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REDUCING EARTH DEPENDENCY FOR HUMAN SPACEFLIGHT THROUGH ROBOTIC SPACE MANUFACTURING

Abstract

Human space exploration is currently hampered by extreme supply chain challenges. Current missions to Low Earth Orbit (LEO) requires constant resupply and is completely dependent on Earth resources. If future missions expand exploration into the solar system, new strategies must be created in order to rely not just on ground based supply chains to ensure safe and affordable programs. Additive manufacturing enables the restrictions placed on Earth supply chains to be lifted and new exploration architectures to be explored. Starting this year (2014), the International Space Station will have the capability to not entirely rely on launches to receive mission items on orbit when Made In Space launches the 3D Printing in ZeroG Experiment (3D Print) in partnership with NASA. This technology demonstration will prove the vitality of additive manufacturing in space and analyze the effects of long duration microgravity on the hardware and process. This mission is a stepping stone for the future Additive Manufacturing Facility (AMF) that will be installed in 2015. The AMF will be able to create high quality parts on demand for any entities that require them. This same technology can support future manned exploration by suppling astronauts with the ability to make critical and non-critical fixes to ensure missions success. Future additive manufacturing technology that is being developed will be able to supply all necessary spares and upgrades for missions as well as create infrastructure, such as habitats on Mars, that can be robotically created before crew arrives. This is only one of many examples of the applications that can be used with the technology. This paper explores the possibility that additive manufacturing provides to the future of both manned and robotic space exploration.