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OVERVIEW OF THE FIRST ISPACE PRIVATE LUNAR LANDER MISSION

Abstract

In recent years, private companies like Blue Origin and SpaceX are actively developing low-cost reusable space vehicles. Launch vehicles such as Falcon 9 aim to dramatically reduce the cost per kg to low Earth orbit, thus opening up many new opportunities for low-cost transits beyond Earth's orbit.

We at ispace, as a start-up company in Japan, are developing a cost effective transportation system that can deliver small payloads to the lunar surface. Such a system can serve as a low-cost platform for frequent access to the Moon for exploration, research, or commercial purposes such as mapping and retrieving valuable resources from the lunar surface.

As a first step to demonstrate our micro robotic technology, our Google Lunar XPRIZE team HAKUTO, built a 5-kg micro rover that can travel over 500 m on the lunar surface and transmit high-definition live videos back to Earth. The HAKUTO lunar rover, named SORATO, can serve as a key component for exploring and locating interesting regions of the Moon for scientific and commercial applications.

Our next step is to develop and test our own lunar transfer vehicle which can deliver small payloads of 30 kg (such as the HAKUTO rover and other scientific instruments) to the lunar surface. Our lunar lander is a single-staged vehicle designed to be launched as a secondary payload to geosynchronous transfer orbit. A trans-lunar injection followed by a capture maneuver will place the vehicle into a low-lunar orbit. After up to two months of observations, the vehicle will attempt a soft landing on a landing site near a lunar skylight hole such as the Lacus Mortis. Surface exploration with multiple rovers that can last up to 14 days will follow after touch down and will transmit data back through relay with the lander vehicle.

We plan to launch our first mission in 2019-2020 as a technology demonstration mission. It will serve as a pilot test for our next series of commercial missions after 2021 whose schedules are demand dependent. Because of the short development cycle, our first mission will rely on commercial-off the-shelf components and partnership with industrial and research organizations.

The overall mission and systems requirements such as GNC, power, propulsion will be presented in the full paper. Trajectory design and trade studies that includes the landing site visibility and illumination conditions will also be discussed.