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DESIGNING A MOBILE INFLATABLE HABITAT FOR SUSTAINABLE MARS EXPLORATION.

Abstract

The human exploration of Mars represents a significant milestone in our understanding of the Earth and our place within it. With the first studies of the Red Planet, we are seeking answers to important questions about the possibility of life beyond Earth, the history of our solar system, and humanity's potential to expand into the cosmos. This effort requires the creation of new technologies that will enable the continuation of human life on the surface of Mars. This paper describes the design and development of a toroidal structured mobile home on Mars that could accommodate four people. This work focuses on creating a living space where the individual is equipped with all the necessary needs for life support, including air purification, oxygen production, water recycling, waste management and temperature control. The main innovation in the use of inflatable systems for the main structure. This approach leverages lightweight construction, rapid deployment, and large habitats to create efficient and safe long-duration Mars missions. The mobile platform uses wheels to traverse different landscapes of Mars, allowing exploration and research near the landing site. The space station is larger and has a more flexible footprint than NASA's proposed Space Exploration Vehicle (SEV). Our design process uses computer-aided design (CAD) models to create a detailed virtual representation of the address. The model simplifies energy analysis of the material to ensure the inflatable structure can withstand the harsh Martian environment, including the energy demands and hazards of the terrain. The inflatable materials chosen are important for Mars, such as strength-to-weight ratio for structural integrity, puncture resistance, and radiation shielding properties to protect astronauts from radiation problems. This study demonstrates the feasibility and advantages of mobile habitats for Mars exploration. The findings, which include results from CAD models and artificial materials, pave the way for further development and improvement. Future efforts will focus on seamlessly integrating life support systems into the inflatable structure and making physical prototypes to validate the design under simulated Martianconditions.