35th IAA SYMPOSIUM ON SPACE AND SOCIETY (E5)
Interactive Presentations - 35th IAA SYMPOSIUM ON SPACE AND SOCIETY (IP)

Author: Ms. Ayse Oren
Türkiye, info@ayseoren.com

# ADVANCING MODULAR UNDERGROUND ARCHITECTURE FOR LUNAR HABITATION

**Abstract**

The Off-world Anthropologic Space Infrastructure Settlement (OASIS) Project is an ongoing requirements-driven design paradigm for establishing a sustainable lunar settlement in the coming period of space architecture (about one decay). The tripartite design analysis is based on the codification of science environment, architectural ideas and systems engineering requirement solutions. The project master plan consists of three primary phases: • Phase 0 – Analog and subscale portlight element and distributed system testing ground analog model, LEO, space born, and lunar resources • Phase 1 – Establish a viable construction site and accomplish in situ testing of all flight elements scalable distributed systems • Phase 2 – OASIS primary buildout infrastructure operations This paper addresses OASIS Phase 1 primarily from an architectural design perspective. The location of Phase 1 will be within a small naturally formed crater in the vicinity of a lava tube sky vent, capitalizing on unique geological features. The OASIS project has baselined the integration and effective use of Earth-launched. Elements and distributed systems, technologies and components that are now extant or under development to minimize cost, schedule, and technical risk (TRL readiness). The habitat modular structures would be installed within the crater's confines, emphasizing the role of modular architecture and standardization in the realm of lunar construction. The science requirements and design drivers are primarily the Lunar environmental conditions. The combination of extreme temperature variations, illumination considerations, asteroid impacts, radiation situation (Galactic Cosmic Rays and Solar Particle Events), no atmosphere, seismic activity, electrochemistry considerations, and the absence of magnetic field protection. This defines an original design environment that is characterized and tested in-situ. This necessitates ingenious solutions for durability of habitation and building a safe environment for humans. The strategic embedding of inflatable modules within the crater promises enhanced insulation and augmented protection against external hazards and threats. Modular design principles of our architectural strategy facilitate efficient construction, adaptability to lunar conditions, and the execution of maintenance and expansion tasks. The use of sandbags filled with regolith as protective encasements around the inflatable modules showcases in-suit, resourcefulness, and sustainability in lunar architectural practices. This paper presents practical applications of inflatable modules, and rigid structures within a modular framework, taking full advantage of the unique lunar crater environment. We developed our strategy to answer the known technical challenges, integrate innovative design solutions, and underscoring the critical importance of standardization in shaping the future of space architecture.