

Exploration of Near-Earth Asteroids (4)
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PRELIMINARY DESIGN OF THE HERA VISION BASED GNC

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. 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. HERA has been approved at the ministerial council Space 19+ and it will be one of the missions of the new Space Safety Program (S2P). GMV is in charge of developing the HERA GNC subsystem, together with its partners like OHB Sweden. The selected solution is a vision based GNC that using images taken by 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. Data fusion techniques with other payloads, such as a thermal infrared camera and an altimeter, are part of experiments that will be performed on HERA as technology demonstrations. An alternative navigation chain based on images will also be implemented and used by the FDIR system to evaluate the collision risk. Advanced Image Processing algorithms will be able to estimate the distance with respect to the asteroids, an on-board collision estimator will assess if there is any risk to collide with the system and therefore the necessity to perform a collision avoidance maneuver. This paper will include the consolidated strategies of the GNC designed for the HERA mission. The focus will be directed towards the vision based solutions, the image processing algorithms and how the measurement is used on-board to estimate the spacecraft state. 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 and its partners 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.