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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 move 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 Mother Ship rover 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 Mother Ship carrier can also be used for surface assays of mineral and water deposits in lunar craters.

For lunar surface mineral assay missions, sensors can be embedded into the feet or the ventral surface of the rover bodies. Each Asagumo rover can travel farther from the lander and Mother Ship, creating a two way data link. The Mother Ship then relays the data and commands back to the lander, where a high speed laser com relay system will connect back to Earth. For surface mineral prospecting missions, the ground truth at bankable assay quantification is essential for economic development and property rights claims. On the surface, the Mother Ship also provides shelter for the lunar night. For subsurface exploration, the chain of Asagumo rovers will slowly advance into the cave system as far as possible over several hours, then attempt to return to the cave mouth to recharge their batteries using solar power. After a few cave entry and return expeditions have been completed, the Asagumo swarm will attempt a final one-way descent as far as they can go on a battery charge while maintaining the wireless data links back to the surface.

This paper will describe the Asagumo walking rover and Mother Ship engineering and operations plans, and the current status of development and testing of the initial Asagumo rover prototype which will fly in 2021.