Exploration of Near Earth Asteroids (4)
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THE MASCOT CONCEPT – AN IN-SITU SCIENCE PLATFORM FOR SMALL BODIES EXPLORATION

Abstract

There are many ways to perform in-situ investigation of a small body ranging from landing actively (propulsive) the complete spacecraft (s/c) such as the NEAR s/c on asteroid 433 Eros to dedicated ballistic descending landers such as Philae of the Rosetta (ESA) mission to comet 67P/Churjumow-Gerasimenko or MASCOT onboard the Hayabusa2 (JAXA) s/c towards near-Earth asteroid (NEA) 162173 Ryugu. The MASCOT deployment strategy is in several aspects different to Philae. Beside the deployment altitude of just 100 m for MASCOT, the lander needs no dedicated orientation during landing. MASCOT has no anchoring mechanism and is designed to lose its kinetic energy of free fall during bouncing on Ryugu's surface till it comes to rest. Because of the unpredictable final attitude of MASCOT but with the requirement that the instruments such as MicrOmega (hyperspectral near-IR microscope), MASCAM (multicolour camera) and MARA (thermal IR radiometer) need to look onto the surface, the lander is equipped with a mobility system. This enables MASCOT to upright into the correct measurement position and even to hop across Ryugu's surface allowing more than one location to be investigated scientifically. The MASCOT lander has a total weight of only approx. 10kg and a size of 30 cm x 30 cm x 20 cm, comparable to a shoebox. Because of its compact dimension, it is an easily to be accommodated instrument carrier. Depending on the mission scenario, a MASCOT type lander could be equipped with even more than 4 payloads as for the MASCOT mission on HY2. The respective mission-specific set of the instruments is mainly limited to the available total volume and mass, its operational concept to the required power and/or energy. A system to payload ratio of 7:3 is the reached benchmark. Depending on the requirements of the science payloads design changes on certain subsystems can be applied such as changing the primary batteries currently integrated in MASCOT for solar cells and secondary batteries or expanding the volume of the lander. The baseline concept of MASCOT, however, remains the same.

We will present the MASCOT lander as presently flying with the Hayabusa2 mission and will introduce possible design variation based on follow-on studies of the MASCOT concept for future missions such as the AIM (ESA) mission.