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CABLECAT: AN AUTONOMOUS SYSTEM TO DEVELOP POWER AND DATA
INFRASTRUCTURE ON THE MOON**Abstract**

Fulfilling the goal of NASA's Artemis program to establish a sustainable presence on the Moon will require a fleet of robotic vehicles performing exploration, resource extraction, and science missions. The challenge of distributing power to each of these assets will be vital to mission success. Current vehicles are responsible for their own power generation capability, or require pre-charged batteries, increasing mass allocation and limiting the vehicle lifespan. The CableCat concept addresses the challenge of establishing power and data infrastructure by autonomously traveling to areas of interest, notably Permanently Shadowed Regions (PSRs), while unspooling a power and data cable. Once the laying of power and data line is complete, the CableCat becomes a service terminal, providing recharging and data relay services to support a variety of vehicles, extending missions and optimizing resource allocation to individual science tasks.

The CableCat design is centered around a cable reel within an autonomous two-wheeled rover. Two independently actuated drive wheels are constructed to reduce sinkage and increase traction in the lunar regolith. Most system hardware (processor, control board, motors, etc.) is contained in a central hub, establishing a single location for thermal control and resulting in a low center of mass. A wide wheelbase and a passive third wheel further improve stability as the vehicle maneuvers across unstructured terrain. The system will use a multi-camera vision system for local navigation and pre-existing satellite reconnaissance and data from the base station for global navigation across the lunar terrain to a target destination inside the PSR. Development of the CableCat will advance the research into autonomous navigation and vehicle drive algorithms capable of operation in environments containing: no ambient light, obstacles of unknown size and placement, sloped crater walls, and soil with unknown consistency. The CableCat will establish wireless communication with the other vehicles operating in the PSR and can provide local command capability and relay commands from the base station.

This new robotic technology is scalable to tens of kilometers of power and data lines deep into a large PSR. The base station, in areas of abundant sunlight and through judicious sizing of generation and storage capabilities, can provide continuous power to rovers allowing operation in a PSR and during the Lunar night. A utilities infrastructure is a milestone technology for planetary colonization, and the CableCat design is the first step in supporting humanity's needs for living and working in these environments.