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HERA – EUROPE'S CONTRIBUTION TO ASTEROID DEFENCE

Abstract

Hera is the European contribution to the international Asteroid Impact Deflection Assessment (AIDA) cooperation of ESA and NASA. AIDA will be the first demonstration and validation of asteroid deflection. More specifically, the objective of AIDA is to demonstrate that the technology needed to deflect an asteroid by kinetic impact is available, in particular the terminal guidance system. It consists of NASA's kinetic impactor "DART" (Double Asteroid Redirection Test) and of ESA's Hera inspector spacecraft that will rendezvous the binary target asteroid "65803 Didymos". Each of the two missions under AIDA can be carried out independently. However, combined, DART and Hera will enhance the output of each segment providing a method to quantify the deflection and to enable the application of the results to other asteroids, therefore fully validating the technique. This is a mandatory step to be able to effectively deflect a hazardous asteroid should it be needed in the future.

The Didymos system is composed of two bodies: the larger asteroid Didymos A (diameter: 780m), and the smaller asteroid, Didymos B (diameter: 160m), which orbits the larger one. The smaller asteroid Didymos B has been selected for this deflection experiment. It is within the 100-200 m size range, most relevant for planetary defence. For smaller objects, no deflection effort would be made, while larger objects have lower impact probability with Earth.

DART will be launched in mid-2021 and impact Didymos B in September 2022. The DART spacecraft will impact Didymos B nearly head-on, shortening the time it takes the small asteroid to orbit Didymos A by several minutes. Hera will be launched in October 2024 and arrive at Didymos in January 2027.

During Hera's mission, the main spacecraft and its two companion CubeSats will conduct detailed surveys of both asteroids, with a particular focus on the crater left by DART's collision and a precise determination of the mass of Didymos B. In order to do so, the mission includes a number of instruments providing images in the visible and infrared spectrum as well as spectral information of the asteroid. In addition, Hera accommodates a Lidar, supporting mass estimates and shape modelling. Hera's detailed post-impact investigations will substantially enhance the planetary defence knowledge gained from DART's asteroid deflection test.

As Hera is a planetary defence mission, core mission requirements are those related to measuring critical properties for planetary defence. There are also a number of opportunity requirements related to those property measurements that are of some relevance for asteroid deflection missions and bring further scientific value from the Hera mission. Requirements for technology demonstration opportunities are specified enabling new future deep-space mission concepts.

The early asteroid characterisation will start from distances below 30 km to determine shape and gravity field. The detailed characterisation phase will be conducted from about 10-20 km distance.

During this phase two CubeSats will be released. Very close flybys of Didymos B at distances < 2 km are foreseen towards the mission end. The end-of-mission currently foresees an attempt to land the Hera spacecraft in the polar region of Didymos A while the CubeSats will try landing on Didymos B.

Currently, the Hera project is in the Phase C led by OHB System as ESA Prime Contractor. The presentation will give an outline of the Hera mission and Hera spacecraft design with focus on the payloads.