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Simulating Space Habitation: Habitats, Design and Simulation Missions (6)

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DEVELOPMENT AND CONSTRUCTION OF A LOW-COST OPEN-SOURCE HABITAT FOR
ANALOG MISSIONS

Abstract

Analogs are settings on Earth that resemble in significant ways a situation or location in space. While analog research is not new in space exploration, it has gained more traction with the current plans for commercialization of Low Earth Orbit, return to the Moon, and future crewed exploration of Mars and deep-space. However, opportunities for crews and researchers to participate in existing space analogs are limited, in particular for individuals in countries without a space program, in addition to requirements such as visas and high travel costs. This work presents the development and construction of the HAdEES-C habitat, Spanish acronym for Analog Habitat for Simulated Space Exploration - Colombia. The project started in January 2021 with support from the Space Generation Advisory Council Incubator grant. The habitat was designed based on first principles of exploration architectures, experience on habitat design and construction, and team members' experience as crew in analog missions. The proposed habitat is aimed to be low-cost and open-source, available to anyone interested in conducting analog research. The structure is based on commercially off-the-shelf components, requiring minimum or basic processing, for teams to have easy access to an analog facility. The habitat has five independent structures connected by tunnels: crew quarters, kitchen, airlock, greenhouse with bathroom, and main dome; the latter houses two laboratories, workspace, and exercise area. The design involves a mission architecture with crews of six individuals for two weeks, which can be extended with resupplies and an extended storing area. Modularity is another key concept in the construction, allowing for changes to be made in a section of the habitat without affecting the rest of it. The general final cost of the habitat is under U\$10.000. The operations of the habitat are run by the non-profit Cydonia Foundation, along with industrial partners such as the telecommunications company BoltCom, and academic partners, such as the Aerospace Research and Development Group of Universidad Nacional de Colombia, becoming a node for the space ecosystem of the country. Additional modes of operation include space school camps, for promoting space and STEM-related activities for children. This low-cost analog research facility provides opportunities for emerging nations and individuals with different backgrounds to participate and contribute to human space exploration. This increases awareness and creates a more diverse community. Additionally, social aspects of the development of human spaceflight will also be discussed, as governing and decision-making strategies for future planetary exploration.