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

Author: Prof.Dr. Shinichiro Sakai
ISAS/JAXA, Japan

Prof. Shujiro Sawai
Japan Aerospace Exploration Agency (JAXA), Japan
Dr. Seisuke Fukuda
Japan Aerospace Exploration Agency (JAXA), Japan
Mr. kenichi kushiki
Japan Aerospace Exploration Agency (JAXA), Japan
Mr. Satoshi Ueda
Japan Aerospace Exploration Agency (JAXA), Japan
Mr. Yusuke Shibasaki
Mitsubishi Electric Corporation, Japan
Mr. Hiroaki Saito
Mitsubishi Electric Corporation, Japan

SMART LANDER FOR INVESTIGATING MOON (SLIM) : RESULTS FROM THE MOON LANDING

Abstract

This paper introduces the moon landing results of SLIM, Smart Lander for Investigating Moon. SLIM is a lunar landing mission of Japan Aerospace Exploration Agency (JAXA) with two main objectives: 1) to achieve precise landing or "pinpoint landing" with the precision better than 100m, and 2) to develop small and lightweight lunar lander. SLIM was launched on 6th September 2023 by H-IIA rocket with XRISM, X-ray Imaging and Spectroscopy Mission. SLIM successfully entered lunar orbit on 25th December 2023, and finally, the lander started its final descent and landing sequence on 19th January 2024, at around 15:00 UTC.

One of key technologies for pinpoint landing is vision-based navigation. SLIM executed it for 14 times in different 7 regions, getting successful results for all attempts. As a result, the lander precisely reached to an altitude of about 50m above the target landing point. SLIM was designed to execute obstacle detection at this point, and to start obstacle avoidance maneuver. Therefore, the pinpoint landing precision should be evaluated at this point with captured image. This evaluation indicates that the precision was at least around 10m, and seems to be around 3-4m.

However, some trouble occurred in one of two main engines at this timing. Onboard software noticed this abnormal event and shifted into emergency mode. As result, SLIM continued slow descent with remaining single main engine, gradually drifting eastward. According to an implemented sequence for abnormal situation, SLIM deployed two micro rovers at an altitude of about 5m. Finally, SLIM touched down maintaining operational condition and stable communication with the ground station. Thus, we could download valuable flight data during descent and landing. However, soon we found that solar cells did not generate electrical power since they faced to the west, although it was morning on the moon. About two and half hours after the touch-down, we sent a command to separate battery electrically for safety, and SLIM was once powered off.

Deployed two micro rovers worked on the moon fully autonomously in cooperative manner, and succeeded in sending a historical snapshot of SLIM on the moon. On 28th January, we could establish the communication again according to the sun direction change, and soon succeeded in scientific observations

with multi-band spectral camera. On 25th February, the communication was re-established after a moon's night. Details of these moon landing results will be reported in the upcoming conference.