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NASA SBIR WIN

Golden, Colorado. N-Science Corp, on a team led by GrainFlow Dynamics, Livermore CA, was recently awarded a NASA SBIR SELECT 2014 Phase I, Topic Human-Robotic Systems - Manipulation Subsystem and Human-System Interaction. In this new project entitled "Subsurface Access, Characterization, Acquisition, Transport, Storage and Delivery in Microgravity", GrainFlow and N-Science will support NASA in development of methods that provide geotechnical measurements, sample extraction and transport equipment for subsurface regolith on Near Earth Objects (NEO), asteroids, moons and planets, enabling accurate evaluation of subsurface composition and chemistry.

Non-contact measurements can provide preliminary information regarding bulk density and composition; however, more accurate assessment of a bodies' composition and evaluation of potential resources, their abundance and ease of recovery will require physical contact with the surface, and penetration or drilling down to depths that are not subjected to significant space weathering. Such surface-contact and sampling probes will enable physical and chemical characterization of unweathered subsurface material. Inertial and autonomous percussive penetration to depth, along with novel drilling and tailings-transfer approaches, will be developed to both attain the required depth, and to advance semi-autonomous sample-collection/recovery technology so as to minimize the need for operator (or tele-operator) involvement. Both core- and bulk-regolith sampling methods which minimize loss of volatiles, will be developed. To the extent feasible in the laboratory, this project will approximate key features of reduced-gravity

conditions both physically and in particle-scale numerical simulations to ensure that the methods developed will function in realistic environments.

The primary aim of this study will be advancement of technologies suitable for use on robotic precursor characterization-missions, with the anticipation that further-improved versions of the same methods will minimize the time and effort of human intervention/involvement during follow-on exploration or prospecting missions. In addition, the feasibility of novel extraction, transport, handling, and storage methods for bulk regolith material, which minimize loss of volatiles, will be developed. Such developments will be especially useful for in-situ resource evaluation and utilization.

The small inertial penetration probes to be developed under this contract are of interest to mission concepts under development by N-Science. N-Science primary responsibilities in this Phase I are for design, development and testing of the inertial penetration probles. The goal of the N-Science HUMMINGBIRDsCHARM (HsC) mission, with the mantra "Observe-Touch-Early-Often" is to provide "up-close & personal" characterization from a range of Near Earth Object/Near Earth Asteroid targets. Fulfilling this goal will also address NEO/NEA Strategic Knowledge Gaps (SKGs) identified by NASA and other community groups, the Small Bodies Assessment Group and TargetNEO.

The Team includes GrainFlow Dynamics, Livermore CA. & N-Science Corp, Golden CO.

For More Information see: www.grainflow.com / www.nscicorp.org

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