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Author: Mrs. Alimsha Mohammed Riyas
Deep Space Initiative, United Arab Emirates

Ms. Lara Alhares
Jordan
Ms. Shahed Alshab
Jordan

# MAHSOS: A MARS ANALOGUE HABITAT FOR SCIENTIFIC AND OPERATIONAL SIMULATION IN WADI RUM, JORDAN

**Abstract**

The establishment of sustainable extraterrestrial habitats necessitates innovative design and interdisciplinary approaches to ensure human survival and well-being in harsh, isolated environments. This paper presents MAHSOS (Mars Analogue Habitat for Scientific and Operational Simulation), an advanced analogue habitat project developed under the MENA (Middle East North Africa) initiative, set in the Mars-like landscape of Wadi Rum, Jordan.

The MAHSOS project aims to simulate Martian living conditions by integrating architectural resilience, human-centric design, and advanced life support technologies. The habitat's design incorporates pre-integrated modular structures, optimizing spatial orientation and adaptability for long-duration missions. It features critical systems such as ECLSS (Environmental Control and Life Support Systems), thermal control, radiation protection, and innovative interior elements like green walls, aquaponics, and AR/VR tools to enhance mental and physical health.

A unique aspect of MAHSOS is its emphasis on crew well-being in isolated and confined environments. By incorporating adaptive interior designs and inclusive technologies, the habitat supports psychological health through biophilic elements and simulated natural cycles, such as circadian lighting. These design choices are not only pivotal for Mars missions but also hold potential applications for terrestrial environments facing extreme conditions, including polar research stations and disaster-resilient housing.

The habitat's Phase A development includes detailed spatial planning, prefabricated construction methods, and robust ancillary systems for power, water, waste management, and data management. The site-specific adaptation to Wadi Rum's challenging topography enhances the habitat's realism, providing valuable data on habitat performance, crew dynamics, and technology testing in analogue conditions.

Through a combination of experimental design, architectural visualization, and on-site research, MAHSOS serves as a testbed for evaluating habitat functionality and advancing the Habitation Readiness Level (HRL) for future Mars missions. This project not only addresses the operational demands of human space exploration but also contributes to broader research on sustainable living solutions in extreme environments on Earth.

This study aligns with MENA's broader mission of pioneering sustainable space exploration solutions and promoting the Arab community's leadership in global space initiatives. The research outcomes are expected to inform future crewed missions, advancing knowledge in space architecture, human factors, and system integration for extraterrestrial habitation

Keywords: Mars Analogue, Space Architecture, Human-Centric Design, Extraterrestrial Habitation, MENA, Wadi Rum, Extreme Environment Adaptation