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Title

Thermoeconomic Analysis of Martian Habitats

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Abstract

The continuous technological advancements have increased the hopes for colonizing other planets and specifically Mars. Mars habitats are pseudo-isolated systems, with strict requirements of mass, occupancy, and energy. A thermo-economic This type of analysis give emphasis to the viability and cost of possible habitat designs. The thermo-economic model can also be used to provide guidelines for optimisation and a tool of comparison between different habitat designs. However, the inherent constrains of the environment difficult the study of these type of habitats.

This work creates a novel model to perform thermo-economic analysis of potential habitats at the Arcadia Planitia location on Mars. The analysis of the habitat system is split in three main categories which are life support systems (Oxygen/CO₂ levels, food/water needs, waste, hydroponics), energy generation/consumption (electricity/heating, power sources) and human factors (physical/mental limits). The analysed habitats are selected from formal competitions and recommendations [1].

The model compares the designs and determines the best option based on cost/optimization analysis. In the future, this model can be expanded to compare several different designs and/or locations on Mars or any other celestial object.

References

[1] T. Prater et al, "NASA Centennial Challenge: 3D-Printed Habitat," Sep 12, 2017.