Paper ID: 37761
oral

SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Space Transportation Solutions for Deep Space Missions (8-A5.4)

Author: Dr. Chit Hong Yam
ispace, Inc, Japan, c-yam@ispace-inc.com

Dr. Mohamed Ragab
ispace, Inc, Japan, m-ragab@ispace-inc.com
Mr. Takeshi Hakamada
ispace, Inc, Japan, t-hakamada@ispace-inc.com

MISSION DESIGN OF THE ISPACE COMMERCIAL LUNAR LANDER

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 aiming to develop 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, is developing a micro rover and getting prepared for launch in 2017. Our rover will travel at least 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 around 30 kg (such as the HAKUTO rover) to the lunar surface. The vehicle adopts a 3-stage design, in which the propellant tanks are detached after burnout at geosynchronous transfer orbit and at lunar orbit insertion. The lander module uses its remaining propellant to perform a soft landing for delivery of the payload at the surface. Various trajectory options will be presented such as resonant flybys at the Moon and long transfer that exploits solar perturbations. Such options can affect the mission duration and sizing of the lander. Trade studies on the propulsion system as well as the landing site selection (e.g. polar vs equatorial) will also be discussed.

We plan to send our first lunar orbital mission by 2019, followed by a landing mission in 2020. The first two missions will serve as pilot tests for our next series of missions whose schedules are demand dependant. Because of the short development cycle, our first few missions will rely on commercial-off-the-shelf components and partnership with research institutes.

Our commercial transportation system is also flexible to transfer and deliver payloads to targets other than the lunar surface, for example, the libration points L1, L2, and near Earth objects.