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IAF SPACE EXPLORATION SYMPOSIUM (A3)
Moon Exploration – Part 2 (2B)

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SYSTEMS CONSIDERATIONS FOR LUNAR POLAR REGION MISSIONS

Abstract

Efficient expansion of human presence beyond low-Earth orbit to asteroids and Mars will require the maximum possible use of local materials, so-called in-situ resources. The moon presents a unique destination to conduct robotic investigations that advance in-situ resource utilization (ISRU) capabilities, as well as provide significant exploration and science value. Since the moon's polar regions have confirmed the presence of volatiles, as revealed by the LCROSS and LRO missions, the next step is to understand the nature and distribution of those candidate resources and how they might be extracted. Recent studies have even indicated that if those volatiles are practically available for harvesting, they could be processed into propellants and human life-support resources, significantly reducing the cost of human missions to Mars – maybe by as much as 50

Resource Prospector (RP) is an ISRU technology demonstration mission under study by the NASA Human Exploration and Operations Mission Directorate's (HEOMD). This clever mission is currently planned to launch as early as 2022 and will demonstrate extraction of oxygen, water and other volatiles, as well measure mineralogical content such as silicon and light metals from lunar regolith.

The knowledge attained by a mission like RP could have many-fold benefits for space exploration, but also commercial applications. There is a veritable "moon rush" growing over the past few years, with both governments and commercial entities making their cases for lunar exploration and exploitation. Resource Prospector aims to understand just how the water-ice and other volatiles are distributed, both horizontally and vertically, to aid in defining what might be required to harvest those resources on a larger scale. Further, RP looks to actually demonstrate a method to do early, small-scale harvesting of volatiles to better understand what might be appropriate on much larger scales, including scales which could eventually support human lunar habitation and manufacturing. The ISECG Global Exploration Roadmap (GER) of 2013 specifically calls for a series of missions which initially locate/map the resources and then attempt to harvest those resources for use. RP is attempting to do both in one, cost-effective mission.

With sufficient infrastructural investment, led by governments and then optimized by the commercial marketplace, RP would be a pathfinder mission answering early strategic knowledge gaps and enabling commercial markets – a stepping stone to this future, great economy on the moon.