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VIPER: PATHFINDING IN-SITU RESOURCE UTILIZATION

Abstract

With the Artemis Program, NASA plans to return humans to the Moon to stay. To help support extended stays on the moon, use of local materials, so-called in-situ resources, could be invaluable. Since the moon's polar regions have confirmed the presence of volatiles, as revealed by LCROSS, LRO and other lunar 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 aiding in sustaining humans on the Moon, and eventually and later to support missions to Mars.

The Volatiles Inspecting Polar Exploration Resource (VIPER) is an in-situ resource utilization (ISRU) mission within NASA's Science Mission Directorate (SMD), based on the pathfinding development of the Resource Prospector (RP) mission concept. This clever mission is currently planned to launch in 2022/23 and spend 100 days mapping and surveying four different Ice Stability Regions to understand the nature and distribution of water and volatiles already confirmed to be there, including measuring mineralogical content such as silicon and light metals from lunar regolith.

The knowledge attained by a mission like VIPER could have many-fold benefits for space exploration, but also commercial applications. VIPER is an essential, early mission supporting the "moon rush" which has developed over the past few years, with both governments and commercial entities making their cases for lunar exploration. VIPER aims to understand just how the water-ice and other volatiles are distributed, both horizontally and vertically, enabling creation of volatiles resource maps, which will guide what might be required to harvest those resources on a large scale.

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