Paper ID: 50293
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30th IAA SYMPOSIUM ON SPACE AND SOCIETY (E5)
Is Space R&D Truly Fostering A Better World For Our Future? (2)

Author: Ms. Agata Mintus
Delft University of Technology, The Netherlands, agata.mintus@gmail.com

ROADMAP TO RESPONSIBLE AND SUSTAINABLE BUILDING ON MARS

Abstract

The plans for manned missions to Mars already include and emphasize the economically-driven approach towards circularity, mainly in the form of material loops in life support systems or reusability of technologies for multiple missions. However, there are no guidelines yet concerning a sustainable built environment, neither for first missions nor for long-term settlement concepts. On Earth, a more sustainable built environment is required to tackle climate change as well as continue to live within the Earth's resources. To achieve this, a wide array of methodologies exists on how to design and build in a sustainable way, which improves and supports the quality of building products as well as protect the environment. This research aims at creating a first roadmap on designing responsible and sustainable buildings on Mars, by assessing and analysing the principles that already exist on Earth and apply them in a Martian environment.

The method used for this research, starts with an analysis of the existing measures on Earth, like the Sustainable Development Goals (SDG), or the Circular Economy principles (Material Flow Analysis, Life Cycle Analysis, Material Efficiency, Sustainable Materials Economy, etc.), which could be implemented in the space building industry. Additionally to these sustainable concepts, the existing Space Law and guidelines established by the UN are investigated, looking for regulations related to sustainability. These regulations mostly concern peaceful, international exploration, while they don't mention commercial or long-term space resources utilisation. On top of this analysis, a qualitative study combines interviews with experts and secondary data analysis to create the roadmap. After collecting the previously mentioned data, the relevant Martian conditions and mission aspects are used as input for the secondary data analysis. The main result of this research is the roadmap which highlights every step of the building phase, the use phase and the End-of-life. This methodology could direct towards implementing sustainability into manned missions, to protect the Martian environment and preserve it for future generations. Moreover, the first missions to Mars are already critical in terms of future environmental impact and contamination. On top of that, it is highly beneficial to test the technology and principles for the sustainable approach with the first habitats. Therefore, it is important to include the responsible and sustainable roadmap before we establish any long-term settlements in outer space.