Paper ID: 57726
student

IAF HUMAN SPACEFLIGHT SYMPOSIUM (B3)
Human Space & Exploration (8)

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SYSTEMS ENGINEERING AND DEVELOPMENT OF TRANSPORT AND LOGISTICS ARCHITECTURE IN THE VICINITY OF MARS TO SUPPLY THE FUTURE COLONY

Abstract

Deep space human exploration is gaining momentum again; space agencies and companies are aiming to achieve this feat in this decade. NASA, with its Artemis mission, aims to land the next man and first woman on the lunar soil by 2024 and head towards the red planet by 2030. In the last two decades, there were many robotic missions to Mars, including rovers and orbiters, and we understand the extremities of the harsh Mars environment better than ever before. Mars Express and Mars Reconnaissance orbiters have surveyed subsurface water ice deposits, proposing several candidates for a colony site.This paper considers two possible long-duration stay zones near discovered deposits of water ice. We consider several viable trajectories for a Mars-bound spacecraft from Earth. We address long term sustainability of the initial colony and development of the population up to 1000 inhabitants. The scope of the paper also includes thermal control of the habitat for the crew. It considers the temperature variance due to geothermal energy in that region, solar irradiance, and atmospheric temperature changes. Considering these factors, appropriate material for thermal insulation is proposed with optimum thickness. The effects of seasonal changes on surrounding temperature and solar irradiance are considered to determine the optimum habitat mass considering the thermal constraints. We consider trade-offs between different sites, accounting for proximity and amount of water, a total mass that is possible to deliver from Earth, and strategies to use in-situ materials for building habitat.