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CONCEPTUAL DESIGN FOR A DEPLOYABLE HABITAT FOR EXTREME ENVIRONMENTS ON EARTH AND SPACE

Abstract

Developing space settlements is crucial for crewed space exploration and scientific missions in extreme environments such as other planetary bodies like the Moon, Mars, or Near-Earth Asteroids, and isolated places on Earth such as the Antarctic. These structures must be easy to transport and provide the necessary stability and features to ensure human safety. A particular scenario for validating space technologies and mission design concepts is analog missions, as well as for obtaining a better understanding of the technical challenges. The main goal of this work is to present the conceptual design for a low-cost deployable habitat. The design should allow the transport of the habitat around Colombia to different environments like Snowy Ruiz Volcano or Tatacoa Desert and can be used for analog research in the country. This initial phase starts by defining the essential requirements and considerations for the deployable habitat in a conceptual design. This includes determining the size, shape, and configuration of the habitat, as well as identifying the mechanical requirements to ensure integrity, stability, and foldability. This phase also involves identifying features required to guarantee the safety of humans in space and assessing the design's feasibility, considering factors such as folded volume, structural strength, weight, and technology readiness levels. While it is important to consider factors such as thermal insulation, radiation shielding, environmental control systems, and power generation, this analysis will focus on the structure, materials, construction techniques, and deployable mechanisms. This information will be useful to develop and analyze a habitat design based on origami that will be innovative and cost-effective, while still meeting the requirements and considerations.