Paper ID: 66694
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32nd IAA SYMPOSIUM ON SPACE AND SOCIETY (E5)
Space Architecture: Habitats, Habitability, and Bases (1)

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D-MARS OFF-GRID HABITATION STUDY

Abstract

The Desert Mars Analog Ramon Station (D-MARS) is a non-profit organization, dedicated to developing and operating an international planetary research analog center in the Negev desert of Israel. An advanced D-MARS habitat that will host the analog Mars mission AMADEE-20 on October 2021, is being established at the Ramon crater. This habitat, defined as prototype 2.0, is designed to be a platform for international analog missions, and could be deployed as a habitation solution in extreme environmental conditions for various other activities. It is aimed also for astronauts training, scientific analog research, and an innovation laboratory for combining existing technologies in future space missions.

The Mars outpost complex design that will be used for AMADEE-20 is composed of two main D-MARS habitats: prototype 1.0 serving as the residential unit, and prototype 2.0 serving as the main operations and workspace unit. Among other extensions considered in the near future, are lava tube simulator and extreme agriculture unit, and possibly other units. Power, communication, water recycling, as well as other subsystems will be integrated to supply all the basic needs of the analog astronauts and the various requirements of the analog mission.

The execution of AMADEE-20 is an opportunity for in-depth study, analysis, and optimization of the Mars outpost units and subsystems design. Particularly interesting is the analysis of habitat prototype 2.0, which includes advanced features like positive pressure and clean room and is the first stage in establishment of the future concept of D-MARS.

During AMADEE-20 a wide range of data will be collected from the Mars outpost units and from the various activities that will be part of the simulation, including sensors data, routine reports, various experiments, and questionnaires. The Off-Grid Habitation (OGH) experiment is focused on three aspects: i) resources and consumables management and optimization; ii) time dependent physical characterization of habitat prototype 2.0; iii) habitat design effects on human factor aspects. The invaluable data that will be collected during the mission will be used for real time preliminary analysis and post mission study and optimization of the design and operation of the Mars outpost complex.

This paper will describe the research rationale, and preliminary results from the OGH experiment, and implementation of the habitat prototype 2.0 during the AMADEE-20 mission. These results will be used to evaluate and improve the D-MARS' new habitat, paving the way for the journey of human missions to Mars.