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Architecture for humans in space: design, engineering, concepts and mission planning (1)

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SUSTAINABILITY-STRATEGIES FOR AN EXTENDED HUMAN PRESENCE ON MARS

Abstract

The increasing (negative) impact of human beings on Earth's ecosystem and humanity's eagerness to explore will likely one day manifest themselves in the colonization of our neighboring planet Mars. Due to the considerable distance and launch-effort, the success of an extended human presence on the Martian surface will be highly dependent on the degree of sustainability and self-sufficiency that the mission and habitat designs provide.

To create sustainable habitats in which humans can thrive, optimum living and working conditions are a requisite. Therefore, crew needs and living preferences have to be considered. For the base to grow with its number of residents, it needs to be flexible in its configuration and should be easily expandable. Innovative solutions (e.g. 3D-printing, LASER-sintering) for the use of in-situ resources to minimize launch burden and promote self-sufficiency are particularly important.

Following a detailed discussion of original designs for a sustained human presence on Mars, the proposals are analyzed in terms of their innovative and efficient use of in-situ resources and their flexibility regarding changing mission requirements, environmental conditions and user needs.

This paper presents an evaluation of innovative habitat designs for the Martian surface according to the measures they propose to significantly increase their life-cycle without being dependent on permanent, interplanetary supply.