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MARS HABITAT SAFETY AND EMERGENCY SYSTEMS DESIGN

Abstract

Through this scientific paper, students from ISAE-SUPAREO, Polytechnic University of Turin, and the University of Leicester, forming the SEEDS XVI team, develop a future habitat solution on Mars. To achieve this, the systems engineering method is first applied to lunar habitat technologies, which will later be reused on Mars.

The Martian environment is known to be harsh, lacking oxygen, and subject to significant temperature variations. Without pressurization, temperature and humidity controlled habitats, it is impossible for humans to survive on this planet. The risks associated with this environment, such as dust storms, exposure to radiation, and the challenge of limited natural in-situ resources available, must be taken into account. These hazards are obstacles to the survival of Martian habitats. Ensuring the safety of individuals is crucial, necessitating a risk analysis related to the Martian environment and resource scarcity.

Considering the various risks identified, we adopt a systems engineering approach to develop effective mitigation strategies, relying on the management of available resources. Emergency systems capable of addressing unforeseen incidents and the integration of emergency protocols are envisioned. These systems and protocols will be adjusted based on the evolving conditions and knowledge on the Martian environment. Implementing in-situ resource management practices plays a key role in reducing our dependence on Earthly supplies and increasing the resilience of Martian habitats to resource shortages, thereby minimizing risks associated with resource scarcity. These strategies have been established to ensure the safety and sustainability of Martian habitats, laying the groundwork for long-term exploration and settlement on Mars.