Low mass, low power, non-mechanical excavation of gypsum and other evaporites for water production on Mars

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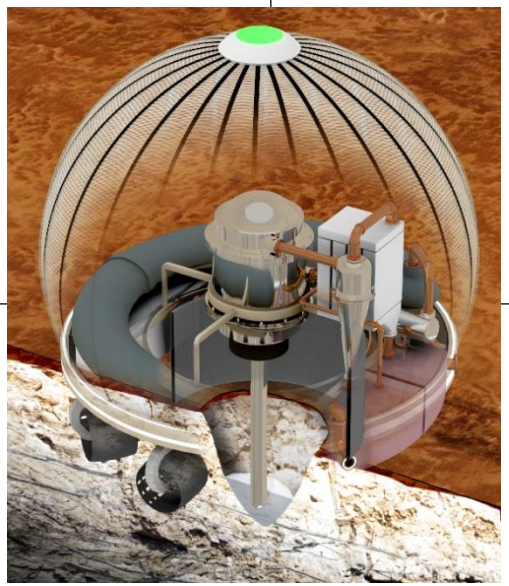
Research Objectives

The objective is to demonstrate an innovative process for extraction of water from hard extraterrestrial soils. The process involves 'dissaggregating' material with a water jet to form slurry, and pumping the slurry into water extraction system. This innovation eliminates the hardest problem in mining: comminution, which involves heavy equipment, significant energies, forces, and tooling impractical for sustained extraterrestrial ISRU. Research is focused on TRL 1-2 processes for excavation of minerals and extraction of water at 0.8 kg/hr. At the conclusion of the project the innovative technology will be at TRL 3-4.



Compact system for water extraction from hard, extraterrestrial soils.

Approach

Concept: create slurry in-situ and transfer to water extraction cycle

Research:

- dissolution, disaggregation, separation and precipitation requirements in relevant environment
- environment constraints – sealing and heat/water losses in mineral deposits and relevant environment
- System integration – size, power required to achieve 0.8 kg/hr water production
- Brassboard feasibility testing

Potential Impact

- reduction in power requirements as compared to mechanical excavation
- improved reliability as compared to mechanical excavation
- Simple, scalable extraction process
- capability to handle a wide range of mineral deposits and contaminants; extract water from multiple locations
- reduced need for resupply – no tooling or replacement components required
- absence of dust dispersion/generation during excavation