objective is to design a module containing a closed loop ecological system supporting a new sustainable presence on the Moon with particular focus on research activities. The core module accommodates from 4 to 8 people and provides laboratories as a test bed for development of new lunar technologies directly in the environment where they will be used. SinterHab also includes an experimental garden for development of new bio-regenerative life support system elements.

The study particularly focuses on in-situ resource utilization methods, membrane structures and a bio-regenerative life support system. The project explores these concepts from an architectural point-of-view, as they constitute the building, construction and interior elements. The construction method for SinterHab is based on contour crafting by sintering the lunar regolith. The regolith is processed, placed and sintered by a robotic system combining NASA ATHLETE and Chariot remotely controlled rovers. Microwave sintering creates a rigid structure in the form of walls, vaults and other architectural elements. The interior is coated with a layer of inflatable membrane derived from the TransHab project.

The life-support system is mainly bio-regenerative and several parts of the system have more than one purpose. The plants for food production are also an efficient part of atmosphere revitalization and water treatment. Moreover, the plants will be used as a “winter garden” for psychological and recreational purposes. The water in the revitalization system has multifunctional uses: for radiation shielding in the safe-haven habitat core, and for other architectural elements. The garden module creates an artificial outdoor environment mitigating the notion of confinement on the lunar surface. The structures for cultivation are designed for the needs of the plants, but also for the ease of maintenance. Also the natural lighting is considered in this concept. Fiber optics systems fed by Fresnel collectors and plasma lamps are used for natural light transmission into the interior.