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ASTEROID IMPACT MISSION: A UNIQUE OPPORTUNITY TO DEMONSTRATE PLANETARY DEFENSE WHILE TESTING TECHNOLOGIES FOR FUTURE MISSIONS AND PERFORMING ASTEROID SCIENTIFIC INVESTIGATIONS

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ABSTRACT

The Asteroid Impact Mission (AIM) is a small mission of opportunity currently under implementation in ESA to explore and demonstrate technologies for future missions while addressing planetary defense and performing asteroid scientific investigations. It is part of an international cooperation entering Phase-A/B1 at NASA and ESA, consisting of two independent mission elements: the NASA Double Asteroid Redirection Test (DART) mission and the AIM rendezvous mission. The primary goals of AIDA are to test our ability to perform a spacecraft impact on a potentially hazardous near-Earth asteroid and to measure and characterize the deflection caused by the impact. The AIDA target will be the binary asteroid (65803) Didymos, with the deflection experiment to occur in October 2022 when Didymos will be on a close approach to the Earth. The DART impact on the secondary member of the binary asteroid will alter the binary orbit period, which will be measured by both AIM and Earth-based observatories.

The AIM spacecraft will be launched from Kourou in 2020 with the following main objectives: to determine Didymos secondary asteroid orbital and rotation state, size, its mass and shape and analyze the geology and surface properties. Also, by means of a ground penetrating radar, AIM will be able to characterize for the first time the internal structure of the asteroid. In the AIDA scenario, together with the DART kinetic impact, AIM will observe the impact crater and derive collision and impact properties. AIM will be a small spacecraft mission demonstrating for the first time a

number of technologies including deep-space optical communication and inter-satellite network in deep-space with CubeSats deployed in the vicinity of the Didymos system and a lander on the surface of Didymos secondary. In addition to the Visual Imaging System (VIS) that is part of the guidance, navigation and control system of the spacecraft, the payload for the characterization of the asteroid consists of a Thermal IR Imager (TIRI), a monostatic High-Frequency Radar (HFR), a bistatic Low-Frequency Radar (LFR), the Optel-D optical communication terminal, the MASCOT-2 lander, and CubeSats opportunity payloads (COPINS).

Preliminary design of the AIM spacecraft will be presented together with the reference payload and its operations.

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