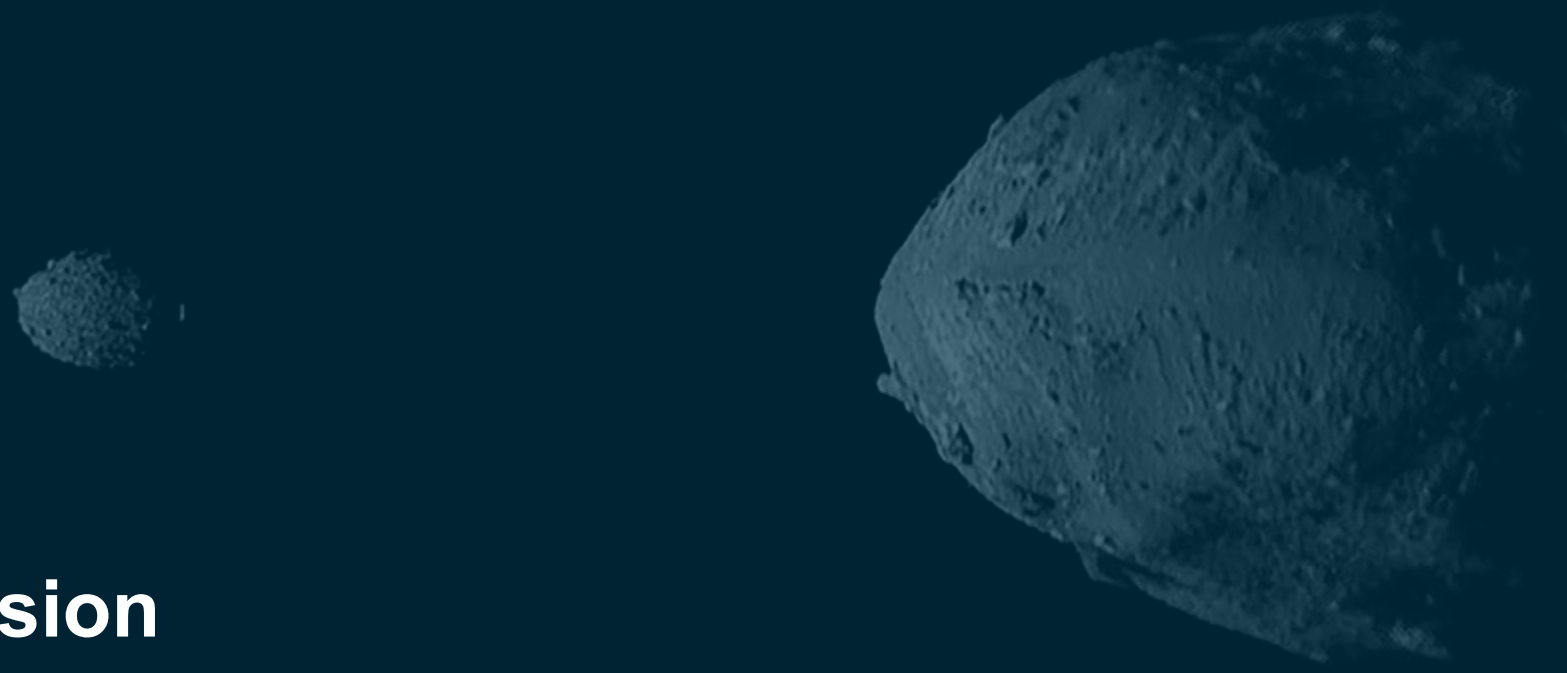


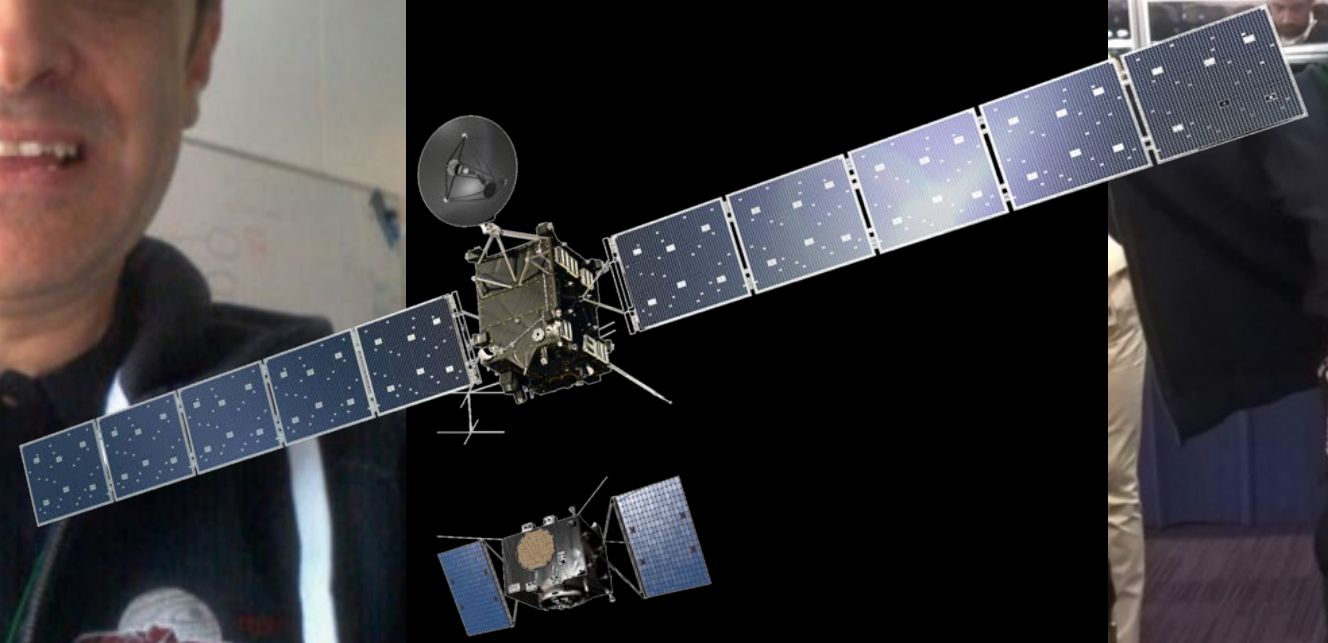
The Hera mission

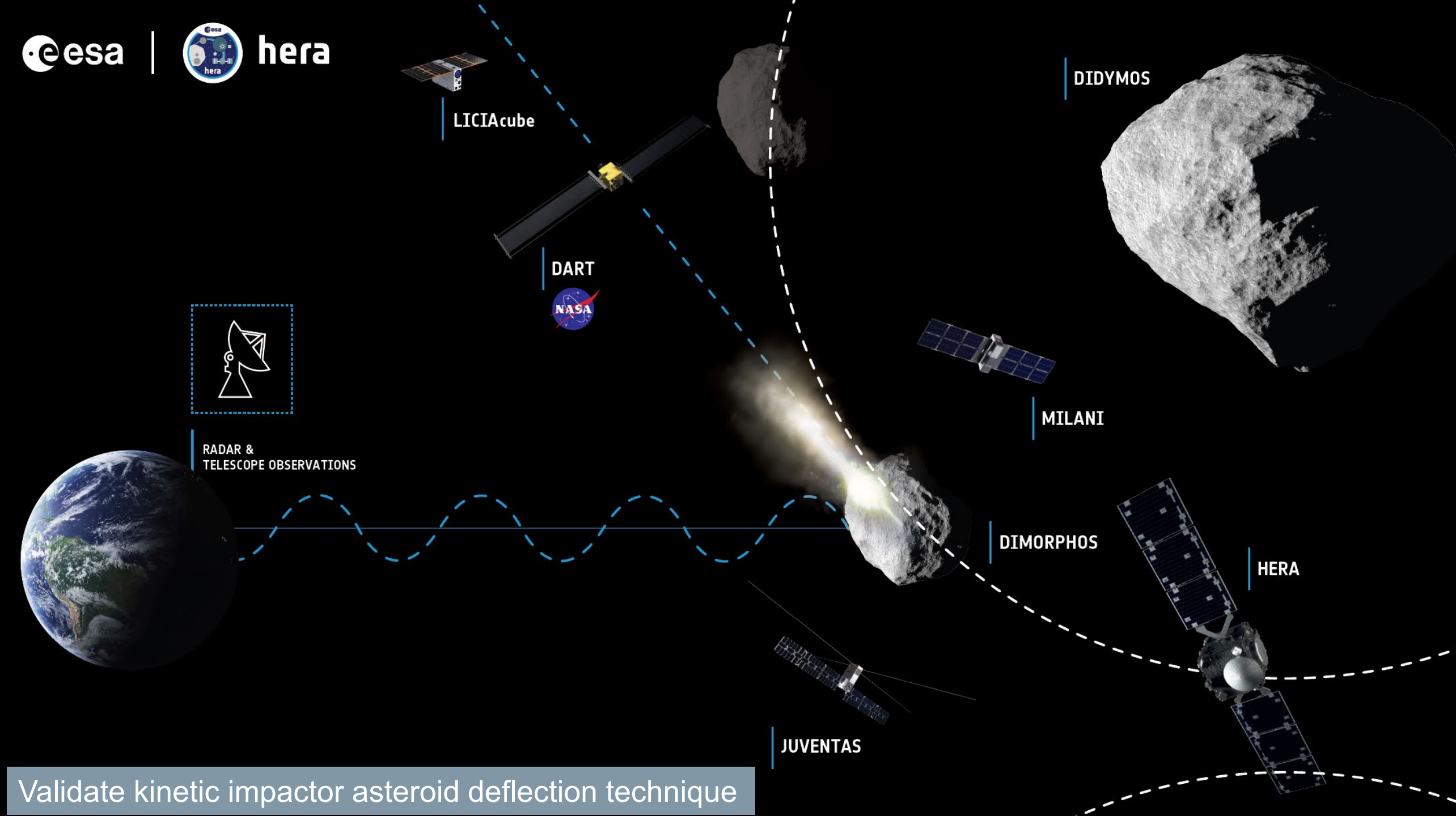
unveiling Didymos mysteries for planetary defence:

Hera team

From Rosetta landing to AIM … to Hera

30 Sept 2016



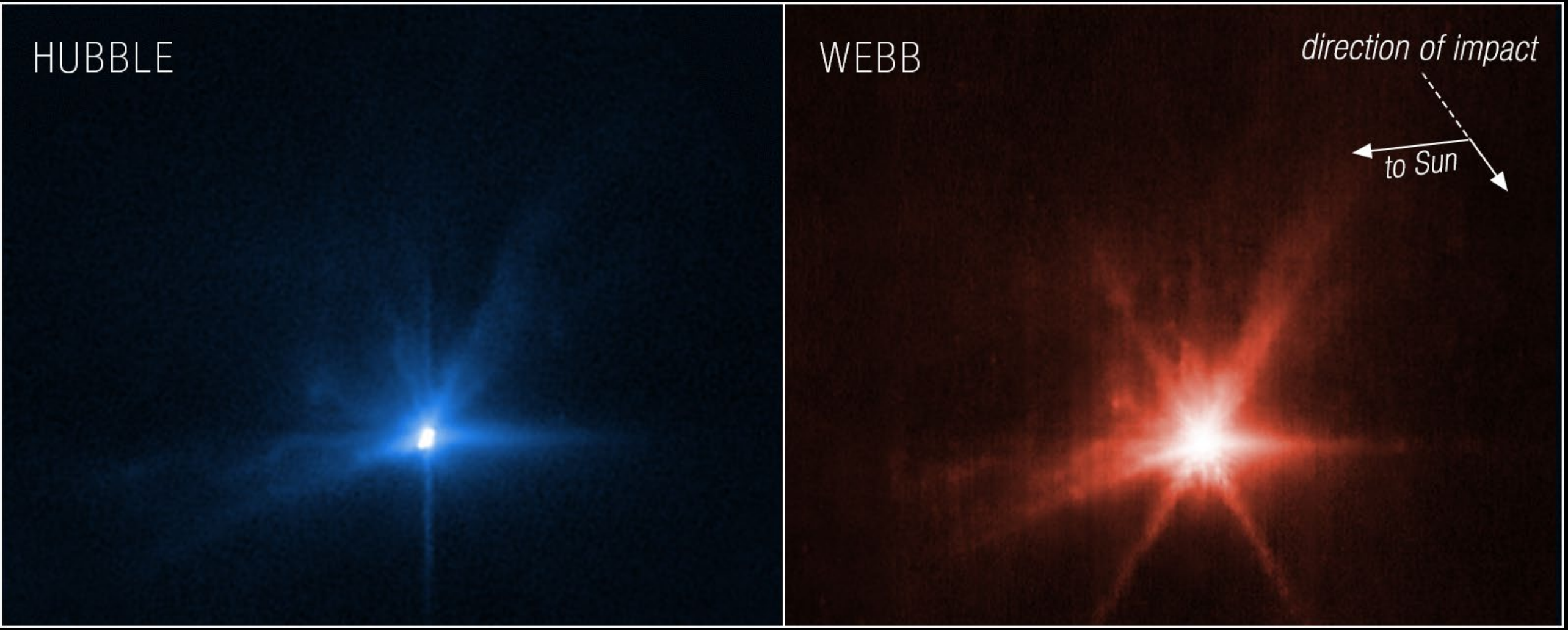

esa | hera
LICIAcube
DART
NASA
DIDYMOS
MILANI
RADAR &
TELESCOPE OBSERVATIONS
DIMORPHOS
HERA
JUVENTAS
Validate kinetic impactor asteroid deflection technique

DART impact: 26 Sept 2022

DART draco images (JHU/APL)

Ground-based images

DART impact

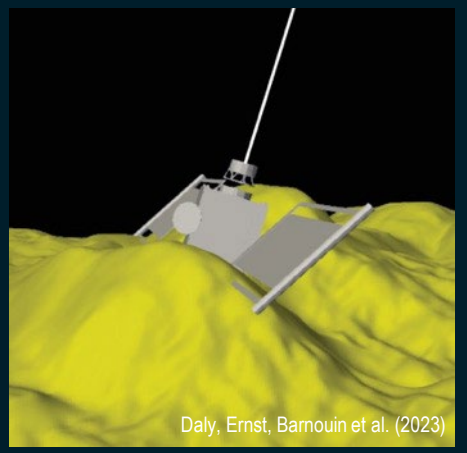


Credit: Science: NASA, ESA, CSA, Jian-Yang Li (PSI), Cristina Thomas (Northern Arizona University), Ian Wong (NASA-GSFC); Image processing: Joseph DePasquale (STScI), Alyssa Pagan (STScI)

Hera mission: unveiling the puzzle

1. What is the asteroid mass? How efficient was the deflection
2. What is the final shape of the asteroid? Is there a crater or total reshaping?
3. What are the surface properties of Dimorphos?
4. What is the internal structure of the asteroid (voids, monolithic rocks)?
5. What is the composition of the asteroid and its dust
6. Why DART deflection was ~6 times what was expected?

…



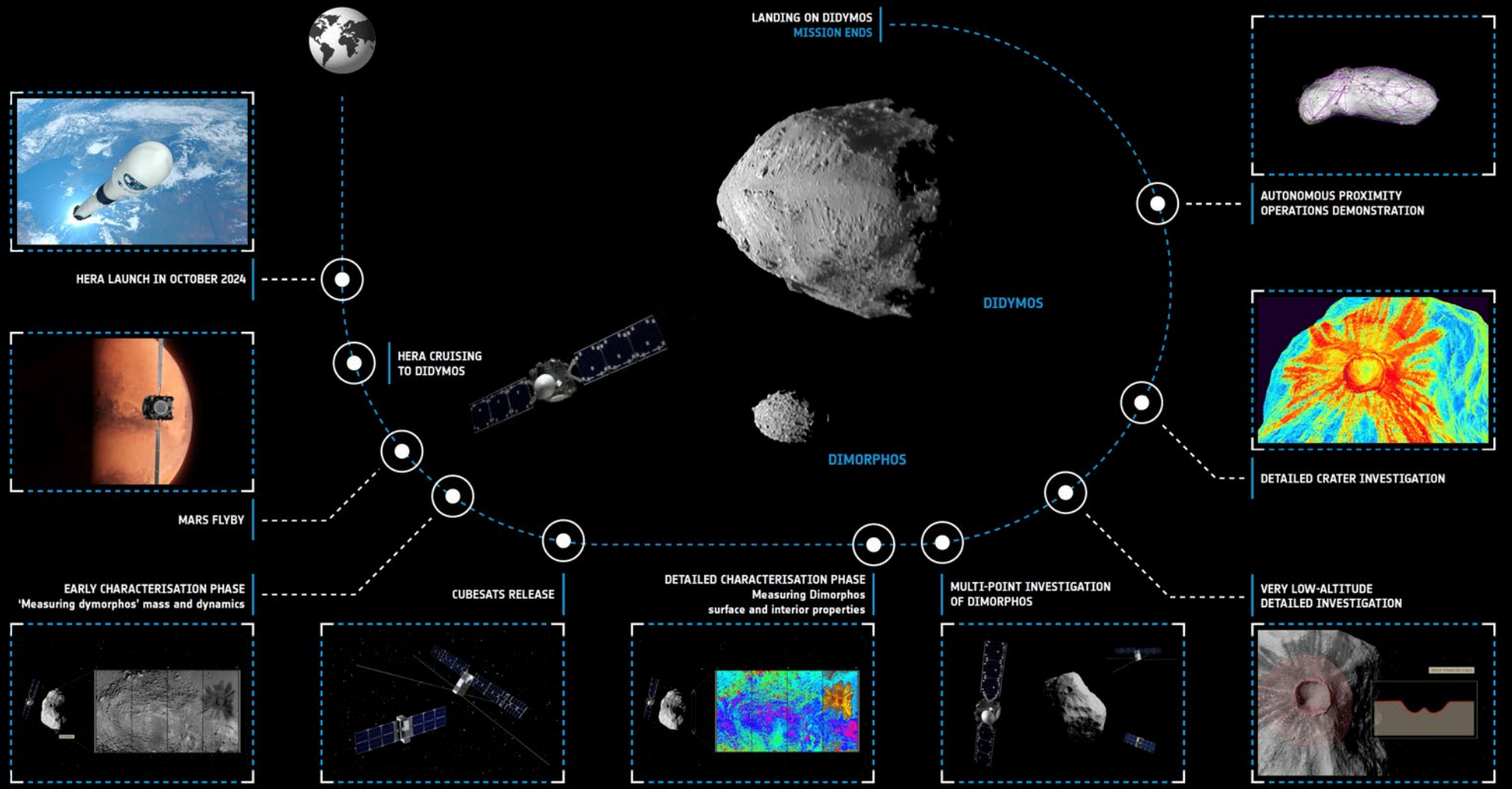
Impact conditions

Impact velocity - known
Impact angle - known
Impactor mass/shape - known

Target properties

- Mass - unknown
- Bulk density / porosity - unknown
- Internal structure – unknown
- Cohesive strength - unknown

Hera mission



- First mission to rendezvous with a binary asteroid and smallest asteroid ever visited
- First radar tomography of an asteroid
- First full-scale cratering physics experiment investigation
- First deep-space CubeSat for very close asteroid inspection

Hera mission key figures

HERA: MADE IN EUROPE

Around **100 European companies and institutes across 18 ESA Member States** are involved in making Hera happen. Here are the leading contributors by country in the consortium, working with multiple subcontractors in turn:

→ **Germany - OHB** led Hera's industrial consortium for ESA, including responsibility for the overall spacecraft design, development, assembly and testing. **HPS** has produced Hera's High Gain Antenna, with **INVENT** making its main reflector dish and spacecraft composite panels. **DSi Aerospace** made Hera's Mass Memory Unit, storing instrument and computer data. **Jena Optronik** produced Hera's Asteroid Framing Cameras while Azur Space supplied Hera's solar cells.

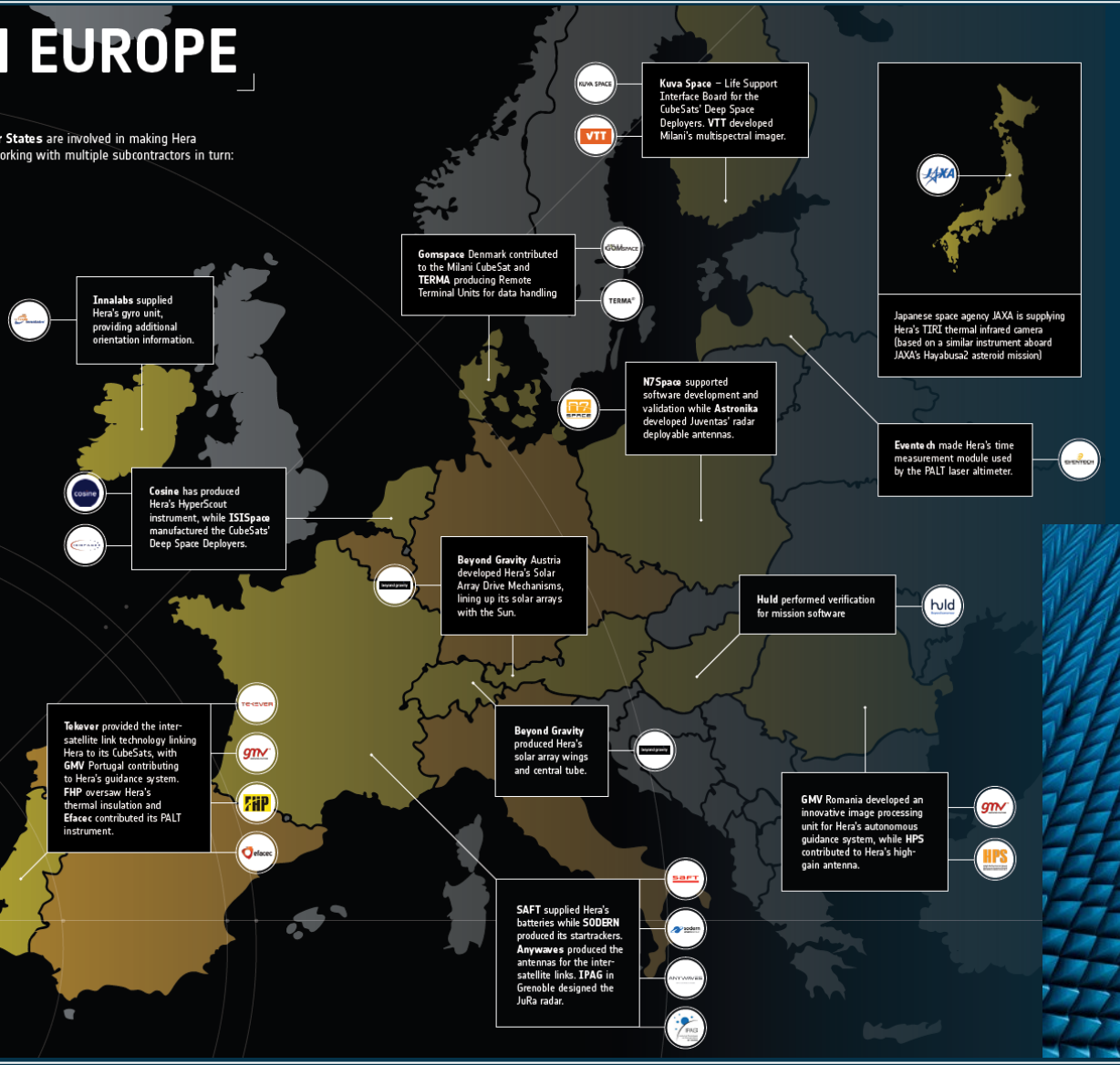
→ **Italy - OHB Italia** developed the electrical power subsystem and led the spacecraft harness design. **Avio** was responsible for integrating and testing Hera's propulsion subsystem while **Leonardo** integrated Hera's photovoltaic assembly. **Tyvak International** designed, developed, assembled and tested the Milani CubeSat, while INAF developed its dust detector. **TSD Space** developed Hera's Spacecraft Monitoring Camera.

→ **Belgium - Redwire Space** led the data handling subsystem including Hera's onboard computer while **Spacebel** developed the spacecraft central software and CubeSats Mission Control Center. **Thales Alenia Space** Belgium developed the power distribution and control unit as well as component for the communication subsystem. The **Royal Observatory of Belgium** developed Juventas' CubeSat GRASS gravimeter.

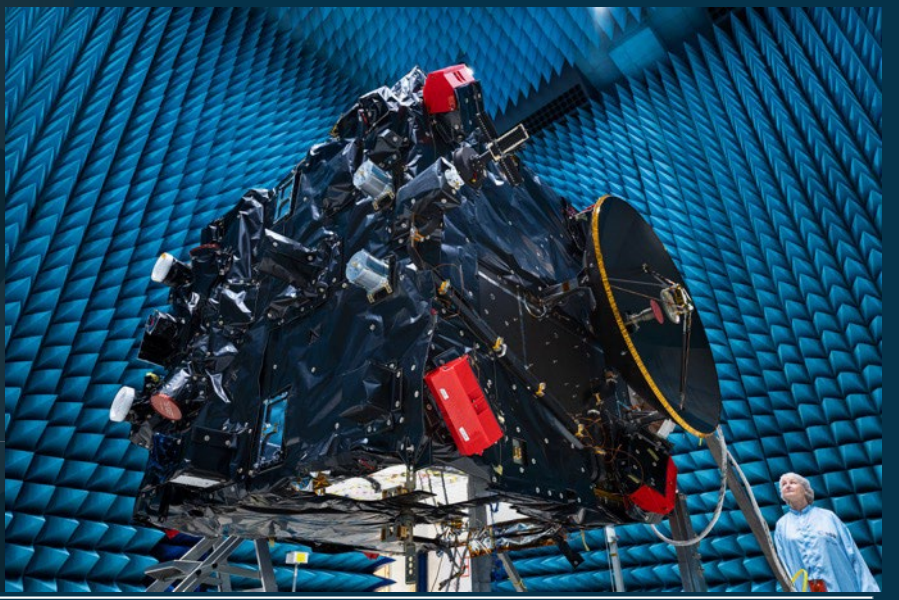
→ **Spain - GMV** led Hera's guidance, navigation and control system, with **EMXYS** developing Juventas's GRASS gravimeter electronics. **SENER** produced Hera's low-gain antennas while **Thales Alenia Space** Spain led the communications subsystem design.

→ **Czechia - OHB Czechspace** led the spacecraft structure subsystem design while **GLE** manufactured Hera's harness – its subsystem-and-component-connecting wiring.

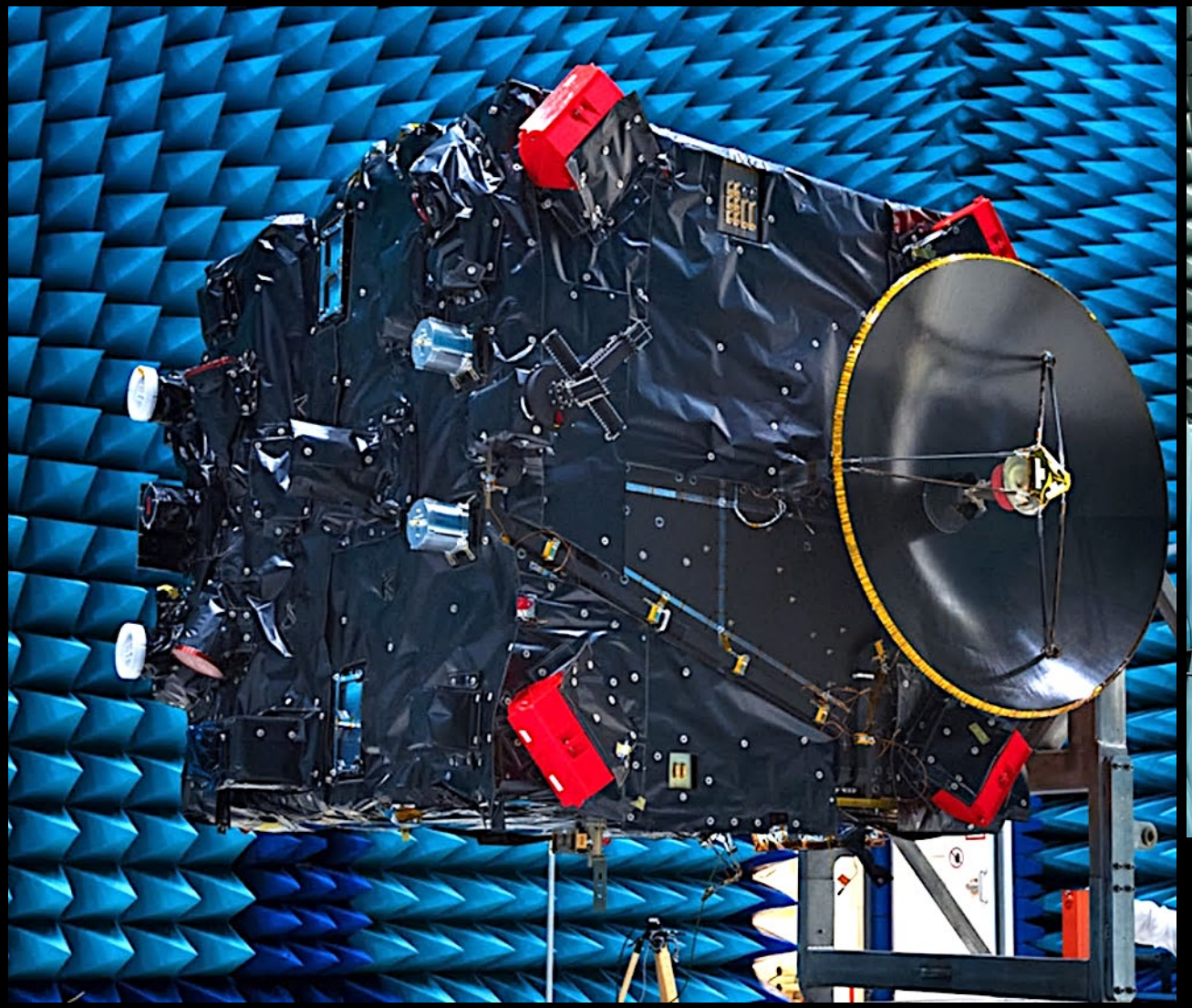
→ **Luxembourg - Gomspace** had responsibility for the Juventas CubeSat design, integration and testing, with **Emtronix** developing the CubeSat's JuRa payload.



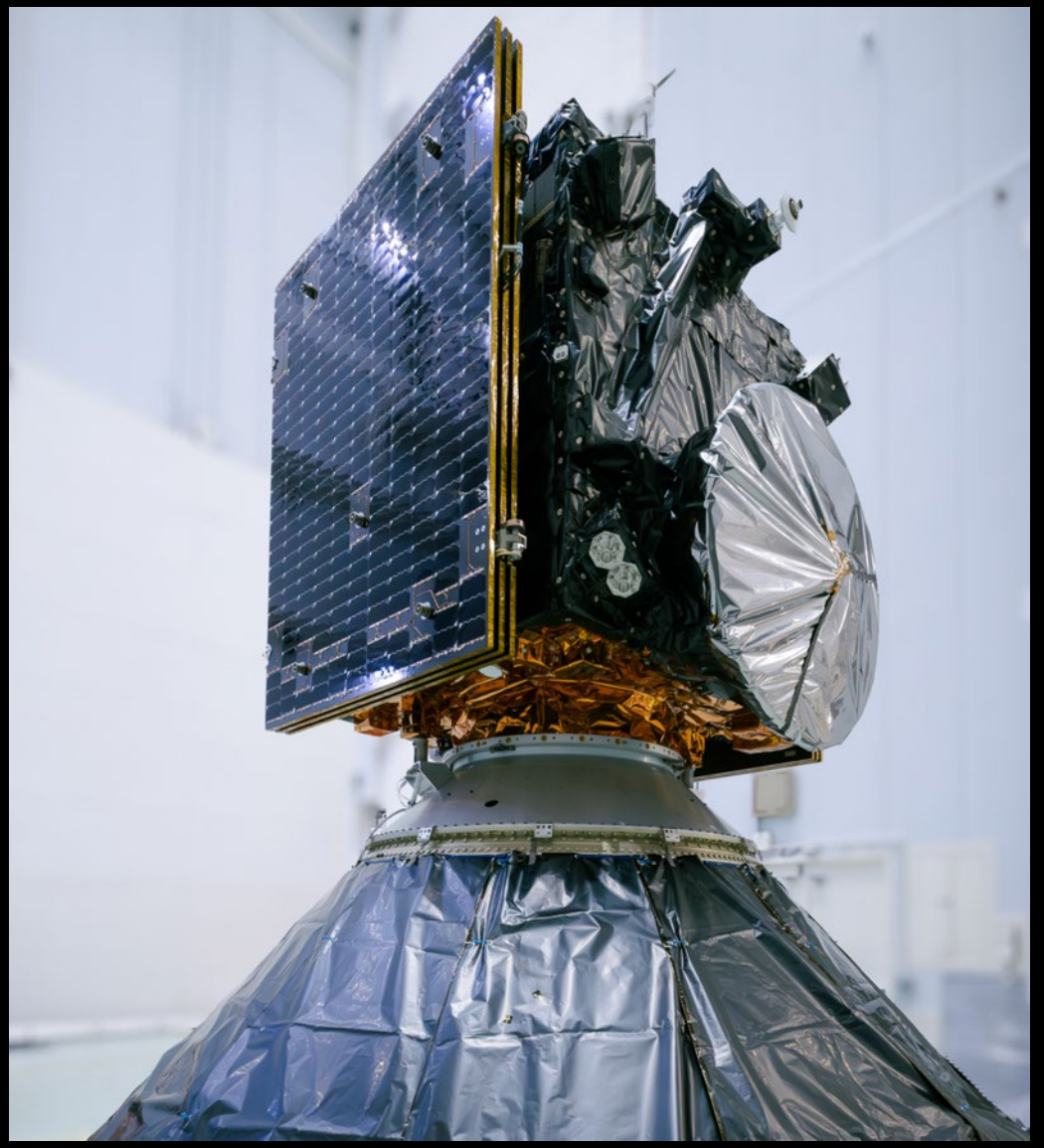
- **18** ESA Countries + Japan
- **70+** companies and institutions
- **4 Years** from contract signature to launch
- Total Cost: **383** M€
- **12** Instruments
- **2** CubeSats



Hera spacecraft

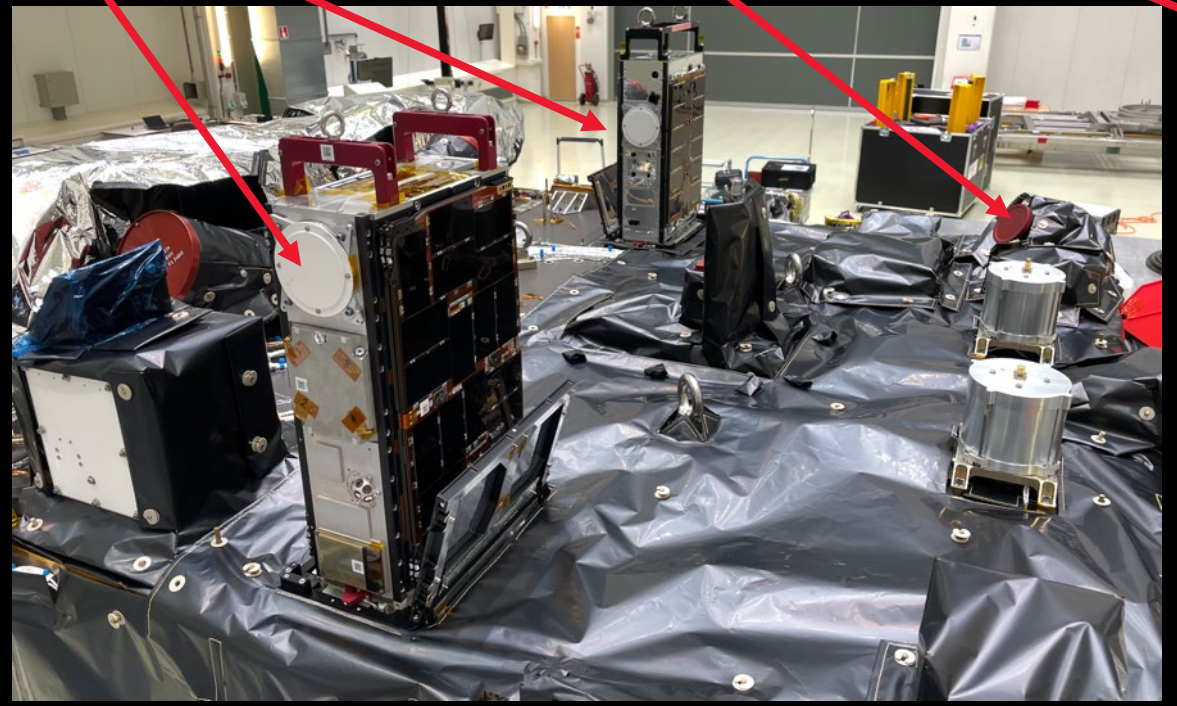


Ready for launch

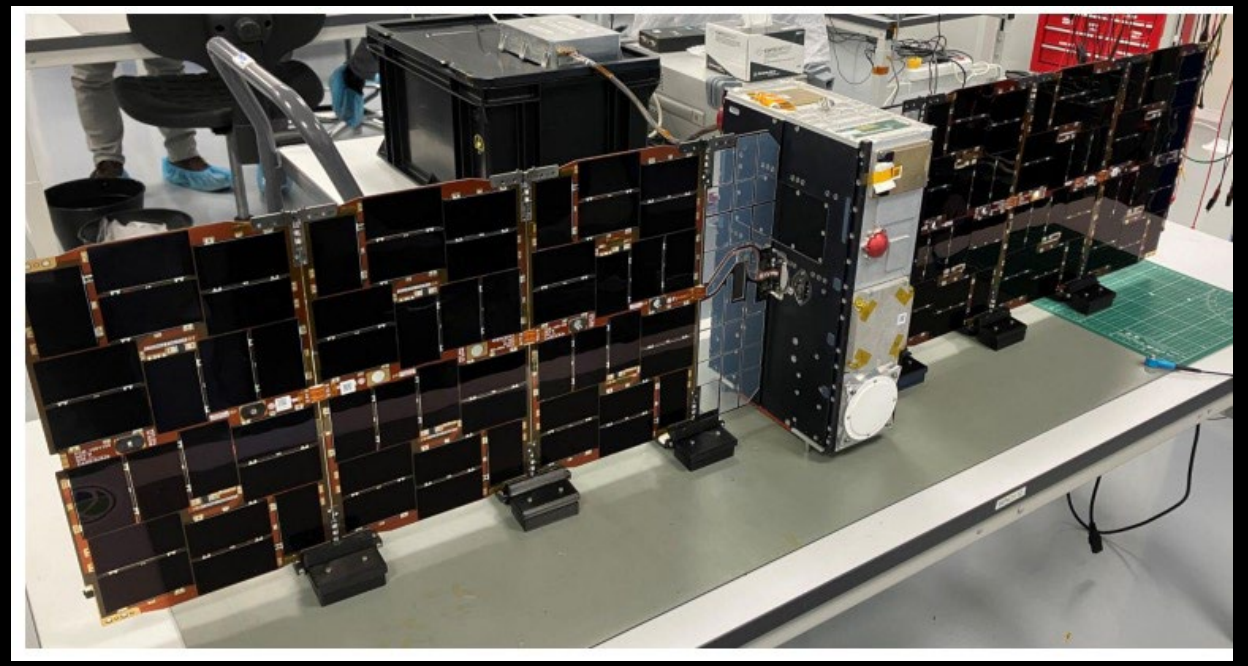


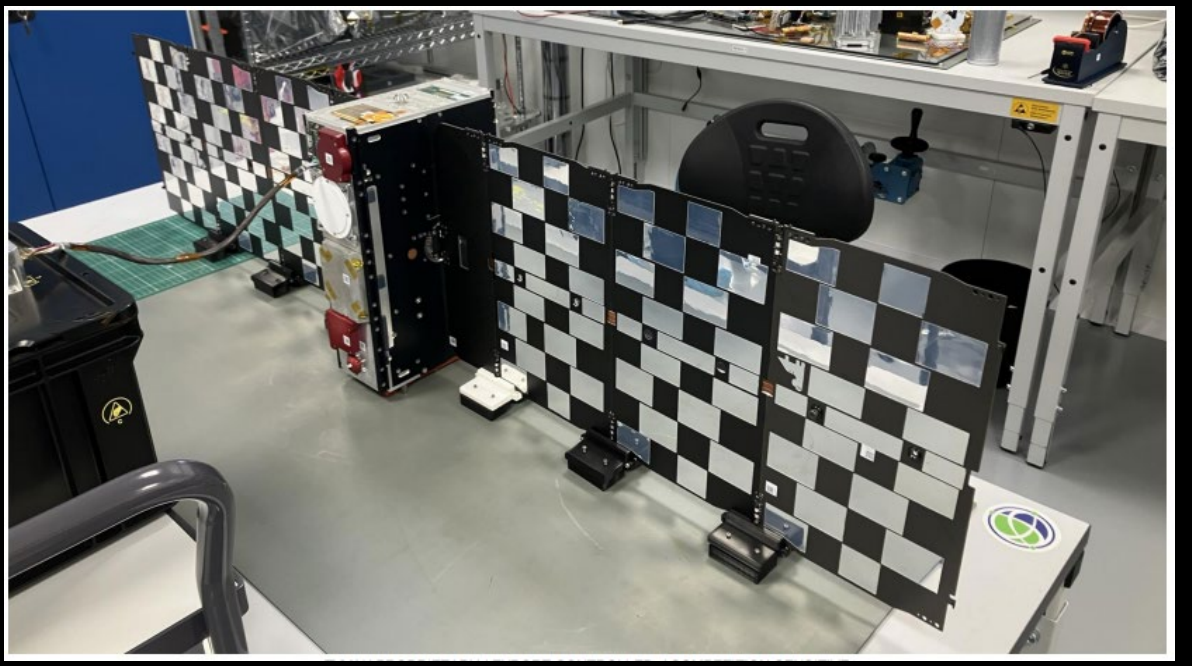
Hera instruments (11 + radioscience)

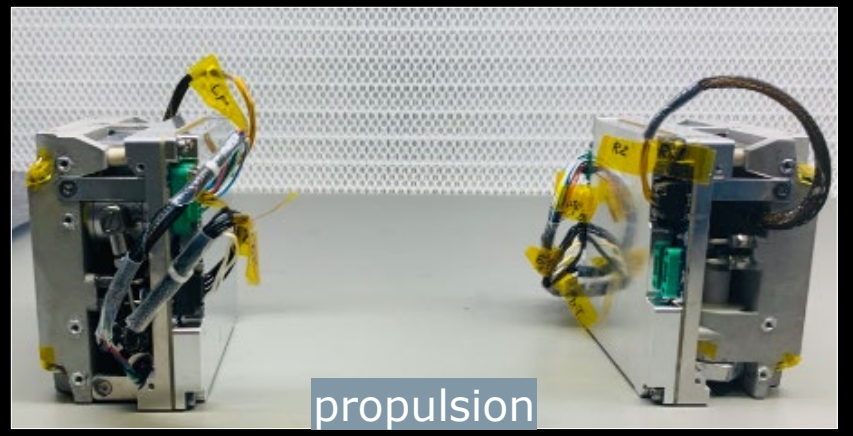
AFC (navigation and science camera)
TIRI (thermal imager)
Hyperscout-H (multispectral imager)
PALT-H (laser altimeter)
Milani CubeSat
Juventas CubeSat
Spacecraft Monitoring Camera

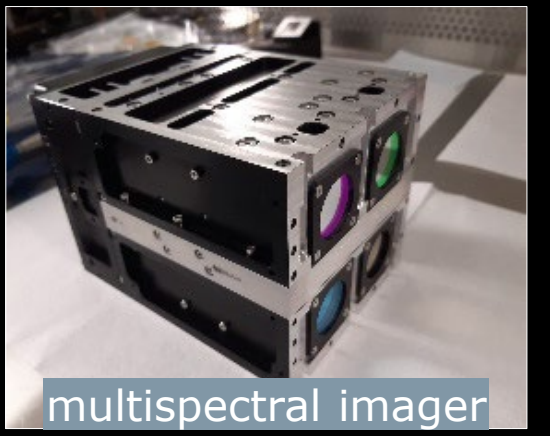


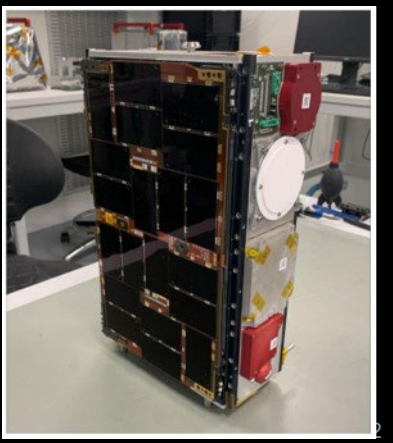
Milani CubeSat



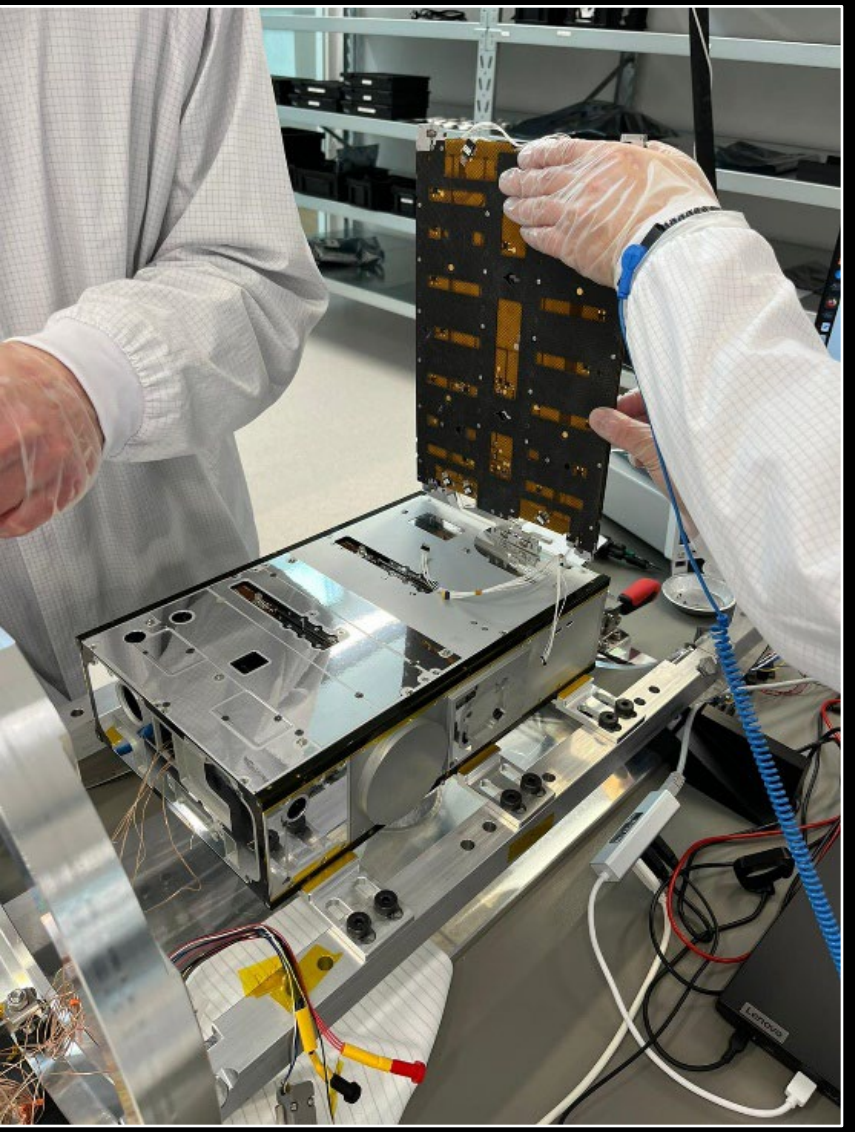




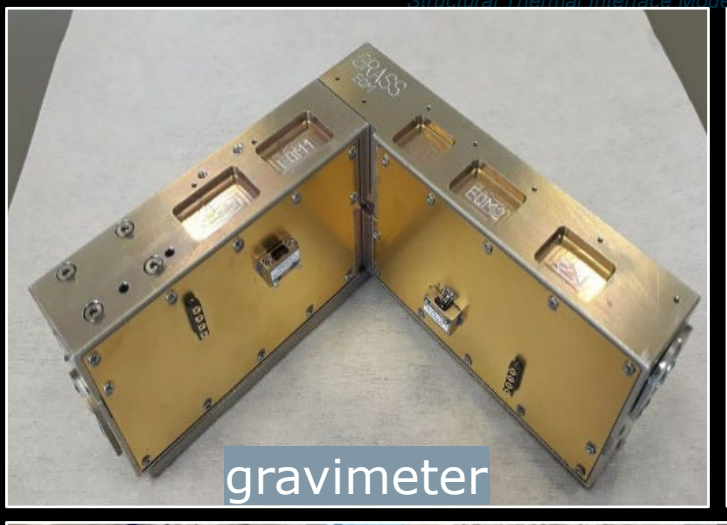


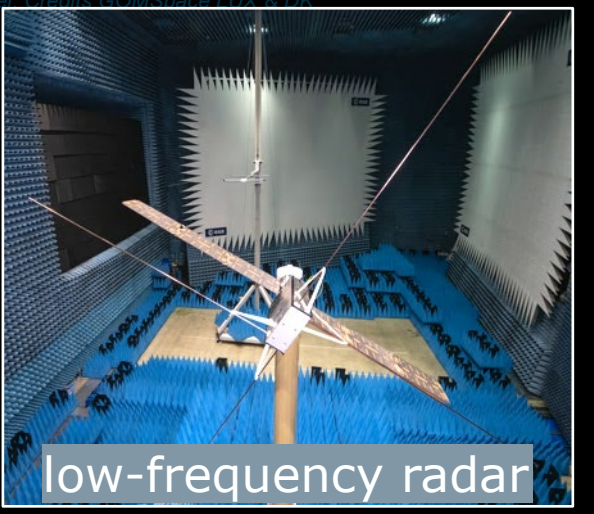


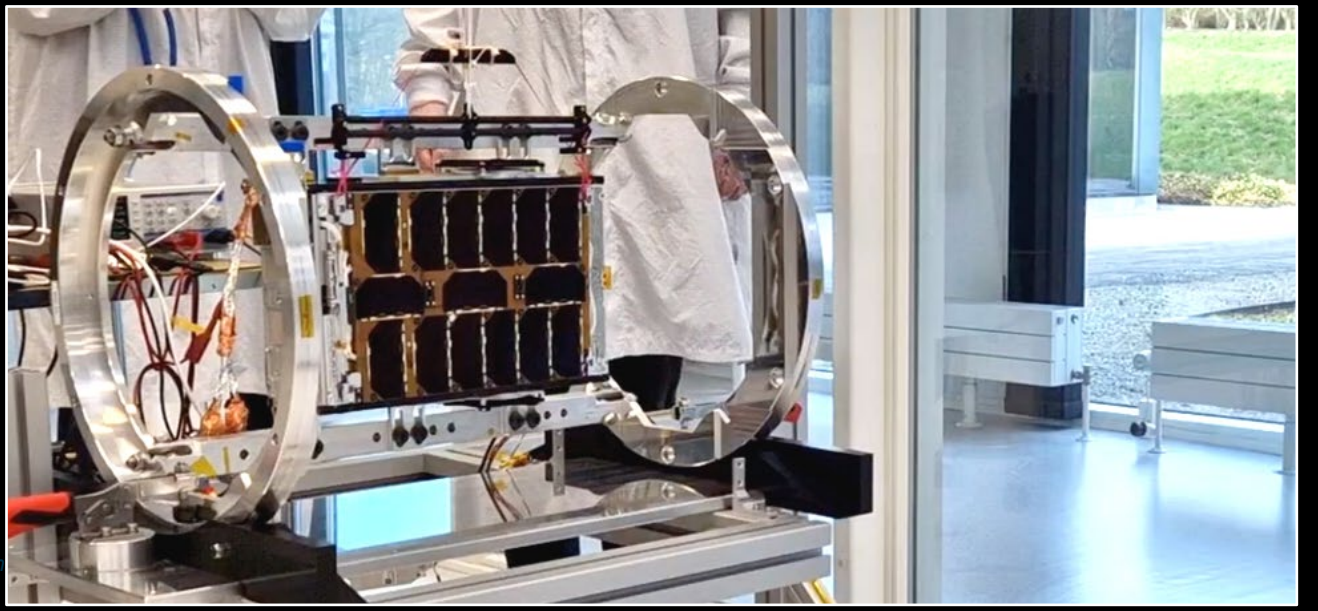
Juventas CubeSat



Structural Thermal Interface Model. Credits GOMSpace LUX & DK



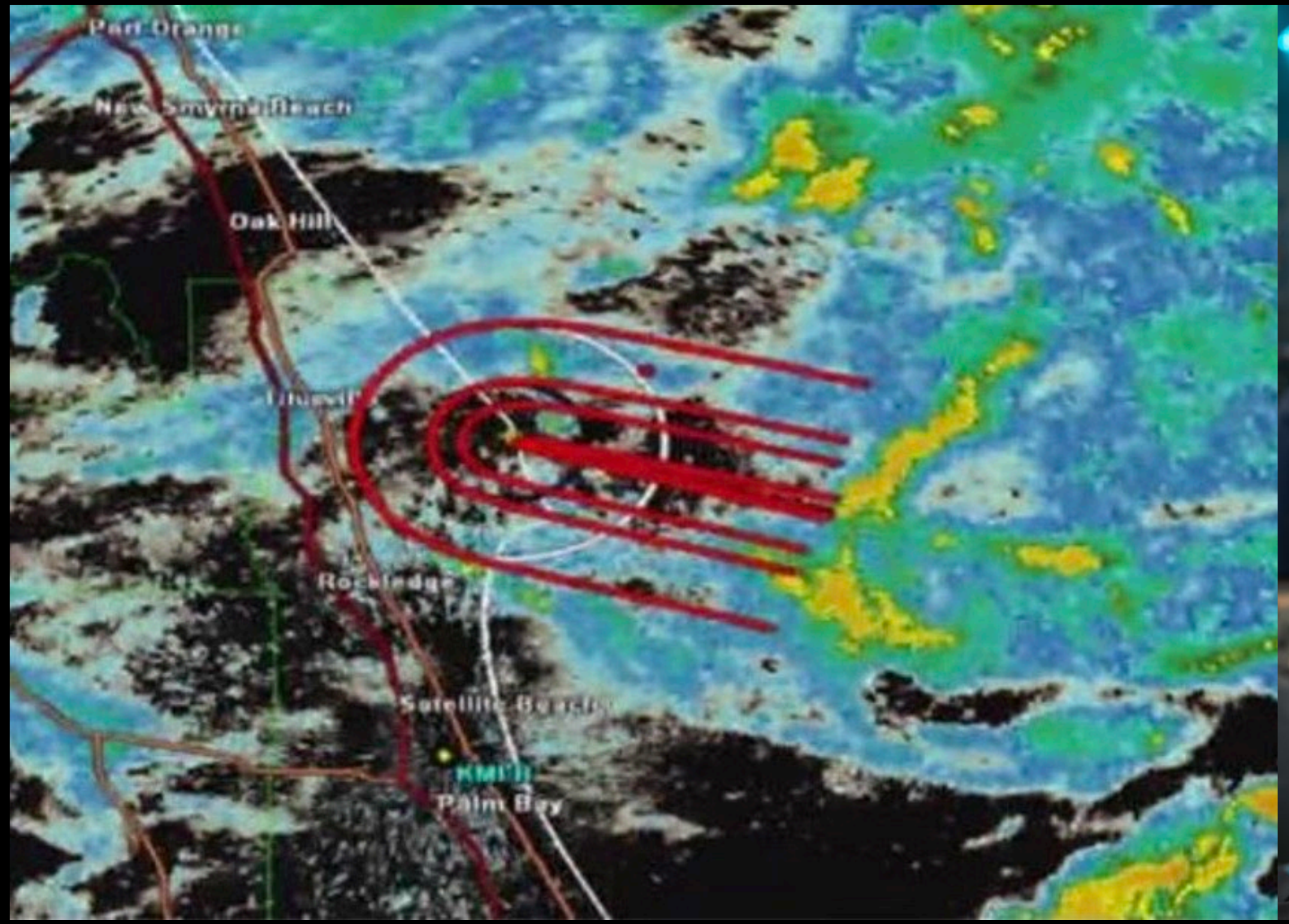




Juven

CubeSats deployment

The miracle on October 7th

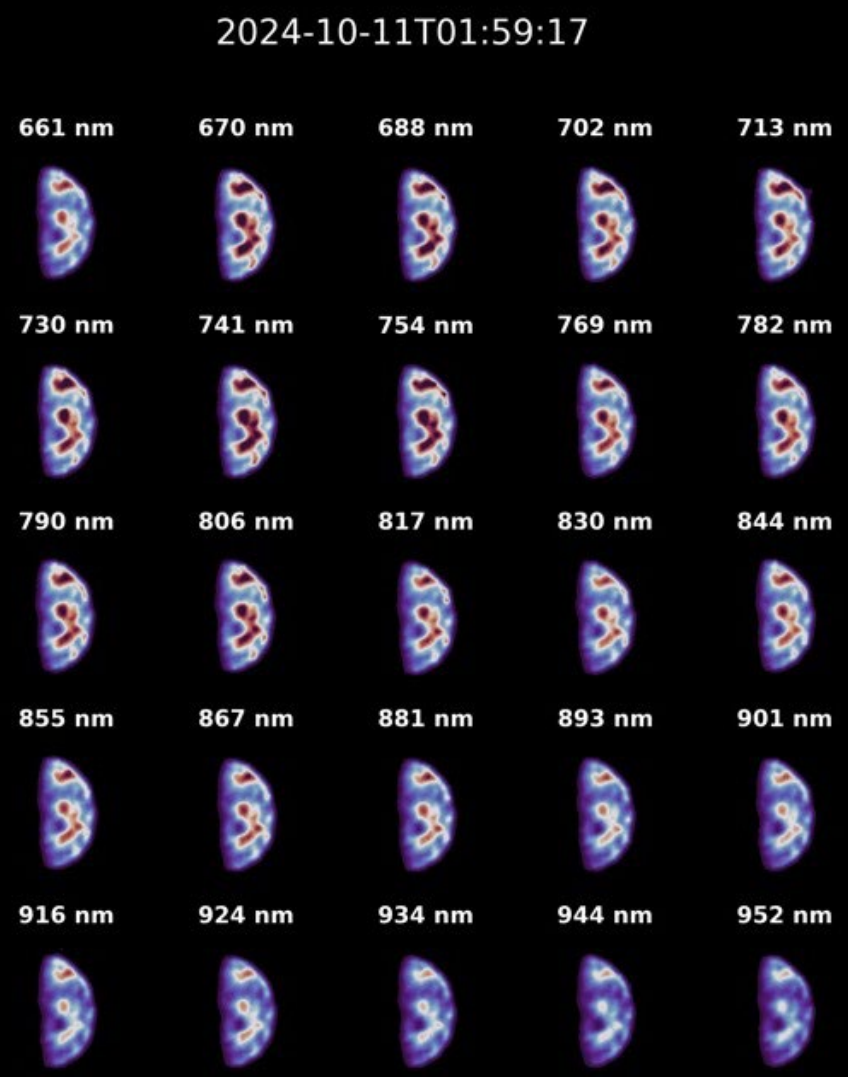


Journey begins

Falcon 9 (SpaceX)

TIRI (JAXA)

FIRST LIGHT (AFC and HYPERSCOUT)



Hera science community

Impacts simulation

Chairs:
Kai Wünnemann
Martin Jutzi

ESA project scientist:
Michael Küppers

PI: **Patrick Michel**

Dynamics

Chairs:
Menios Tsiganis
Adriano Campo Bagatin
Sébastien Charnoz

Close-proximity operations

Chairs:
Ozgur Karatekin
Naomi Murdoch
Stephan Ulamec

Data Analysis Exploitation Interpretation

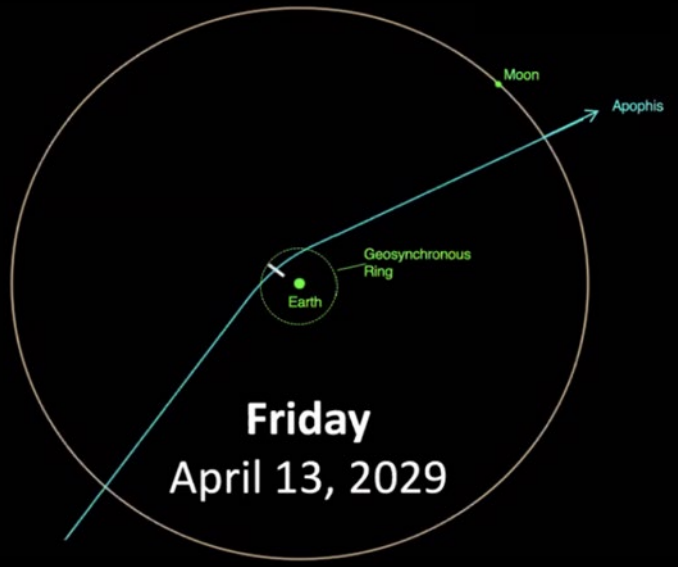
Chairs: Alain Hérique
Jean-Baptiste Vincent
Paolo Tortora

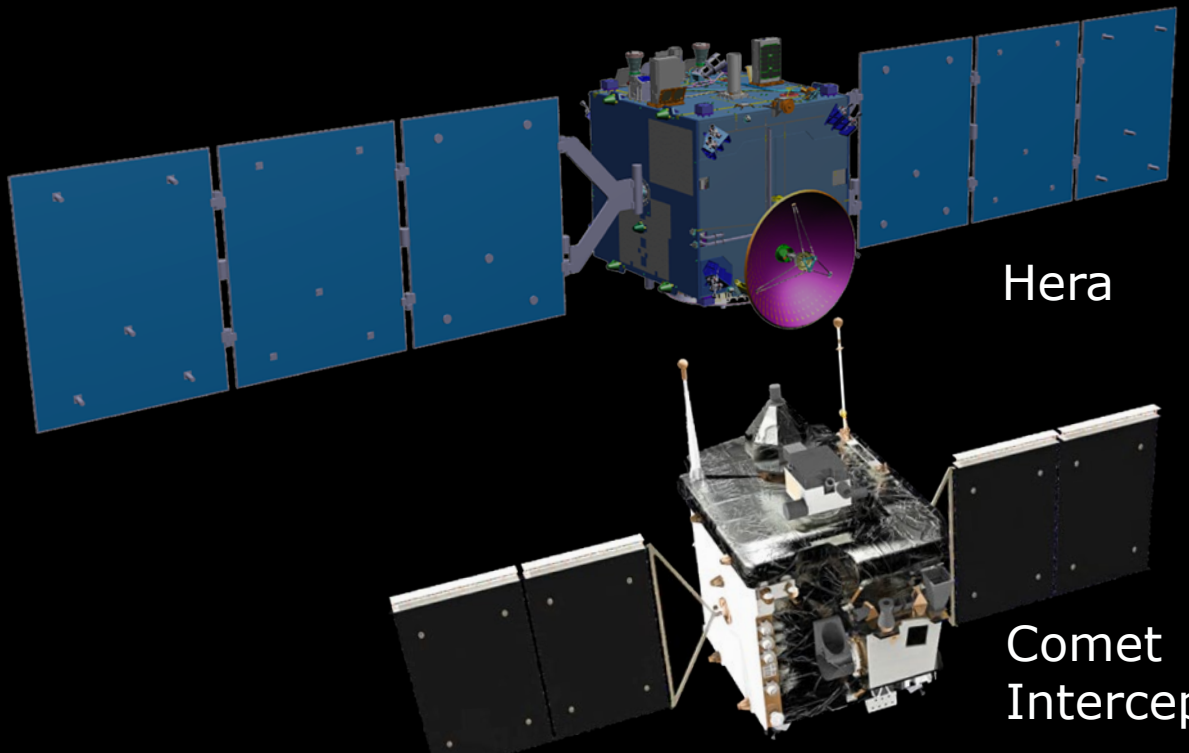
Ground-based observations

Chairs:
Petr Pravec
Julia de Leon
Benoît Carry
Colin Snodgrass

Hera Science Team

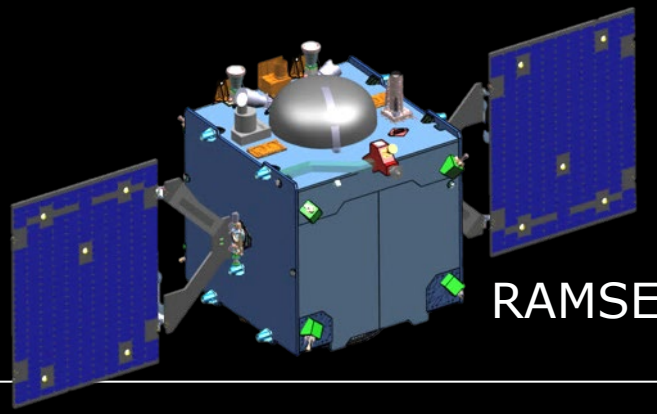
What is next? RAMSES mission to Apophis





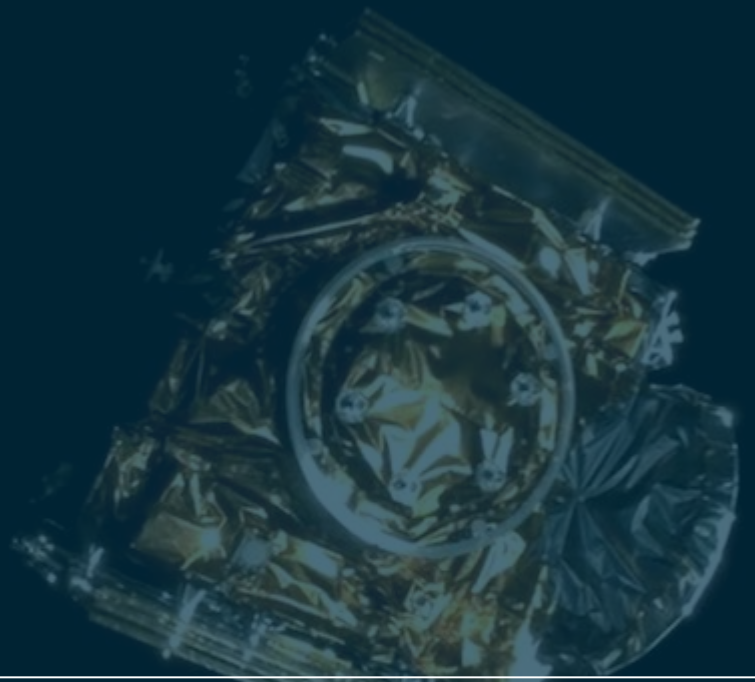
Hera

Comet Interceptor



RAMSES

#HeraMission



Chat with Hera: *https://www.hera.space*