IAF SPACE EXPLORATION SYMPOSIUM (A3)
Small Bodies Missions and Technologies (Part 1) (4A)

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# HERA VISION BASED GNC DESIGN

**Abstract**

AIDA is the international NASA- and ESA-supported collaboration that will combine the data obtained from NASA's DART mission (which includes ASI's LICIACube) and ESA's Hera mission to produce the most accurate knowledge possible from the first demonstration of an asteroid deflection technology. AIDA is not a formal joint project of NASA and ESA, but instead an agency-supported collaboration among planetary defense and asteroid science researchers, most of whom are involved in the DART or HERA missions, to share information and contribute to the planning and execution of both missions so as to enhance their synergy. HERA is an ESA mission that will rendezvous with and explore the Didymos binary asteroid system approximately two years after the impact of DART, studying both Didymain and Didymoon in detail and examining the visible after-effects of the impact. GMV is in charge of developing the HERA GNC subsystem. The selected solution is a vision based GNC that using images taken but the Asteroid Framing Camera (spare flight model of the DAWN mission) is capable of estimating the state of the spacecraft with respect to the asteroids and will allow to get close to the binary system in safety conditions. Thanks to data fusion techniques with other payloads, such as a thermal infrared camera and an altimeter, it is possible to have an independent navigation chain for the collision estimation with the asteroids. Furthermore, this will give the flexibility to perform experiments in the extended operations phase that will be performed on HERA as technology demonstrations. Advanced Image Processing algorithms will be able to generate the measurements required by the autonomous navigation filter in order to maintain an on-board estimation of the relative state with respect to the asteroids and to perform autonomous correction maneuvers to navigate close to their surface with no risk. This paper will include the consolidated strategies of the GNC designed for the HERA mission. The focus will be directed towards the modes and functions necessary to increase the spacecraft autonomy level. HERA is currently in its phase B2 and the GNC baseline is not closed yet, but to respect the challenging schedule of the mission

GMV invested a lot of effort to carefully assess the feasibility of the proposed solution, together with its robustness, anticipating a validation phase that usually occurs at later mission stages.