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MARS HABITAT SETTLEMENT- A SCALED DOWN CONCEPTUAL DESIGN CAPABLE FOR SUSTAINING LIFE

Abstract

The search for planets with potential to develop conditions to sustain life is being sought by NASA and ESA. The motivation behind this search is to better understand the conducive conditions that led to human development and sustainability on our planet Earth. Mars water discovery prompted space agencies to push for Mars exploration and therefore this paper is attempting to respond to this challenge by design of a life sustainable habitat. A habitat design was conceived for Mars colonization with the objective to sustain life for 4 crew members for extended period of time. Design architecture emphasized by simplicity to promote collaboration and alleviate stress and boredom, in addition to thermal design and space habitat systems directed towards the wellbeing of the crew will be described. The design of the habitat architecture is based on two levels, horizontal orientation cylindrical shape with ellipsoidal endcaps. The habitat pressure and habitable volumes of 108 cubic meters and 23.8 cubic meters per crew respectively were estimated based on the Celenatno curves; a mass of 5631kg based on the total pressure volume was heuristically evaluated. Thermal design indicated Fluorinated Teflon Polypropylene material is a good candidate to maintain a comfortable temperature within the habitat. Pentene fluid heat pipes will be utilized to maintain good life cycle systems performance temperatures. Hybrid radiation shielding combining carbon with high density polyethylene (HDPE) was selected with optional Martian regolith to block solar and cosmic radiation to acceptable levels. The life support system which consists of air revitalization and CO2 removal system is based on Water Vapor Electrolysis and a combination of Four Bed Molecular Sieves and Sabatier reactor respectively. Solar thermal power management system to capture the sun rays and a nuclear reactor with 1MWth power will be utilized when solar power is not abundant. The above, architecture and associated thermal, radiation shielding, life support systems and nuclear power optimization can deliver a long term life sustaining habitat directed towards the welfare of the crew members during the long missions and for the establishment of permanent planetary settlement.