The ESA Hera mission to the binary asteroid (65803) Didymos: Planetary Defense and Science

Austrian Contribution: 3D Imaging & Visualization; Impact Science

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Contains slides provided by: Michael Küppers, Patrick Michel, Stephan Ulamec, Alan Fitzsimmons, Simon Green, Monica Lazzarin, Ian Carnelli, Paolo Martino and the The Hera Science Team
First demonstration of asteroid deflection by kinetic impact on Dimorphos, to change its orbit.

First prompt imaging of the impacted surface, ejecta plume evolution and of the non-impacted hemisphere of Dimorphos.
Hera mission scenario

October 2024

2.3 YEARS CRUISE

2 x Asteroid Framing Cameras
2 x 6U CubeSats
Laser Altimeter
Thermal Infrared Camera (JAXA)
Hyperspectral Imager

08/10 - HERA LAUNCH

6-Month Characterization

Early 2027

28/12 - ASTEROID ARRIVAL

CUBESATS RELEASE

DIMORPHOS

LANDING ON DIDYMOS
MISSION ENDS

DETAILS CRATER
SHAPE INVESTIGATION

DETAILS SUBSURFACE
CRATER INVESTIGATION

MULTI-POINT ASTEROID INVESTIGATION
Low-frequency radar, multispectral imager, dust detector, gravimeter.

DETAILS CHARACTERISATION PHASE
Measuring surface and interior properties

EARLY CHARACTERISATION PHASE
Measuring mass and dynamics
**AT Background: PRoViP & PRo3D**

- **PRoViP:** Batch 3D Vision **Processing**
  - DTM & additional products
  - Automatic service for tactical use
    - Designed for ExoMars Pan/Nav/LocCam)
    - In operation for Mars 2020 Mastcam-Z

- **PRo3D:** Real-Time **Rendering / Analysis & 3D GIS**
  - Huge multi-scale 3D data
  - Supports scientific operations
Exploit PRoViP & PRo3D also for HERA

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- Huge multi-scale 3D data
- Supports scientific operations
3D Processing „rehearsed“ during Phase B2 (under GMV Contract)

Data Credits: HERA Science Team / GMV
Scale Bars embedded in 3D shape....
3D Annotations / GIS / Measurements
Geologic et al annotations

True Thickness

Data Credits: NASA/JPL/ASU/MSSS

Interpretation Credits: ICL / Rob Barnes
View Simulation & Planning

- Ingest camera & instruments’ pointings
- Display simulated views
- Support instruments’ cross calibration (superimpose observations, manually co-align,…) – even at early flyby occasions

FoV in Overall Scene

Pointing Params
Credits: ICL
Trajectory Reconstruction (Perseverance Touch-Down)

Data Credits: NASA/JPL/USGS
Additional Aspects:
Superimposition / Co-registration of surfaces

Data Credits: NASA/JPL/ASU/MSSS/Cornell/USGS
Support by AT Scientists

- Strategies for hazardous asteroid deflection based on crater structure, momentum enhancement factor, and deflection method.
- Help determine the internal structure of the asteroid, and respond to possible deflection mechanisms.
- High Level Product „Satellites/Debris/Dust ejection“
**Programmatics**

- AT signed up for HERA
- PROVEX – Provenance starts in July
- 3D (Process & Visu) Activity to start ~Sept (proposal currently set-up)
- Complement to tools & frameworks available already for HERA
- Further activities > 2023 subject to Ministerial
- Work Plan until 2027 exists
Thank You