SPACE EXPLORATION SYMPOSIUM (A3)
Small Bodies Missions and Technologies (4)

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A SMALL ASTEROID LANDER MISSION TO ACCOMPANY HAYABUSA-II

Abstract

The JAXA Hayabusa-II mission is the ambitious follow-up to the original Hayabusa mission launched in 2003 [1], which succeeded in returning the first dust particles from a near-Earth asteroid to Earth. JAXA intends to launch Hayabusa-II in 2014 for similar measurements on the asteroid 1999 JU3, a C-type asteroid, and invited the German Aerospace Centre (DLR) to contribute a small lander package to the mission. Based on this invitation, DLR is developing the Mobile Asteroid Surface Scout (MASCOT) to complement the main spacecraft's scientific objectives, with the Centre National d'Etudes Spatiales (CNES) providing payload and subsystem support.

MASCOT will provide in-situ surface science and allow investigation of up to three sites on the asteroid surface. A short on-asteroid lifetime of two complete asteroid rotations (16 hours) will provide measurements under different illuminations and thermal conditions, with Hayabusa-II being used to transmit all of the scientific data back to Earth.

The harsh landing environment and strict mission requirements lead to some difficult design challenges. An innovative "hopping" mechanism will allow MASCOT to leap across the asteroid surface in bounds

of approximately 40m, albeit robustness of this concept must first be proven in a comprehensive suite of simulations and tests. Mass, limited to 10 kg, is critical: savings via the use of a carbon-fibre main structure and simplified subsystems allows the carriage of four scientific payloads: a multispectral wide angle camera, a radiometer, a magnetometer and an IR microscope. Thermal control is also a challenging topic: the competing requirements of deep-space cruise and on-surface operation necessitate a highly robust, isolated design. Available energy also puts a limit on operations and restricts the lifetime of the mission.

The original Hayabusa mission achieved considerable scientific success. DLR hopes to contribute to the success of the follow-on mission, Hayabusa-II, by allowing for in-situ surface measurements. The tight system constraints are apparent from the challenging mission requirements; however the resulting design promises a high degree of performance.