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ARCHITECTURAL DESIGN SOLUTIONS FOR HUMAN HABITATION ON MARS

Abstract

One of the key objectives of the 2014 NASA Strategic Plan is to “expand the human presence into the solar system and to the surface of Mars to advance exploration, science, innovation, benefits of humanity and international collaboration”. To achieve this, NASA proposed the Evolvable Mars Campaign. The campaign begins with Earth-reliant missions between 2015 to early 2020s to expand the knowledge of human operations in space, followed by missions to the vicinity of Mars and ultimately resulting in long duration stays on the Martian surface. With the increasing investment in Mars research and exploration by various countries, and commercial partners, architects and designers have a role to play in addressing the challenge of designing, building and executing spaces for human habitation on Mars. This paper presents a robust architectural design for human habitation on Mars using traditional architectural tools where design is an evolution of inferences of all the factors that make up the context.

Mars, unlike the Earth has a different composition of atmosphere, reduced gravity, pressure, presence of dust storms, extreme temperatures, and radiation. We begin with a comprehensive study of the environmental conditions, conceptualize the architecture, and propose design solutions. A thorough study of the Martian conditions is necessary in order to further study the static and dynamic behavior of structures, material properties like strength and thermal expansion, and radiation effects. The paper will explore design strategies, and provide solutions to cater to the challenging environmental conditions on Mars as well as research different materials and forms that uphold structures in such scenarios. The primary questions that will be addressed are: How do we transform uninhabitable spaces into habitable ones in the context of Mars? What architectural tools can be applied to conceptualize, and design habitats for human exploration of Mars? How does context play an important role in design?