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OUROBOROS: ARCHITECTURE IN SPACE

Abstract

Designing architecture for space presents a unique challenge. The uncertainty of the Martian environment and the evolving needs of a future base make it difficult to predict the optimal design. At the same time, sustainability is crucial as minimizing waste and maximizing efficiency are essential for long-term space habitation. To address these challenges, the architecture department of Dream Team Space Oasis Delft collaborated to design 'Ouroboros': a concept for a circular, adaptable, and human-centered habitat. The base is designed to support a five-year Martian mission with a crew of 150 members. The crew size aligns with Dunbar's number theory for sustaining human life in space.

Inspired by biomimicry, 'Ouroboros' incorporates nature-driven solutions to enhance adaptability and sustainability. The concept is based on the characteristics of snakes. Snakes are flexible, self-repairing and highly efficient in their use of resources. To make the habitat adaptable for the obstacles on the rough surface of Mars, it is constructed out of modular units. These can be reconfigured to adapt to the needs of the crew and possible expansion. Each living module accommodates between ten and fifteen people and is connected to the central hub.

The structure of the modules is primarily made of triangular panels that can be easily removed or added to modify the shape. This modular approach enables adaptability, periodic repurposing, and increased customization of the habitat. The panels on the exterior have an innovative purpose of cleaning the indoor climate during Martian dust storms, mimicking the self-cleaning mechanisms found in snakes. Beneath these panels, the outer shielding layer is made of pykrete: a composite material combining ice and waste materials from the farming system. Pykrete is effective in blocking radiation and has self-repairing properties, as it can refreeze and regain its strength when damaged.

By integrating biomimicry and the design principles, the concept of 'Ouroboros' demonstrates how sustainable space habitats can be developed despite the uncertainties of the Martian environment. This concept serves as a model for future space architecture, showing that respecting the environment and designing for adaptability can lead to long-lasting, self-sufficient extraterrestrial settlements.

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