

SPACE EXPLORATION SYMPOSIUM (A3)
Space Exploration Overview (1)

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REGOLITH AS A RESOURCE IN SOLAR SYSTEM HUMAN AND ROBOTIC EXPLORATION

Abstract

Extra-terrestrial regolith is a resource in the exploration of the solar system since the mineralogy and embedded volatiles in the regolith contain valuable elements and compounds that are essential to human survival (e.g. oxygen, hydrogen, water). These, and other resources, can also be used as propellants, purge gases, buffer gases, make-up gases, manufacturing feedstocks, construction material, radiation shielding, plant growth media, and energy sources. In addition the regolith contains a scientific record of the solar system's history and origins. In other words, regolith resources will allow humans and robots to survive, prosper and gain knowledge by using locally acquired resources in space. These resources may well become the commodities that enable a viable exploration architecture or may even become a source of economic wealth.

This paper will review the known regolith properties at various desirable human /robotic exploration destinations such as the Moon, Mars, Near Earth Objects, and outer Solar System Moons. Possible prospecting and resource extraction methods and uses will be discussed and compared. An overview of a potential technology maturation process for critical enabling technologies will be presented. Various regolith operations challenges in reduced gravity and hostile environments will be considered, as well as regolith simulant availability. In addition recommendations for future missions and payloads will be presented.