The World is Not Enough (WINE): Harvesting Local Resources for Eternal Exploration of Space

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OBJECTIVES

The World is Not Enough (WINE) is a new generation of CubeSats that take advantage of In Situ Resource Utilization (ISRU) to explore space. The WINE uses existing CubeSat technology and combines it with 3D printing technology and ISRU, a water extraction system. 3D printing enables development of steam thrusters as well as tanks that fit within the available space within the CubeSat. The ISRU module captures and extracts water assisted by heat generated by the CubeSat electronics system supplemented by power from solar charged batteries. The extracted water is used as fuel for propulsion to fly to another location. The WINE is ideally suited as a prospecting mission and reconnaissance mission.

ACCOMPLISHMENTS

NOTABLE DELIVERABLES PROVIDED
In this Phase 1, we demonstrated critical technologies such as (1) sample acquisition, (2) volatiles capture, and (3) various CubeSat designs. The results of which are captured in this Phase1 final report.

KEY MILESTONES MET
Phase 1 was successful in demonstrating the 4 main Technical Objectives (TOs): TO1: Developed a simulant that replicates the known characteristics of a carbonaceous asteroid. TO2: Developed and tested miniature drilling systems. TO3: Analyzed volatiles in extracted water for the development of a thermal rocket performance model. TO4: Designed preliminary CubeSat and Mother ship subclasses of WINE.

FUTURE PLANNED DEVELOPMENTS

PLANNED POST-PHASE II PARTNERS
In Phase 3 we envision demonstration onboard the International Space Station (ISS): extract water from a meteorite analog (brought up to ISS), use the water to fuel a WINE, eject it into a LEO, and demonstrate a change in Delta-V.

PLANNED/POSSIBLE MISSION INFUSION
A water-based cold-gas propulsion system is planned for development by the KSC Swamp Works for the Extreme Access vehicle, so all the progress made here will directly help NASA advance that project.

PLANNED/POSSIBLE COMMERCIALIZATION
Non-NASA applications include use of this technology by several commercial companies that are interested in ISRU for financial gain. These include Planetary Resources and Deep Space Industries targeting asteroids.

CONTRACT (CENTER)

NNX15CK13P (KSC)

SOLICITATION-PHASE

STTR 2015-I

SUBTOPIC

T4.02 Regolith Resource Robotic

TA 7.1.3 Consumables Production

TRL

1 2 3 4 5 6 7 8 9