HUMAN EXPLORATION OF THE SOLAR SYSTEM SYMPOSIUM (A5)
Human Exploration of the Moon and Cislunar Space (1)

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FOSTERING A CIS-LUNAR INFRASTRUCTURE FOR HUMAN EXPLORATION AND SPACE COMMERCE

Abstract

This paper addresses NASA's Asteroid Redirect Mission (ARM) and In Space Robotic Servicing (ISRS) which when coupled with technology development such as high power Solar Electric Propulsion (SEP) provide the foundation of a cis-lunar space infrastructure as a building block for future human exploration of Mars.

A number of ISRS technologies demonstrated on the International Space Station may provide improved exploration mission resiliency and safety through spacecraft life extension and improved maintenance via refueling, repair, repositioning, component replacement, and remote inspection.

ARM is an early cis-lunar demonstration of advanced technologies and capabilities for future human exploration such as advanced SEP which allows for the movement of large objects through deep space trajectories and staging points. Astronauts arriving on the Orion spacecraft will dock with the ARV to retrieve samples through integrated robotic and crewed mission operations, building important extravehicular activity, complex trajectory operations, and rendezvous and docking experience beyond low-Earth orbit.

The common approach to rendezvous sensor and high-speed fault tolerant processing technologies utilized by ARM and ISRS can provide autonomous proximity operations for a variety of exploration applications such as mapping and navigating relative to planetary terrain, such as at the asteroid, and providing for sensors that enable precision crew vehicle docking to the ARM robotic spacecraft.

The ARM robotic spacecraft may be reused as a future infrastructure element by serving as a tug to move cargo between cis-lunar space and Mars orbit. Similar space tugs, operating between low-Earth orbit and higher orbits, could support logistics requirements for cis-lunar operations. Robotic repair tools and techniques may have applications for in-situ resource utilization and asteroid mining, and may assist crew in spacecraft operation and maintenance, or assembly of large structures.

Finally, ARM and ISRS also may help boost the emerging commercial space arena by laying the ground work for technology demonstration of satellite refueling, relocation, and repair ventures with potential markets servicing government and commercial satellites at geosynchronous Earth orbit and beyond for international exploration.