

EPSC : PLANETARY DEFENCE Session research

ESA's HERA

Binary Asteroid system Radar Tomography mission

First rendezvous with a binary asteroid system · first CubeSat radar sounding of an asteroid interior

Ben · September 10 2026



https://www.esa.int/ESA_Multimedia/Search?SearchText=hera&result_type=images

The AIDA Experiment

DART (NASA, Sept 2022): kinetic impactor struck Dimorphos, the small moon of Didymos, at 6.1 km/s, the first deliberate change to a celestial body's orbit.

Hera (ESA, launched Oct 2024): the forensic follow-up. DART could not observe its own aftermath, Hera returns to measure the crater, the momentum transfer, and, for the first time, an asteroid's internal structure.

Together, AIDA (Asteroid Impact & Deflection Assessment) turns a one-off demonstration into a repeatable planetary defence technique.

780 m

Didymos primary ~ mountain-sized

151 m

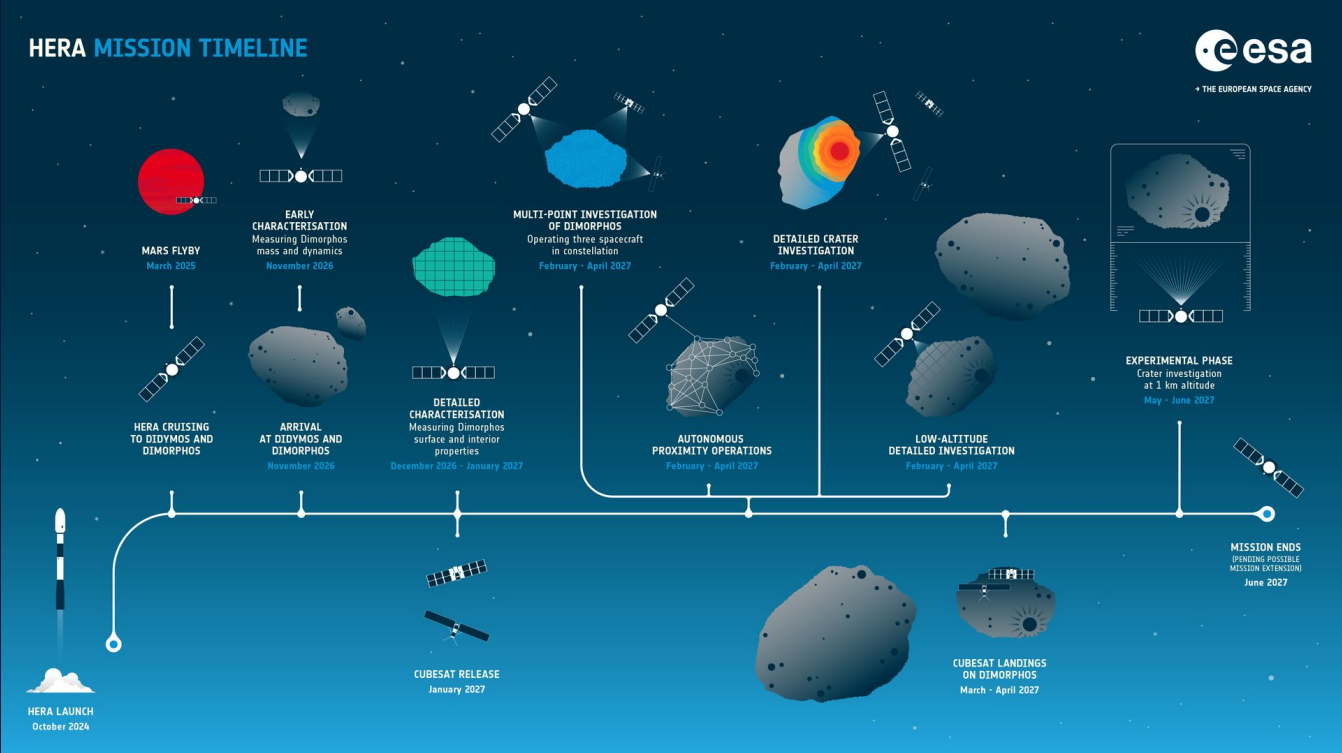
Dimorphos moonlet ~ Great-Pyramid-sized

33 min

orbital period change from DART impact

25×

the minimum change needed to call DART a success



Deployment happens at very low speed, just a few centimetres per second

SPACE SAFETY

Hera's CubeSat deployment process

14/03/2024 4050 views 60 likes 490387 to 06/02/49

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DETAILS **RELATED**

ESA's Hera asteroid mission for planetary defence will journey to the distant Didymos asteroid system with two shoebox-sized 'CubeSats'. CubeSats are small, low-cost satellites built up from 10 cm boxes, traditionally employed for educational purposes but increasingly finding operational uses in Earth orbit. The Milan

Hera and Its Two CubeSats

Hera flies as a mothership; the CubeSats fly closer, take more risk, and land.



<https://www.worthpoint.com/worthopedia/power-rangers-samurai-deluxe-gigazord-1724937202>

Hera

MOTHERSHIP

- 1.6 m cube-body, 11.5 m solar arrays
- ~1,150 kg fuelled, hydrazine propulsion
- High-res camera, thermal & spectral imagers
- Deploys and relays both CubeSats

Milani

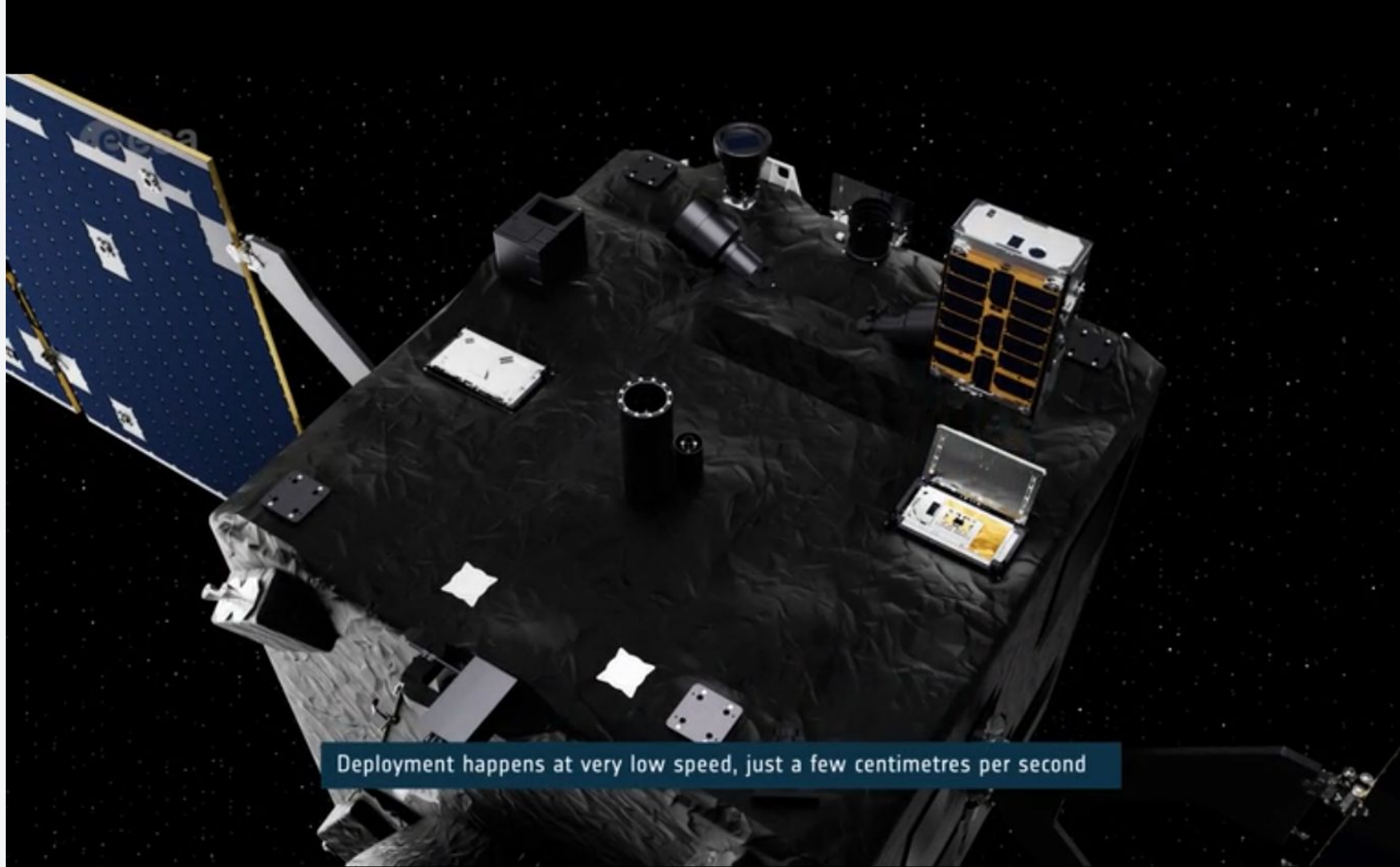
6U CUBESAT

- Multispectral imaging of the surface
- Maps mineral composition & dust
- Thermal infrared spectrometer
- Attempts a landing on Dimorphos

Juventas

6U CUBESAT

- Carries JuRa — the radar payload
- Low-frequency radar sounding of the interior
- Gravimeter measures the gravity field
- Landing with bounce-dynamics data



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SPACE SAFETY

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DETAILS

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INSTRUMENT FOCUS

JuRa: Radar Tomography from a CubeSat

Carried by Juventas.

HERITAGE

Monostatic radar, inherited from CONSERT/Rosetta

MODULATION

BPSK-coded, 60 MHz carrier, 20 MHz bandwidth

PENETRATION DEPTH

≥ 100 m into Dimorphos' interior

VERTICAL RESOLUTION

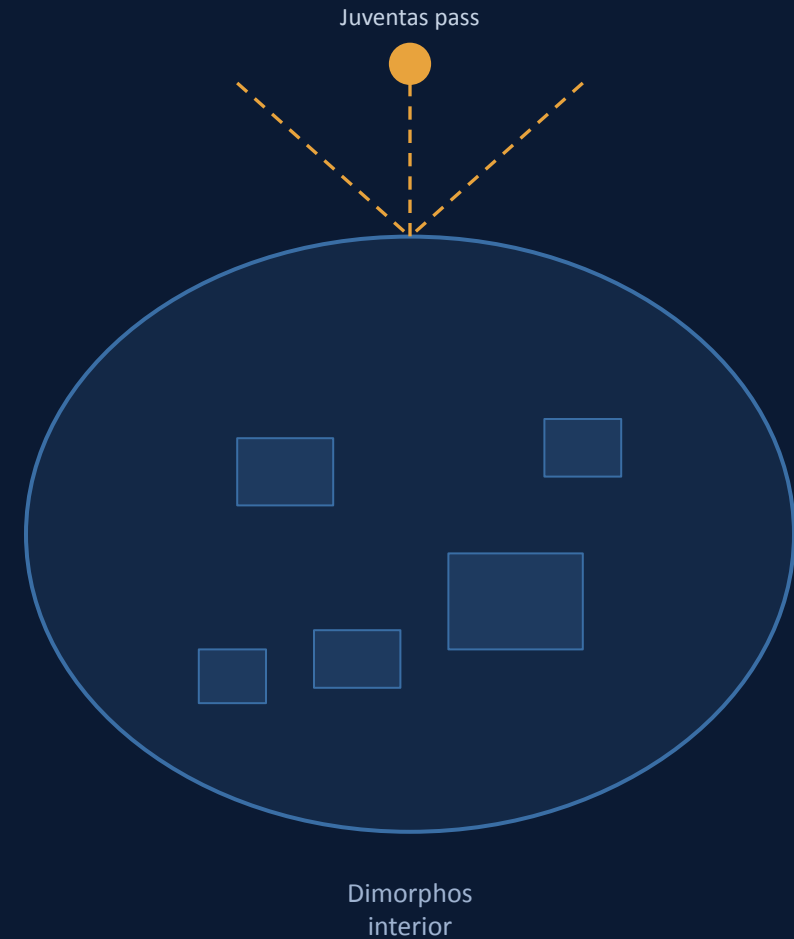
~20 m per sounding pass

METHOD

Multipass processing builds a 3D tomographic image — an 'X-ray scan' of the asteroid

PAYLOAD CLASS

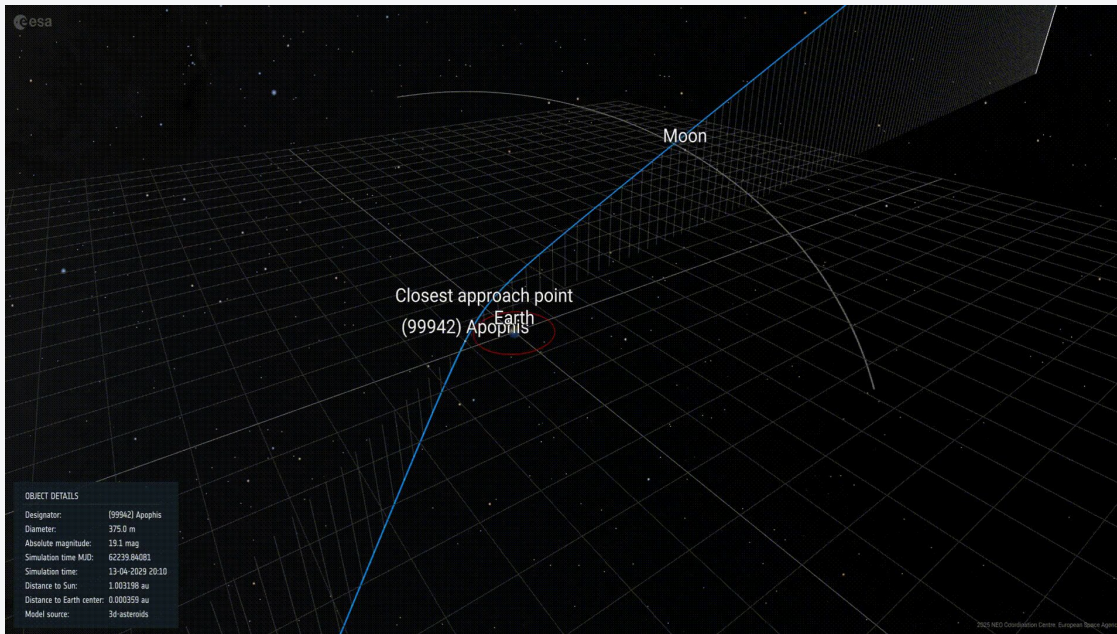
Smallest radar instrument ever flown in space



NEXT MISSION

RAMSES: Planetary Defence After Hera

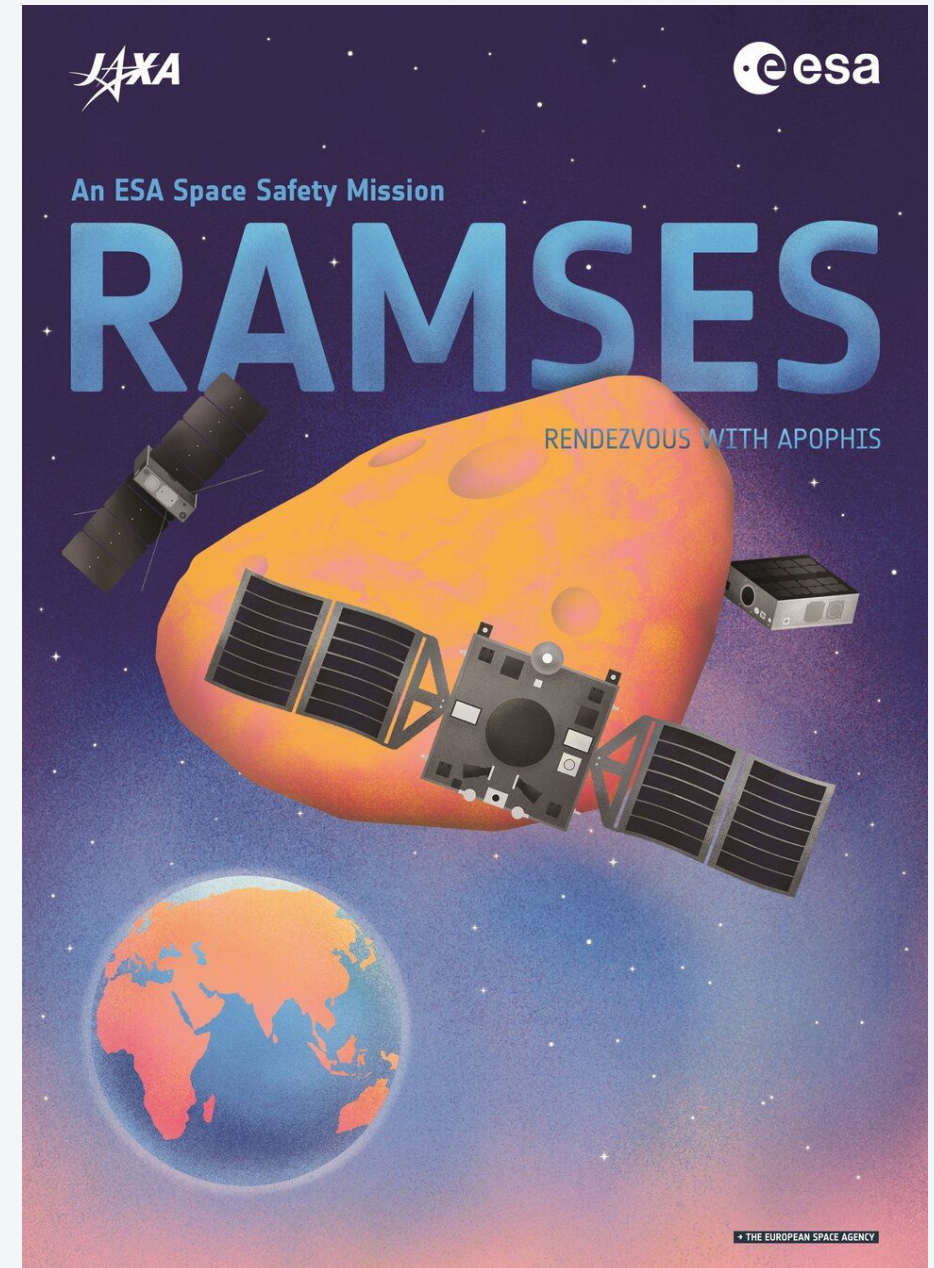
RAMSES (Rapid Apophis Mission for SpaceE Safety) is ESA's next planetary defence cornerstone, following Hera. It will rendezvous with **Apophis** and escort it through its historic close encounter with Earth on 13 April 2029, investigating the asteroid before, during and after the flyby.



https://www.esa.int/Space_Safety/Planetary_Defence/Ramses_ESA_s_mission_to_asteroid_Apophis

< 32,000 km

Apophis' closest distance from Earth's surface
inside geostationary orbit!!!!

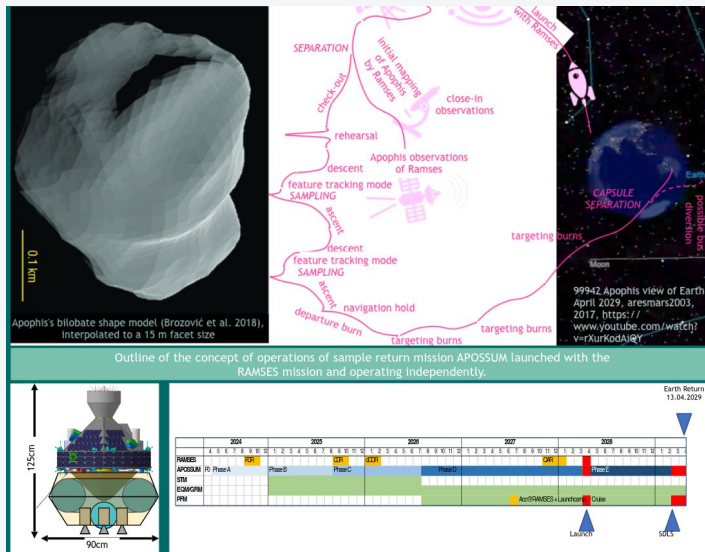
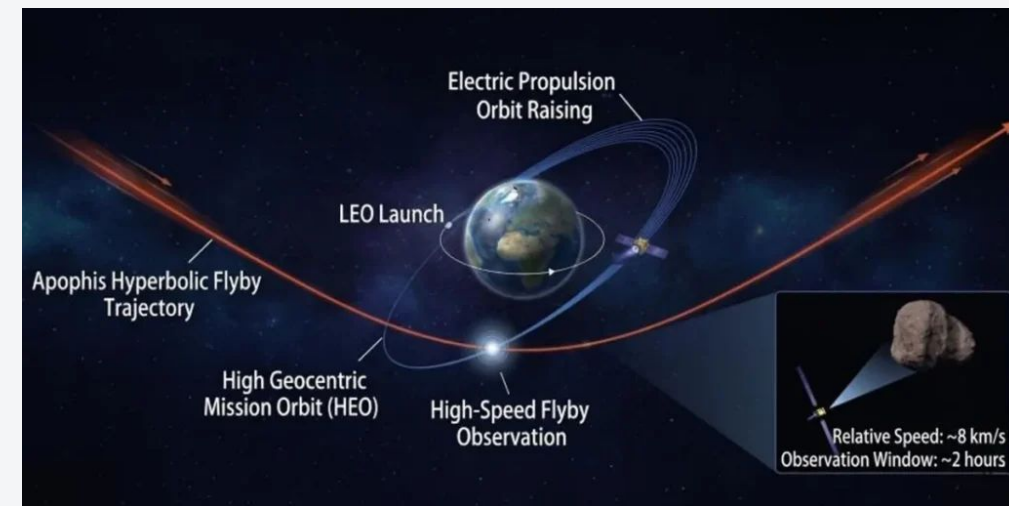


Launch to Close Encounter

Launch window	24 Apr – 11 May 2028	Shared launch with JAXA's Destiny+ on an H3 rocket
Transfer	10 months · $\Delta v < 1.6$ km/s	Low-cost, low-propellant cruise to Apophis
Arrival at Apophis	February 2029	Orbit insertion completed within 20 days
Pre-encounter phase	1 Mar – 11 Apr 2029	Hyperbolic arcs, hovering down to 1 km, CubeSats released
Close-encounter phase	12 – 14 Apr 2029	Hovering at 5 km through Apophis' Earth flyby
End of nominal ops	31 Aug 2029	16-month total mission lifetime; extended/autonomy phase to follow



ESA and JAXA's
Ramses and
Destiny+ missions



China's Tsinghua Uni wants to launch START

<https://edumagz.com/tsinghua-university-students-develop-spacecraft-for-historic-apophis-asteroid-encounter/>



NASA has OSIRIS APEX

<https://science.nasa.gov/mission/osiris-apex/>

Even Germany's DLR has Apossum

https://elib.dlr.de/207006/1/Apophis%20T-5__Apossum.pdf

References

- EPSC : [The ESA Hera mission: two months before arrival to the binary asteroid Didymos](#) & [The ESA -JAXA RAMSES Mission to Apophis](#)
- ESA — “Hera's Targets Early Arrival at Didymos Asteroids”, esa.int/Space_Safety/Hera
- ESA — “Hera Mission Overview” and “Hera Operations”, esa.int/Space_Safety/Hera
- ESA — “Hera's CubeSats” and “Radar Journey to Centre of Hera's Asteroid with Juventas CubeSat”
- “Radar Tomography of Asteroid Deep Interior: JuRa / HERA to Didymos and the Radars to Apophis”, EPSC-DPS 2025 conference abstract
- “The Dynamical State of the Didymos System Before and After the DART Impact”, arXiv:2502.14990
- EarthSky — “Hera Mission Will Arrive at Asteroid Impact Site in November” (Jul 2026)
- New Space Economy — “ESA's Hera Arrives at Didymos: Completing the World's First Planetary Defence Test” (Apr 2026)
- Anywaves — “Juventas CubeSat: Anywaves' JuRa Radar Electronics for Hera” (Jun 2026)
- ESA/JAXA — RAMSES “Mission Statement and Objectives”, “Mission Profile” and “Payload Suite”, presented at EPSC-DPS 2026
- ESA — “Apophis”, esa.int/Space_Safety/Planetary_Defence/Apophis