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Small Bodies Missions and Technologies (Part 1) (4A)

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HERA – A SMALL SPACECRAFT TO INVESTIGATE IN-SITU THE IMPACT CRATER OF AN ASTEROID DEFLECTION TEST

Abstract

The Hera spacecraft is an important element of the asteroid deflection proof-of-concept, AIDA (Asteroid Impact and Deflection Assessment), which is an ESA/NASA collaborative mission. Hera originates from the previous ESA mission AIM (Asteroid Impact Mission), which was previously a part of AIDA. NASA's spacecraft DART (Double Asteroid Redirection Test) is scheduled to impact the moon of the binary asteroid system Didymos in 2022, with the effect on the asteroid pair being observed from ground based assets. This moon has a representative size for a potential impact threat on Earth. The Hera spacecraft will visit the Didymos system after the impact thereby significantly improving the scientific and technical data needed to understand the impact effects. This will enable, for the first time, a full characterization of the β-factor and thus the momentum transfer efficiency and the role of ejecta momentum. Hera will provide valuable data about the DART impact crater and a detailed characterization of the Didymos system as a whole. This data will enable validation of numerical models, measurement of the momentum transfer from a kinetic impactor on an asteroid and distinguish between the linear momentum from the impact and other dynamical effects. Additionally, it will also allow validation of the numerical scaling laws from impact cratering. Hera shall be a small spacecraft, adhering to a short development cycle. It will make use of existing technologies, with the exception of a few elements, which have been subject to several development activities. Hera shall be launched in autumn 2023 with a preferred back-up in 2024. The short development timeframe, as well as the selected small class of mission, and the geometry of the asteroid orbit pose several challenges to the overall mission and spacecraft development. The Hera spacecraft is presently under investigation in the frame of a phase B1 ESA contract study (contract No. 4000125037). The industrial team is led by OHB System AG and includes different subsidiaries of GMV (Spain, Poland, Portugal, and Romania), OHB Sweden, QinetiQ, Spacebel, SSC, Antwerp Space and

Euro-Composites. The core of the team was formed during the AIM mission study and enlarged for the present phase B1. Work is currently underway to adapt the AIM design to the Hera mission. This paper will provide a mission and system overview on Hera. This includes not only the technical challenges and their intended solution, but also programmatical challenges such as the tight implementation schedule.