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MISSION ARCHITECTURE OF A HELIUM-3 LUNAR MINING MISSION

Abstract

With fossil fuels running out and global energy demand increasing, the need for alternative energy sources is apparent. Nuclear fusion using Helium-3 is looked upon as a viable solution. Helium-3 is a rare isotope on Earth, but it is abundant on the Moon and dubbed as 'lunar gold'. Throughout the space community, lunar Helium-3 is often cited as a major reason to return to the Moon. Despite the potential of lunar Helium-3 mining, little research has been conducted on a full end-to-end mission. The novelty in any sample return mission lies in the mining architecture developed to extract an adequate amount of the required materials from another celestial body's surface and transport them back securely to Earth within the mission time-frame. Sample return missions by various space agencies around the world have tried to unravel some of the greatest mysteries surrounding our universe and the technology utilized for such missions continues to evolve as the years progress. The mission design for the project was prepared keeping in mind the mission statement, viz. development of a mission architecture for sample return of Helium-3 from Earth's moon as a pre-cursor to permanent sustainable mining missions in the future. Such a mission would involve three major phases: Earth to Moon phase, on the Moon phase and back to Earth phase, which constitute the mission profile. The mission design is just a bird's-eye view of the sample return mission. To dive into the specifics of various segments of each phase of the mission, subsystem detailing with a focus on outcome-based analysis has been performed.