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Systems and Infrastructures to Implement Sustainable Space Development and Settlement - Systems (2A)

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SUPPLY CHAIN STRATEGIES FOR THE SUSTAINABILITY OF DEEP SPACE EXPLORATION

Abstract

NASA's Artemis program will send the first woman, and the next humans, to the surface of the Moon, and implement an orbiting lunar gateway to help sustain future missions on the lunar surface and in Cis-Lunar space. Unlike Apollo, where each mission to the lunar surface was a self-contained, single journey, Artemis also carries a high priority for NASA to build it with long-term sustainability. To sustain human presence on the moon, NASA needs to develop a functional and efficient supply chain strategy. NASA and its international partners have mastered the long-term sustainment of humans in space with a reliable supply chain network servicing the International Space Station (ISS). This complex logistics undertaking is, in many ways, as difficult and challenging as the original design-engineering, and has worked to keep humans in space, 24/7/365, for over two decades. However, using the ISS as a logistics node or 'cloning' the ISS logistics model for future deep-space missions is likely to be problematic. As a platform itself, for example, the ISS' orbit is highly inclined to that of the Moon, presenting significant orbital mechanics and delta-V challenges. The ISS is also unlikely to be maintained, financially or politically, in such a manner as to allow it to serve as a critical and long-term part of the Artemis support structure. Current supply chain tools and strategies are not yet fully developed for a Cis-Lunar or interplanetary network, thus presenting challenges for the Artemis Program to overcome in order to be sustainable. This paper offers an investigation of different supply chain strategies and tools, along with their applicability to interplanetary mission planning, potentially assisting Artemis and future deep-space human exploration to create greater sustainability.