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CUBESATS FOR ASTEROID EXPLORATION: ASTEROID IMPACT MISSION (AIM) CASE STUDY

Abstract

The scope of this paper is to carry out a Phase 0 study of a CubeSat mission for asteroids exploration (COPINS mission). The proposed study is based on the current AIDA mission, an ESA/NASA joint effort that aims to study the secondary body of the binary system Didymos 65830, to demonstrate new space-based technologies, and to test the orbital deflection capabilities through the impact of DART probe. COPINS mission involves a number of CubeSats operating in interplanetary space in support of the objectives of a proposed ESA's mission, the Asteroid Impact Mission (AIM). The study has involved the definition of mission objectives and requirements, followed by the development of different concepts of operations and mission architectures proposals. Eventually, trade-off tools have been used to define the mission baseline. The proposed mission architecture involves two 3U CubeSats deployed from AIM's mother-ship. The final mission configuration, composed by one 2U and four 1U CubeSats, is achieved through a detachment operation. Different satellite constellations are planned to carry out the different phases of the scientific campaign. The CubeSats are also capable to provide useful close observations of DART's impact, as well as useful data to study the asteroid's internal structure. This task is achieved landing a seismometer onboard the 2U CubeSat. Wide chip-size-sensor nets have been also considered for in-situ measurements. The proposed mission concept accounts for just 0.5% of the expected AIM's mission cost. This makes the concept a valuable low-cost piggyback solution with a potential high scientific return, also adaptable to other mission contexts, especially in perspective of the innovative ideas implemented with the aim to pave the way to a new space exploration era.