IAF SPACE EXPLORATION SYMPOSIUM (A3)
Small Bodies Missions and Technologies (Part 2) (4B)

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HERA 3D GEOGRAPHICAL INFORMATION SYSTEM

Abstract

The Hera robotic ESA-driven mission will rendezvous in late 2026 with the Didymos double Asteroid System, in particular to analyze the outcome of the NASA DART mission impact on September 26, 2022 on its moon Dimorphos. Hera and its two cubesat companions will carry a multi-cue sensor suite covering vision, radio, radar, laser, multispectral and thermal infrared, gravimetry, and accelerometry. The sensors' observations will be brought into spatial and temporal context on Didymos' two bodies, making use of shape models obtained from the Asteroid Framing Camera (AFC), overlaid by layers in a 3D-Geographic Information System (GIS).

The 3D-GIS is realized by PRo3D (Planetary Robotics 3D Viewer), an interactive viewer for the virtual exploration and analysis of planetary surface 3D reconstructions. Scientists already use the tool in production to perform geological interpretation on large-scale 3D reconstructions of the Martian surface. For Hera, different requirements such as working with multiple celestial bodies simultaneously in one scene or exploiting heterogenous, layered instrument data is crucial. We extended PRo3D with 3D-GIS functionality where layers can consist of geometry, texture or vector graphic. Geometry layers result from reconstructions from imagery captured at different positions or time instances in the mission. Texture layers represent (projected) instrument data, and vector graphic layers usually annotations and space probe trajectories. Scientists organize all these layers hierarchically according to their semantics and/or chronology with PRo3D's user interface. Recent developments allow to combine texture layers for instrument data visualizations. They can be seamlessly blended and restricted to a region of interest on the asteroid surface to allow effectively comparing different data sources and recognize correlations. Iso-lines for all texture layers further support visual analysis. PRo3D was extended to import custom SPICE kernels to show trajectories of celestial bodies and the Hera space probe. This allows to show time-lapse animations of different trajectories whereby an object can be selected as frame of reference.

We report on the current state of Hera 3D-GIS development, tied to use cases from the mission's science requirements matrix, with its short-term target to obtain an end-to-end functional and validity check on the occasion of Hera's Mars flyby in March 2025 which we simulated from different reference frames,

whereby an orbiter-based reconstruction of Mars is shown. Scientists can use this feature to plan observations and perform opportunity science on the way to the actual target – the Didymos double asteroid system.