Z12.02-2955 - NeuRover: Rover Enabled Neutron Energy Detector for Lunar Resource Mapping

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NON-PROPRIETARY DATA

IDENTIFICATION AND SIGNIFICANCE OF INNOVATION

NASA requests a high spatial-resolution, wide-area scan of lunar soil composition, especially within impact craters, that may contain a higher concentration of usable material such as 3He and H2O. Identifying areas of high concentration of these materials will narrow the list of target sites for future human and robotic exploration and maximize the overall scientific output of the research community. Soil with a higher hydrogen content will tend to slow down (i.e., thermalize) neutrons rather than absorb them, thereby depressing the fast and epithermal components of the neutron energy distribution while enhancing the thermal component.

RDT is proposing to continue development and testing of an advanced neutron detector coupled to a microrover (NeuRover). This integrated system will be capable of searching for water-ice and 3He on the Moon by performing neutron energy spectroscopy on cosmic-ray-induced neutrons in the Moon's subsurface by accurately differentiating epithermal neutrons from thermal and fast neutrons at the meter resolution scale.

TECHNICAL OBJECTIVES AND WORK PLAN

The primary objective of the proposed effort will focus on the integration of a neutron detector onto a mobile platform. An integrated mobile platform provides numerous benefits compared to a stationary instrument, in that it provides greater area coverage and high spatial resolution data.

The NeuRover instrument is capable of accurately differentiating epithermal from thermal and fast neutrons at the meter resolution scale, by stacking alternating layers of neutron absorber, moderator, and detectors. The Omni-Directional Multichannel Neutron Energy Identification Instrument (OMNI) developed by RDT, is a compact solid-state neutron spectrometer designed by RDT, in conjunction with Southwest Research Institute. The mobility platform, CubeRover, is a light weight, low-cost, and modular planetary rover designed by Astrobotic in conjunction with Carnegie Mellon University. Models will be developed to simulate expected NeuRover performance on the lunar surface. Electronics of the OMNI neutron detector will be assessed for brassboard integration with the CubeRover.

This Phase I program will deliver:

- A proof of concept demonstration of the OMNI neutron detector avionics integrated with the CubeRover single board computer;
- A systems configuration study of the OMNI neutron detector integrated with a 12U-sized CubeRover, with an emphasis placed on structural and thermal optimization.

TRL

Estimated

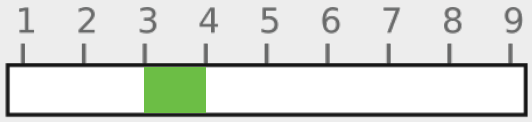
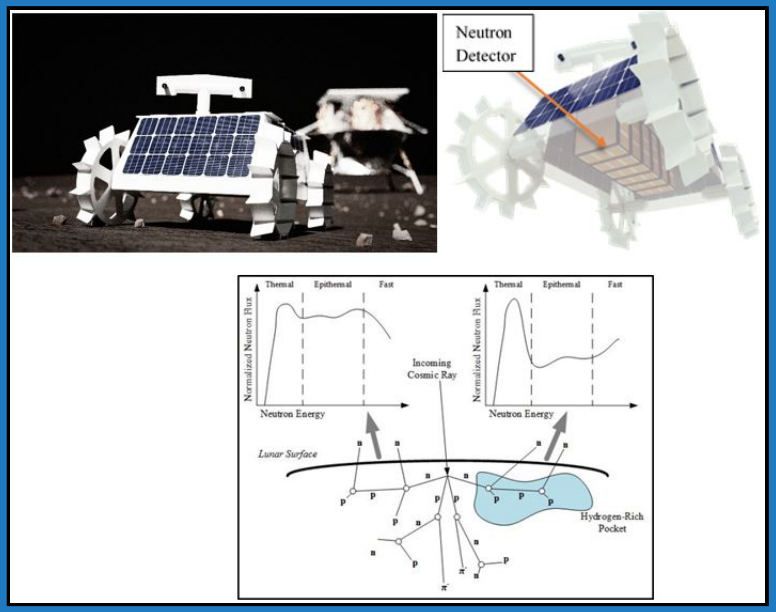


IMAGE TITLE: Rendering of the NeuRover



NASA APPLICATIONS

A compact, low-power NeuRover would yield benefits to the NASA mission beyond the search for hydrogen below the lunar surface as proposed. A major hurdle to overcome to ensure the success of the human exploration of space and extraterrestrial bodies is to limit the radiation dose to astronauts. A commercially-available NeuRover system could help to understand these issues to a greater degree of accuracy than existing technologies, by inexpensively roving in unknown areas before human astronauts are sent in for missions.

NON-NASA APPLICATIONS

An application for a roving (autonomous), robust neutron energy spectrometer would be in the field of nuclear non-proliferation. It is possible that with the increase in nuclear fuel and waste storage, and along with the unfortunate radiological accidents at various sites, e.g., Hanford, Fukushima Daiichi, NeuRover's remote roving capability may be beneficial for inspecting these sites.

FIRM CONTACTS

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