27th IAA SYMPOSIUM ON HUMAN EXPLORATION OF THE SOLAR SYSTEM (A5)
Interactive Presentations - 27th IAA SYMPOSIUM ON HUMAN EXPLORATION OF THE SOLAR SYSTEM (IP)

Author: Mr. Evandros Theodosiou
Private individual www.oleg.space, United Kingdom, th.evandros@gmail.com

THERMO-ECONOMIC ANALYSIS OF MARTIAN HABITATS

Abstract

In an area of continuous technological advancements, the prospects of colonizing other planets, particularly Mars, has never been more tantalizing. Mars habitats are pseudoisolated systems, with strict requirements of occupancy, mass and energy. The thermoeconomic model mentioned in this abstract provides a versatile tool of comparison between different habitat designs and mission specifications. The lack of resources and the environmental constrains make the study of these types of habitats complex. Hence, the necessity for assumptions and compromises, notably regarding parameters like temperature, humidity, and pressure.

This work introduces ARHS [is an Anglicization of a Greek spelling of the word Ares (=Mars)], a novel software tool for thermo-economic analysis of potential habitats at Arcadia Planitia, a location on Mars, providing output reports. The research and analysis of the habitat system are split into three main categories: life support systems (Oxygen/Carbon Dioxide levels), power generation/consumption (electricity, heating), and human factors (physical/mental limits). The categories are then split into classes; flows, systems, and controllers which make the Object-Oriented Programming (OOP) used by the software more convenient. The aforementioned categorization and classification are vital for the analogous representation and comparison of different mission or habitat inputs. By offering distinct outputs, ARHS enables a straightforward selection of the most fit-for-purpose habitat for the mission or the most suitable mission for the habitat. To ensure the precision and reliability of the code, extensive verification has been conducted, drawing data from analogue astronaut missions and space expeditions.

ARHS empowers users to compare inputs and determine the best expedition, in manner of either habitat or mission parameters, based on either cost and resources. This groundbreaking software represents a leap forward in space expeditions, providing reliability, precision, and much-needed standards. It simplifies the selection of missions and habitats based on their features and user requirements. Furthermore, by harnessing machine learning techniques, it can be evolved from a comparison tool to an optimization tool, creating a valuable database for future space expeditions.Looking ahead, the possibilities of this software are endless, it is intriguing to consider that once the astronauts are selected missions can be tailored to perfection for each member. Finally, the sheer potential of the OOP enables the focus not just in space but also on expeditions here on Earth, from analogue astronaut missions to deep-sea explorations.