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Human Exploration of the Moon and Cislunar Space (1)

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HABITAT, SPACE SYSTEMS AND EARTH ANALOGS SOLUTIONS DESIGN FOR HUMAN AND ROBOTIC EXPLORATIONS OF THE MOON

Abstract

We are entering on the 7^{th} step of 1926 Space colonization plan of Constantin Tsiokolvski, thanks to the space Technology Readiness Level (TRL) achieved on programs like NextSTEP of NASA and "Concordia" Analog Mission. Space Habitat Solutions and Analog Mission Tests become an essential part of all the new space exploration programs.

Since last Apollo Program mission several Architect Ateliers, Students, Space Agencies and Startups created concepts of Moon Habitat, however only few have dedicated to directly apply this knowledge to improve living conditions on earth.

This paper present feasible solutions to manned Space exploration and its applications to improve life on earth. Firs goal is to present a Space Habitat using medium and high TRL components. Then discuss the creation of a Analog Colony in Namibe Desert and design Micro/Macro Gravity experiments, to Increase the TRL and use it as Space STEM Education Tools. According the United Nations more than 1 billion people as no habitable conditions so the 3rd goal brought a roadmap to support 11^{th} Sustainable Development Goal using Nambe's and others Analogs Solutions designed here.

Inspired by nature using Biomimicry and some indigenous habitat concepts the designed solutions used simple and Modular geometries that allow its construction in 3D printing over other analyzed techniques,

exploring some In Situs Resources Utilization Solutions like Regolith Concrete Basalt.

Mission Analysis calculations of cost effective transportation between earth and moon, subdivide the colonization process in 4 Steps from the Short Permanence with Primary Conditions for Scientific Experiences with crews of 4 to 20 up to Colonization with 1000 members were robotic and Space Assets for Mobility Assessment were taken into account. Surface and underground architectural concept seizing the characteristics of the Equatorial and Pole Regions of the Moon allowed a greater optimization of the interior space and define from Pneumatic Structures of Inflatable Kevlar up to Shelters tents supported by arches and beams using existing Craters or Tubes of Asleep Lava.

INCOSEs and NASAs Model Based System Engineering and System Markup Language were used to integrate the Space System, Architecture, Geology, Sociology, Psychology, Mechatronic Engineering and other areas of the Project. This methodology allows transverse application in several areas and contribute to the development of future studies in the exploration of Asteroids, Housing on Mars, Titan and other celestial bodies.