# Abstract #771

## English

**Novel Concepts for Extraction and Capture of Water from Martian Regolith**

Abstract Submission to: Planetary & Terrestrial Mining Sciences Symposium (PTMSS) and the Space Resources Roundtable (SRR) 6th joint meeting. Date: May 9 – 13, 2015 Location: Montreal, Quebec, Canada Other: Held in conjunction with the Canadian Institute of Mining (CIF) 2015 Convention Novel Concepts for Extraction and Capture of Water from Martian Regolith Diane L. Linne and Julie E. Kleinhenz NASA Glenn Research Center Cleveland, OH, USA The concept of using available resources at an exploration site to make propellant and life support consumables, known as in-situ resource utilization (ISRU), is often referred to as a game-changing, but high-risk technology. NASA's current plans for human exploration of Mars, known as Design Reference Mission 9, is based on the extensive work performed by the Mars Architecture Working Group (MAWG) and documented in Mars Design Reference Architecture (DRA) 5.0 (ref. 1). For the first time this document names ISRU production of oxygen from the Mars atmosphere (for ascent propulsion and crew consumables) as enabling for robust human exploration missions. While production of methane from ground water and atmospheric carbon dioxide was also evaluated, it was not included in the baseline due to "limited concept evaluation to date and Mars surface water property and distribution uncertainty." Since that report was published in 2008, Mars missions such as Odyssey and Phoenix have confirmed that water can be found globally across the Mars surface, and that there are regions with up to 8 to 10 percent water by mass in the top 1 m of the regolith. So while there is more confidence that sufficient water can be found at the desired exploration site, there has been little progress made in defining concepts for extraction and capture of this valuable resource. Therefore the TRL level remains too low to support higher fidelity system studies of a Mars fuel production plant. The Mars DRA 5.0 report compares water extraction from the Mars soil to oxygen extraction from the lunar regolith, where oxygen is extracted in a batch process at high temperature with the aid of a working fluid that must be recycled. Due to the low yield (~ 2 percent of the regolith mass) and high-energy expenditure (in terms of power, excavation, etc.), all current lunar concepts include sealed reactors to capture every precious molecule. However, repeated sealing of hot surfaces that are constantly exposed to abrasive regolith has proved to be one of the biggest technology challenges for lunar oxygen and water production. This paper discusses several novel concepts for extracting the water from the Mars soil in a continuous process, using the Mars atmosphere as a sweep gas to collect the released water. While this process may 'lose' some of the evolved water, it eliminates the need for reusable, high-temperature, dusty seals, as well as provides heat at the granular level to reduce long heating times and the resultant loss of energy to the environment. The overall system simplicity should prove the concept to be a very attractive option. Concept designs, system analysis, and preliminary test results will be presented.

## French

**No abstract title in French**

No French resume

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