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

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LUNAR NEXUS: EXPLORING SUSTAINABLE EXTRATERRESTRIAL HABITAT DEVELOPMENT  
WITHIN A LUNAR PIT.

**Abstract**

The Lunar Nexus project envisions a research base on the Moon as a nexus between Earth and space exploration, conceived as an expandable human habitat within a system of lunar pits. The project's core objective is establishing a profound connection between architecture and the lunar landscape to address the challenges of sustainable human habitation beyond the Earth. To address this challenge, Lunar Nexus looks at vernacular architecture on Earth to establish a synergy between architecture and landscape: mitigating environmental "threats" on one hand and seeking dialogue with the existing on the other. The project is located within a lunar pit, which is considered a potential "home" within the Moon morphology, just as the primitive humans sought shelter in terrestrial caves, to protect themselves from environmental and anthropic threats. Lunar pits are cavities that open on the lunar surface, often formed by the collapse of underground lava tubes, providing access to an unknown underground realm of high scientific value that offers natural protection from cosmic radiations, extreme temperatures, and micrometeorites. To self-sustain, the project unfolds on various levels, proposing a surface support system reliant on In Situ Resource Utilization (ISRU), connected by an infrastructural network with a central Outpost as its hub, facing the pit opening and allowing communication between the surface and the underground. Within the lunar pit, the habitat is constructed with lunar regolith and inflatable modules, adapting to the cave's shape, and providing spaces for human habitation and plant life. Engaging in a dialogue with the lunar pit's rocky wall, the architecture integrates with the natural surroundings. The form, scale, and sequence of designed spaces depend on the shape of the rocky wall, creating a design harmonious with the lunar pit's specific characteristics. Compared to surface habitats, the Lunar Nexus benefits from the lunar pit's unique environment, allowing experimentation with a novel settlement logic characterized by linear and vertical development. This minimizes resource consumption and extensive surface construction, leveraging the site's features for innovative possibilities in lunar living. The present study aims to contribute to extraterrestrial habitat literature, initiating a discourse on sustainable principles for construction on other planetary bodies, and maintaining a human-centric design approach, leveraging the use of lunar morphology.