Current NEO-related Activities in Germany

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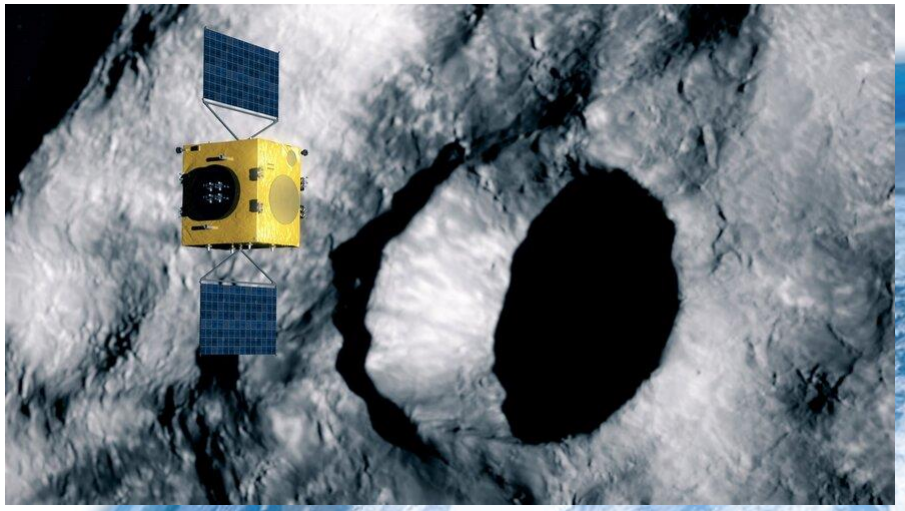
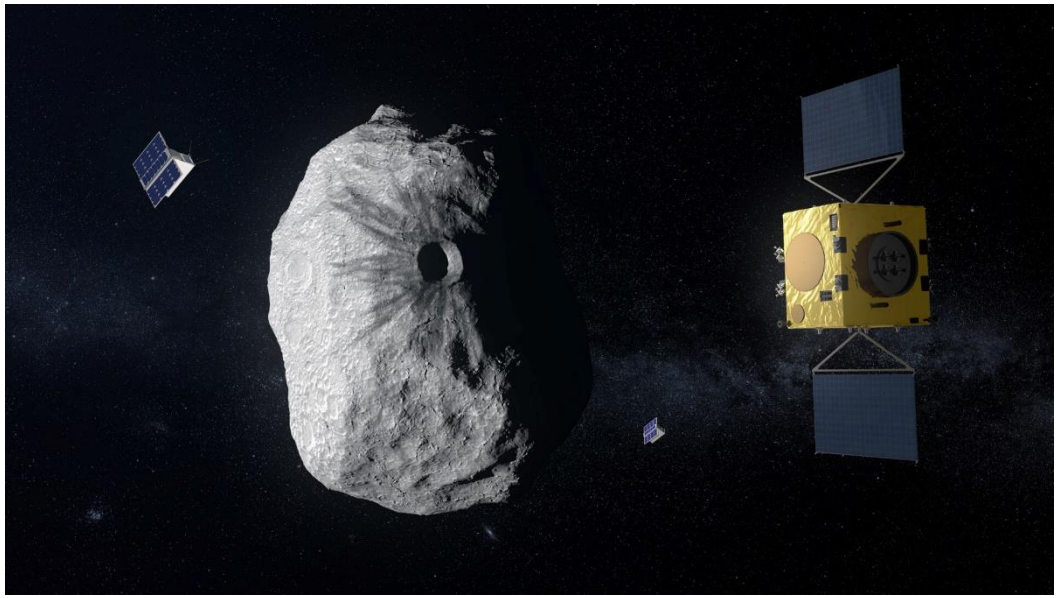


Current NEO-related Missions and Projects with German participation

1. **Hera** – Europe's reconnaissance mission to Didymos and Dimorphos, planned for launch in 2024, following and complementing NASA's DART impactor.
2. **NEO-MAPP** – EU-funded project (Feb. 2020 – Jan. 2023) with work packages in support of Hera science.
3. **FastKD** - Fast Kinetic impactor Deflection mission concept



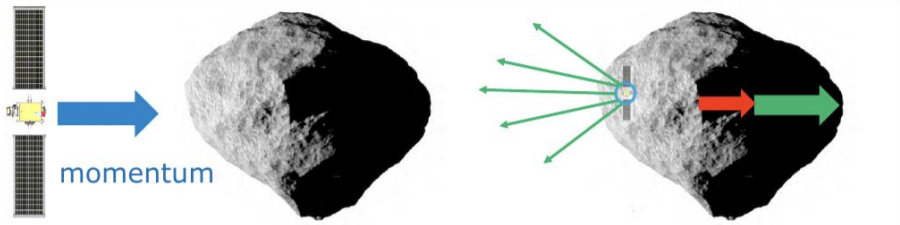
Hera

- Hera is the European reconnaissance mission to the Didymos system which complements NASA's kinetic-impactor mission, DART, with the aim of returning precise information on the effects of the DART impact.
- German participation is primarily via industry but DLR provides two working-group leaders (S. Ulamec and J.-B. Vincent), and the Museum für Naturkunde, MfN, (natural history), Berlin, provides one (K. Wünnemann).
- The German aerospace company, OHB System AG, Bremen, is the ESA prime contractor for Hera and is responsible for the design and construction of the spacecraft. The MPS/DLR camera (Dawn's flight spare) has been de-selected in favour of a camera without a filter wheel from the German company Jenoptik.
- Hera includes a pair of CubeSats: 'Milani', which will perform spectral measurements of both Didymos and Dimorphos, down to investigations of individual boulders, and 'Juventas', with German participation, which will perform the first radar survey of an asteroid's interior.
- Launch date: 2024; arrival: end 2026; duration of operations: at least 6 months.

DART/Hera

MfK is represented in the DART and Hera mission working groups on impact simulations:

- Working group leaders:
  - Angela Stickle (DART, Johns Hopkins Applied Physics Laboratory)
  - Martin Jutzi (Hera, Univ. of Bern)
  - Kai Wünnemann (Hera, MfN, Berlin)
- Task: Conduct numerical models and laboratory experiments to predict the outcome of the DART impact experiment.



$$\text{Efficiency } \beta = \frac{\text{Didymoon mass} \times \Delta V}{\text{momentum}}$$

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NEO-MAPP ('NEO Modelling and Payloads for Protection')

15 partners; funded Feb. 2020-Jan. 2023

Tasks with German leadership or significant participation

1. Advanced payload synergies (DLR) - focusing on Hera

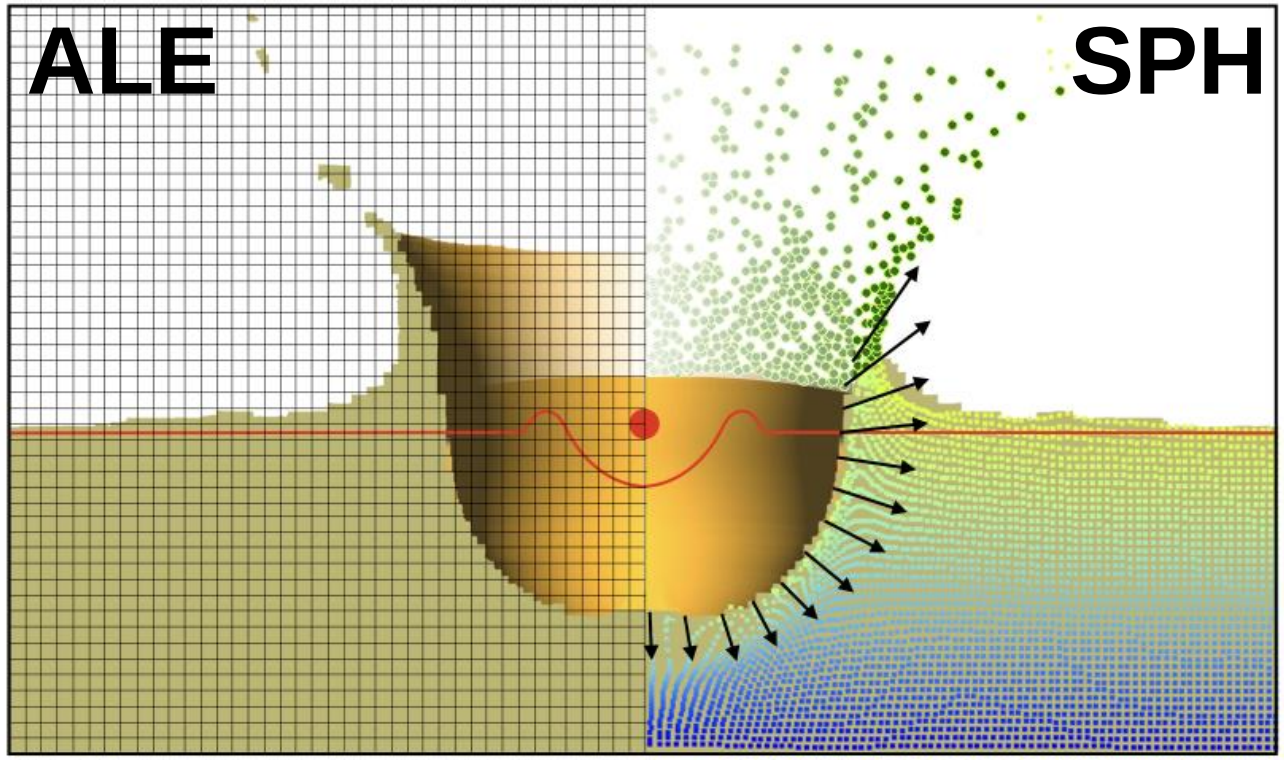
Develop innovative and synergetic measurement and data-analysis strategies that combine multiple payloads, to ensure optimal data exploitation for NEO missions:

- Collect scientific objectives and potential capabilities of instruments and modelling tools.
- Identify observables and possible synergies amongst instrument measurements and modelling (e.g. improve shape modeling by combining image, lidar, radar data).
- Define payload/instruments, objectives, and performance requirements, including a final performance synthesis summary.

NEO-MAPP ('NEO Modelling and Payloads for Protection')

Tasks with German leadership or significant participation

2. Simulation of the collision of a kinetic impactor with an asteroid by coupling different numerical approaches (MfN, Berlin)



Target properties determine:

- Efficiency of Momentum transfer
- Crater morphology + morphometry
- Ejecta mass
- Global scale effects
- Impact seismicity

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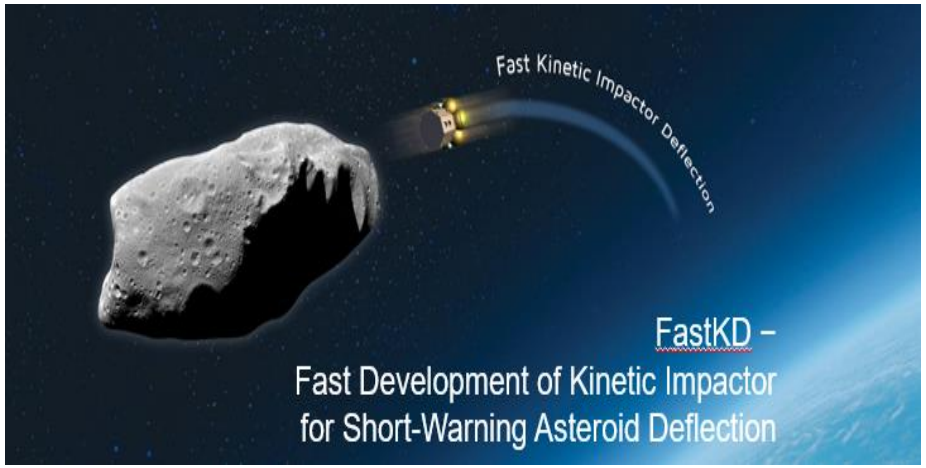
DLR

Fast Kinetic Impactor Deflection Mission Concept (FastKD)

Airbus DS, Germany

- With ESA funding, the Airbus Defence and Space operation in Germany is assessing the feasibility of modifying a commercial spacecraft platform in order to perform asteroid kinetic deflection in the shortest possible time.

- The tight schedule would be maintained by taking a commercially available (e.g. telecommunications) satellite and adapting it for the kinetic deflection attempt (actual build/adaptation time: 2-3 months; launch readiness: within 6 months from threat discovery).



- A major issue is how to minimize the necessary modifications to the spacecraft's platform and subsystems and the effort involved in attaching a deflection module.

- The results have just been presented to ESA and will be published after evaluation.