



## NASA STTR 2015 Phase I Solicitation

### T4.02 Regolith Resource Robotic

Lead Center: KSC

Participating Center(s): ARC, LaRC

Using resources in space is the first step towards human self-sufficiency while expanding its presence into the Solar System. The use of robotics for In-Situ Resource Utilization (ISRU) in outer space on various planetary bodies is essential since ISRU requires large quantities of local regolith that must be acquired and processed by capable machines. In some cases this will happen prior to crew arrival on site, or it will take place at a remote destination where the crew cannot spend much time due to radiation exposure limits or other constraints. In addition, communications latencies at remote locations such as Asteroids mandate autonomous robotics applications.

The first step towards using resources derived from small bodies in space, Mars, Mars Moons and Earth's Moon, such as water, volatiles, metals and organic compounds, is to visit a target body, prospect it with sample acquisition devices and subsequently do characterization of these samples. This data will feed into eventual missions and methods for using resources in outer space by mining the ore on these target bodies and then transforming it into useful products via In-Situ Resource Utilization (ISRU) and advanced manufacturing techniques such as Additive Manufacturing and Construction. For these reasons, resource prospecting, identification and sampling regolith for characterization are priorities in this sub-topic.

Proposals are sought for innovative resource prospecting mission concepts, technology development, and demonstrations.

Technologies include sample acquisition methods and devices, regolith anchoring methods, autonomous conops, sub-surface access, excavation, specialized sensors, dust lofting mitigation, perception in dusty environments, mobility methods, surveying, remote sample characterization, geodetic mapping, replenishing and transferring robotic commodities such as propellants, electric power, data transfer, pneumatics and robust interfaces for commodity transfer.

Future prospecting missions include:

- Water/Ice on Mars, Mars moons or Earth's Moon.
- Micro-gravity Near Earth Object (NEO) operations to prospect/sample surface resources.
- Lava tubes/shadowed crater cold traps on planetary surfaces to characterize volatiles accumulation.