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MASCOT2 – A SMALL BODY LANDER TO INVESTIGATE THE INTERIOR OF 65803 DIDYMOS' MOON IN THE FRAME OF AIDA/AIM

Abstract

In the frame of NEO exploration and planetary defence, the two-part AIDA mission is currently studied by NASA and ESA. Being composed of a kinetic impactor, DART (NASA), and an observing spacecraft, AIM (ESA), AIDA has been designed to deliver vital data to determine the momentum transfer efficiency of a kinetic impact onto a small body and key physical properties of the target asteroid. This will enable derivation of the impact response of the object as a function of its physical properties, a crucial quantitative point besides the qualitative proof of the deflection. In the course of the AIM mission definition, a lander has been studied as an essential element of the overall mission architecture. It was to be deployed on Didymoon, the secondary of the binary NEA system 65803 Didymos and it was supposed to significantly enhance the analysis of the body's dynamical state, mass, geophysical properties, surface and subsurface structure.

The mission profile and the design of the 13kg nano-lander are derived from MASCOT flying aboard Hayabusa2, differing from its predecessor by having an increased lifetime of more than three months, a surface mobility capability including directed movement, a sensor system for localization and attitude determination on the surface and a redesigned mechanical interface to the mother S/C.

The MASCOT2 instrument suite consist of a bi-static, low frequency radar (LFR) as main instrument, supported by an accelerometer (DACC), a camera (MasCAM), a radiometer (MARA), and a magnetometer (MasMAG); the latter three already flying on MASCOT1. Besides the radar measurements, the camera will provide high-resolution images of the landing area, and accelerometers will record the bouncing dynamics by which the top surface mechanical properties can be determined. During the DART impact, MASCOT2 could be able to detect the seismic shock, which could give valuable information on the internal structure of the body. MASCOT2 will also serve as a technology demonstrator for very small asteroid landing and extended operations powered by a solar generator.

In this paper, we describe the science concept, mission analysis of the separation, descent and landing phase, the operational timeline, and the latest status of the lander's design. Despite the fact that AIM funding has not been fully confirmed during the ESA Ministerial conference in 2016, MASCOT2 is an instrument package of high maturity and major interest for planetary defense and NEO science. With appropriate tailoring and optimization it is considered and studied for future missions.