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IAF SPACE EXPLORATION SYMPOSIUM (A3)
Moon Exploration – Part 1 (2A)

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SMALL ROBOTIC SWARM TECHNOLOGIES FOR LUNAR SURFACE EXPLORATION

Abstract

Spacebit Global is now completing development of its first robotic surface exploration rover scheduled to land on the Moon in the fall of 2021 on the Astrobotic Peregrine lander for their NASA CLPS first mission. The Asagumo rover will deploy from the Peregrine lander and walk at least 10 meters from the lander using its unique leg system of locomotion under tele-operation control through the WIFI system resources on the lander. This technology demonstration mission will last for up to 8 days on the lunar surface, and validate the key systems including the legs, the wide field cameras and the 3D LIDAR scanners as well as the ability to tele-operate the rover. The ultimate goal of Spacebit is to use a swarm of Asagumo walking rovers deployed from a wheeled Motherover to climb down into the surface opening of a lunar lava tube and map the interior of the cave system using its HD cameras and 3D LIDAR surface scanners and temperature and radiation sensors. The swarm rovers and the Motherover carrier can also be used for surface assays of mineral and water deposits in lunar craters.

This paper will describe the main challenges of designing small robots for Lunar exploration. It includes designing of a low-weight deployer for the Lunar surface that would hold the robot during flight and protect it from low temperatures. Regular CubeSat deployers are adapted for LEO and weights around 1 kg. They are designed for zero gravity while the deployment mechanism for the Lunar surface could use Lunar gravity for the drop. Another issue is that the deployer should keep the robot warm during the cruise of up to 30 days from LEO to the Lunar surface.

One of the biggest issues is to design software that would make it possible for the robot to execute its mission by it's own in case of communication issues with Earth. In general the complexity of the SW is similar to autonomous vehicles. The robot is designed in a way that it uses only proprioceptive sensor and position information. So even without data from cameras and Lidar the robot is able to move on the rough terrain. This paper will describe the Spacebit technology roadmap and testing plans over the next several years of NASA CLPS mission cycles.