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16th IAA SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND DEVELOPMENT (D3)
Systems and Infrastructures to Implement Future Building Blocks in Space Exploration and Development (2)

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MARS EXPEDITION RESUPPLY NODES [MERN]: DESIGN OF REUSABLE, TRANSPORTABLE IN SITU RESOURCE UTILISATION MODULES FOR SUSTAINABLE MARTIAN INFRASTRUCTURE

Abstract

To promote a sustainable future space exploration program, space infrastructure needs to be designed that increases the supply network of future manned missions. Crew expedition range from a central base is limited to critical variables such as energy reserves, oxygen, water and food. This project aims at designing transportable pods that act as supply network nodes, gathering and resupplying finite resources during extra-vehicular activity (EVA) through in-situ resource utilisation (ISRU). These pods shall be known as Mars Expedition Resupply Nodes (MERN). Autonomous rovers will be utilised for the deployment of the nodes at predetermined locations, allowing for the collection and distribution of in-situ resources to future vehicles during manned expeditions.

The MERN pods will primarily gather and store energy and water from the Martian environment. Generation and storage of electricity is a prerequisite for the acquisition of oxygen, water and food from the surrounding martian environment. This paper addresses the design of power, resource collection, resource storage, deployment and structural subsystems with focus on common interfaces and implementation of existing solutions. Monitoring and communicating the amount of usable resources is a functional requirement that is excluded from the scope of this paper but is identified as an area for future work. Another future mission objective is for the pods to function as temporary emergency shelter which can sustain a suitable environment for human life.

The MERN system will support future sustainable space exploration through providing a reusable network of ISRU resupply nodes. These nodes facilitate crewed mission demands and allow for long-term reusable and affordable exploratory infrastructure for Mars operations.