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Moon, Mars and Beyond: Analogues, Habitation and Spin-Offs (2)

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THE EUROPEAN MARS ANALOG STATION FOR ADVANCED TECHNOLOGY INTEGRATION (ERAS)

Abstract

There are numerous technological and scientific gaps concerning the crewed exploration of Mars. These gaps are in the fields of psychology, physiology, medicine, mission operations, human factors, habitability, robotic operations and life support systems – all of which can be addressed using terrestrial analogs.

While there are presently numerous terrestrial Mars analogs in operation, they fail to address several key aspects of a crewed mission to Mars. The European MaRs Analog Station for Advanced Technology Integration (ERAS) is an evolution of the Mars Analog Research Station Program (M.A.R.S.), an international effort spearheaded by The Mars Society. The goal of ERAS is to provide an environment where the aforementioned gaps can be addressed and increasing public support for crewed missions to Mars, thereby increasing their feasibility. The "Five Showstoppers for Mars" identified by the scientific community are:

1. Hypogravity
2. Radiation
3. Need for Regenerative & Bioregenerative Life Support
4. Martian Dust
5. Planetary Protection (forward- and back-contamination)

The primary innovations of ERAS compared to existing terrestrial analogs come in the areas of habitat typology, shielding, sealing, location, and testing of electric power technologies. ERAS will be a hybrid inflatable habitat, which will significantly lower launch mass and volume for a given deployed volume. Radiation shielding, thermal mass and micrometeorite protection will be achieved using composite materials created in-situ using high-performance polymer binders and Martian regolith. One of the major technological challenges addressed by ERAS will be the construction and operation of such a habitat module. Testing of photovoltaic power generation systems with regenerative fuel cells will be undertaken at ERAS, along with testing of other proposed technologies. ERAS will be located in an accessible region in Europe, such that costs of logistics, operations and research are minimized, and education/outreach opportunities are exploited. ERAS will enable researchers from all over the world to conduct experiments pertaining to nearly all aspects of a crewed Mars mission in a high-fidelity analog.

Implementation of the ERAS would provide an effective test bed for field operation studies in preparation for crewed missions to Mars. The potential results are innovative and will foremost benefit a wide range of users and impact on researchers, mission planners and future Mars exploration.