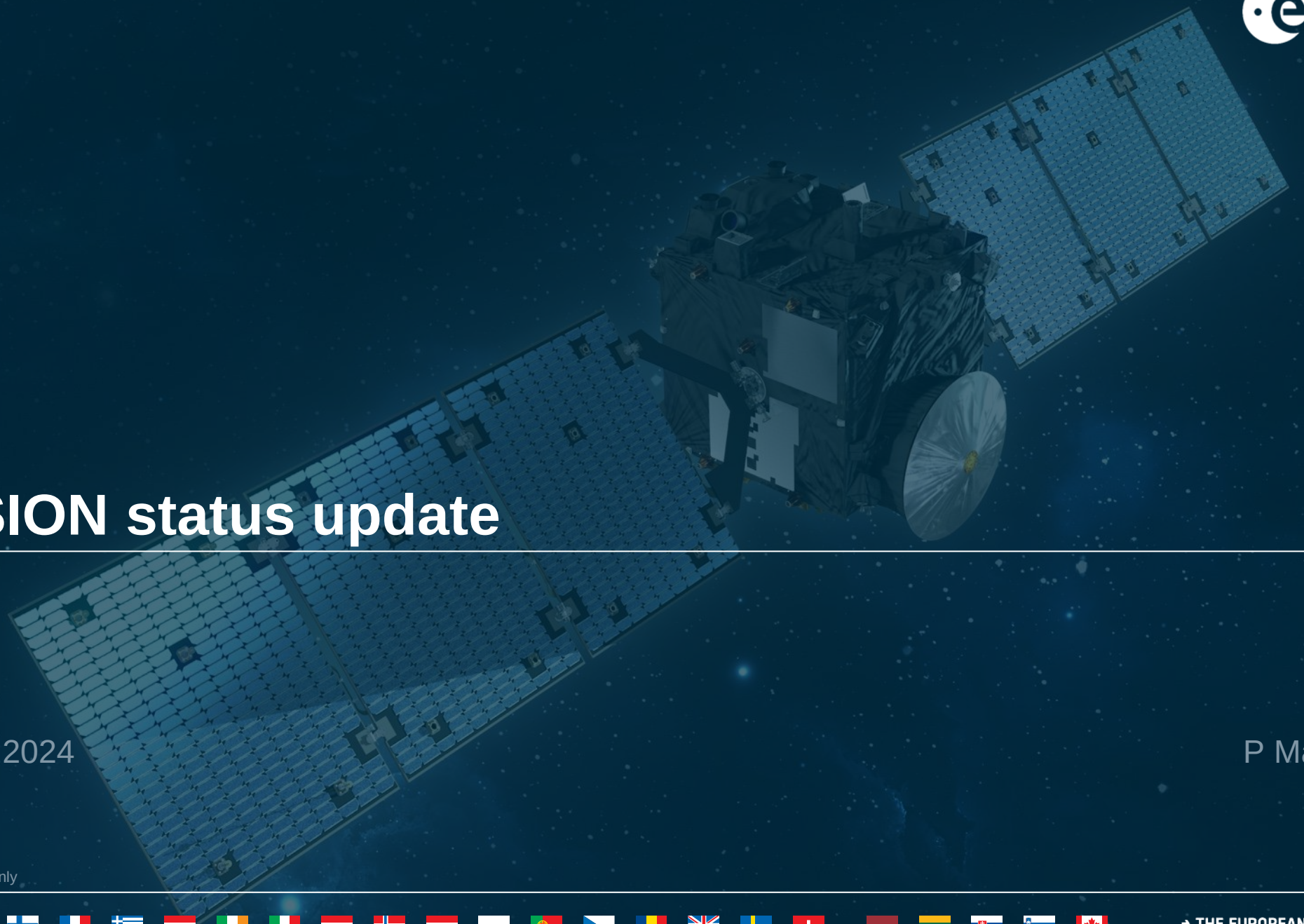


HERA MISSION status update

SMPAG - 31 January 2024

P Martino

Mission objectives

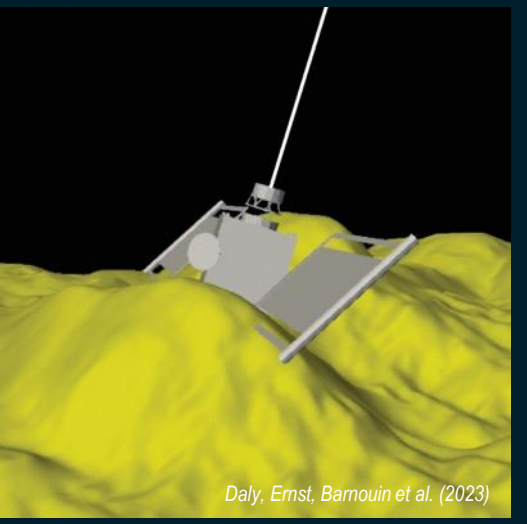
Key questions Hera needs to answer:

1. What is the final state of Dimorphos? (crater, reshaped)
2. What are its internal properties? (rubble pile, monolith)
3. What is the actual momentum transferred by the impact? (mass)

Target properties

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

Impact conditions



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

Hera will gather all the physical and dynamical properties

Hera mission objectives

CORE asteroid investigation requirements

- Mass of Dimorphos
- Global properties (volume, linear scale, density)
- Size distribution of surface material
- Dynamical properties of the Didymos system
- Shape and volume of DART impact crater
- Size distribution of excavated material

OPPORTUNITY asteroid investigation requirements

- Surface strength
- Interior structure of Dimorphos
- Composition of Dimorphos
- Transport of impact ejecta from Dimorphos to Didymos

Hera Payload Summary

AFC: Asteroid Framing Cameras

Visible camera for GNC and asteroid science
1020x1020 pixels, 10µm, 12-bit
FOV: 5.5°x5.5°
Integration times between 224µs and 5 sec
Power: <1.3 W
Mass: <1.5 kg (each)

PALT: Planetary Altimeter

Time-of-flight laser ranging
Instrument for GNC and science
1m accuracy from range 0.5-14 km
Laser: 1.535µm, 1.1mrad divergence
Power: <14.5W
Mass: 4.4 kg

SMC: Small Monitoring Camera

Low-cost COTS camera to image CubeSat deployment on payload deck
1600x1600, 5.5µm, 12-bit
FOV: ±44°
Up to 4 fps (TBC), 32 Gb NAND flash
Power: <4 W
Mass: <850 g

TIRI: Thermal Infrared Imager

Uncooled micro-bolometer for thermal images from 7-14µm, including filter wheel
1024x768 pixels, 17µm, 14-bit
FOV: 13.3°x10.0°
Power: <30 W
Mass: <4.4 kg

Hyperscout

Multispectral 2D imager, snapshot
665-975nm, 25 spectral bands,
20nm spectral resolution
FOV: 15.5°x8.3°
1.33 mrad per macropixel
Power: <4.5 W
Mass: <5.5 kg

Hera CubeSats

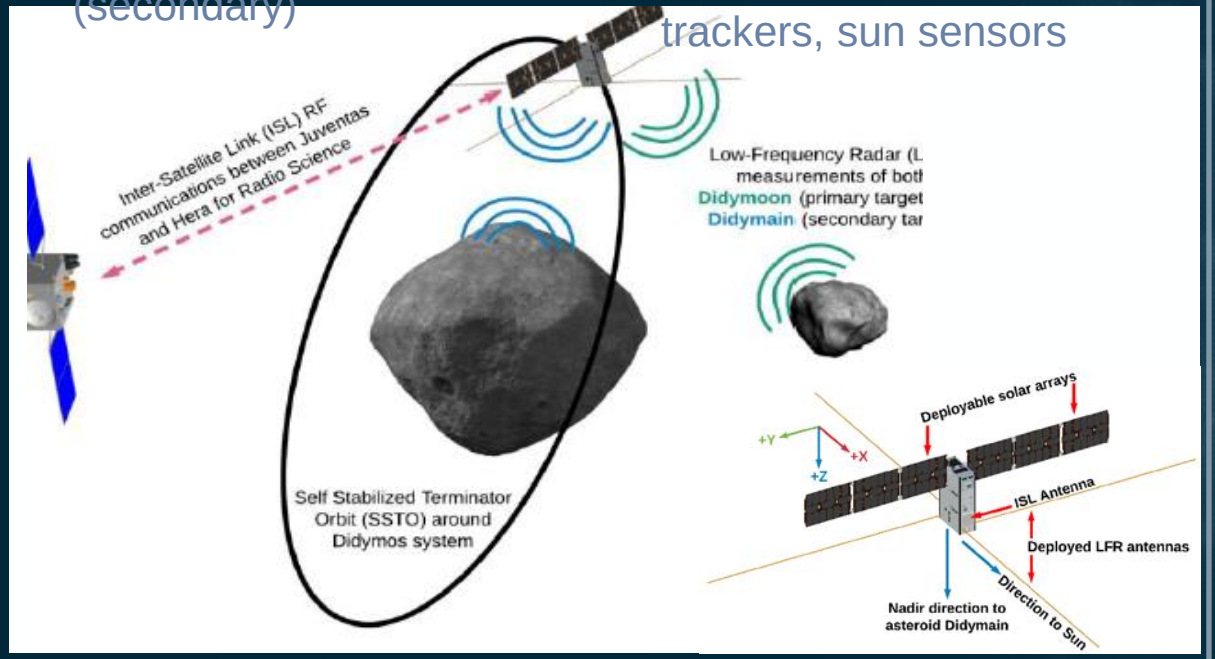
Juventas

Objectives:

- Interior Structure
- Gravity Field
- Surface properties
- Dynamical Properties (secondary)

Payloads:

- Low-frequency radar (JuRa)
- Gravimeter (GRASS)
- Radio science using Inter-Satellite Link (ISL)
- Visible context camera, star trackers, sun sensors



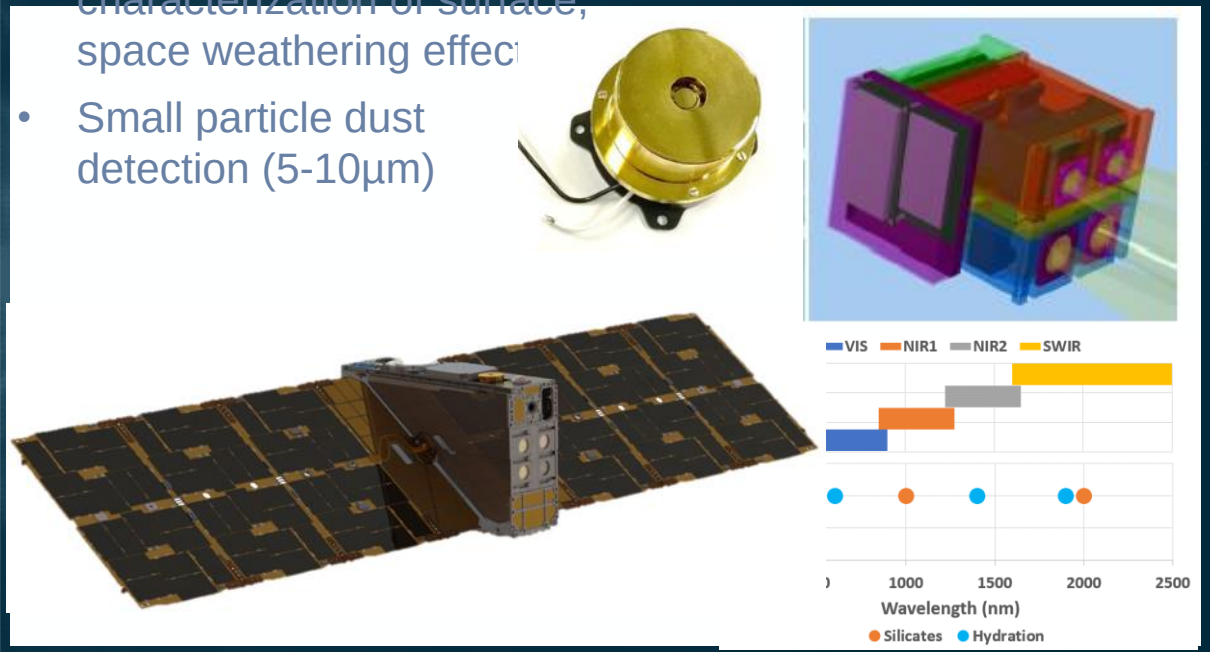
Milani

Objectives:

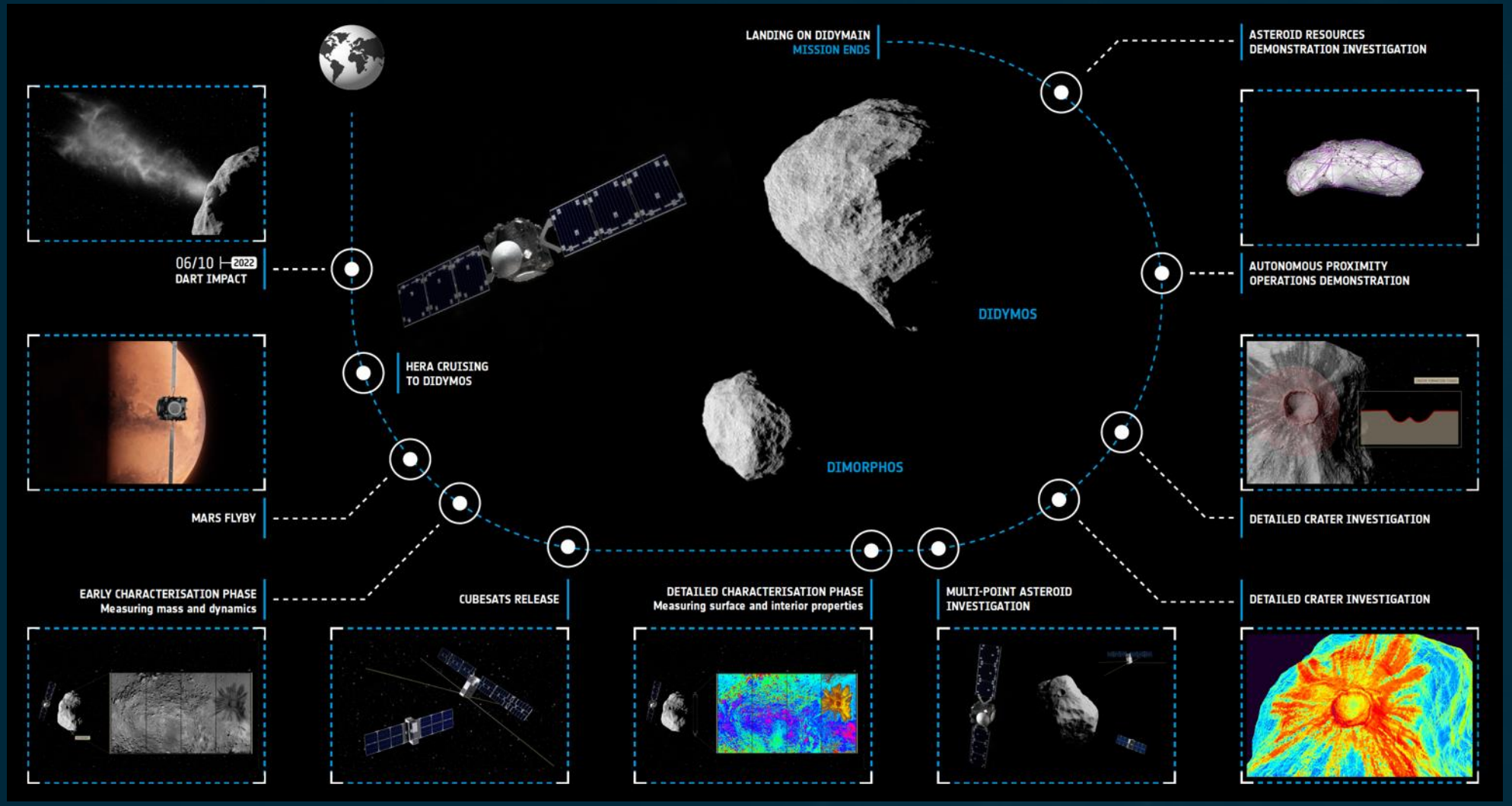
- Map global asteroid composition
- Multispectral characterization of surface, space weathering effec
- Small particle dust detection (5-10µm)

Payloads:

- Multi-spectral imager (ASPECT), 4 channels: VIS, NIR1, NIR2, SWIR
- Dust analyzer (VISTA)



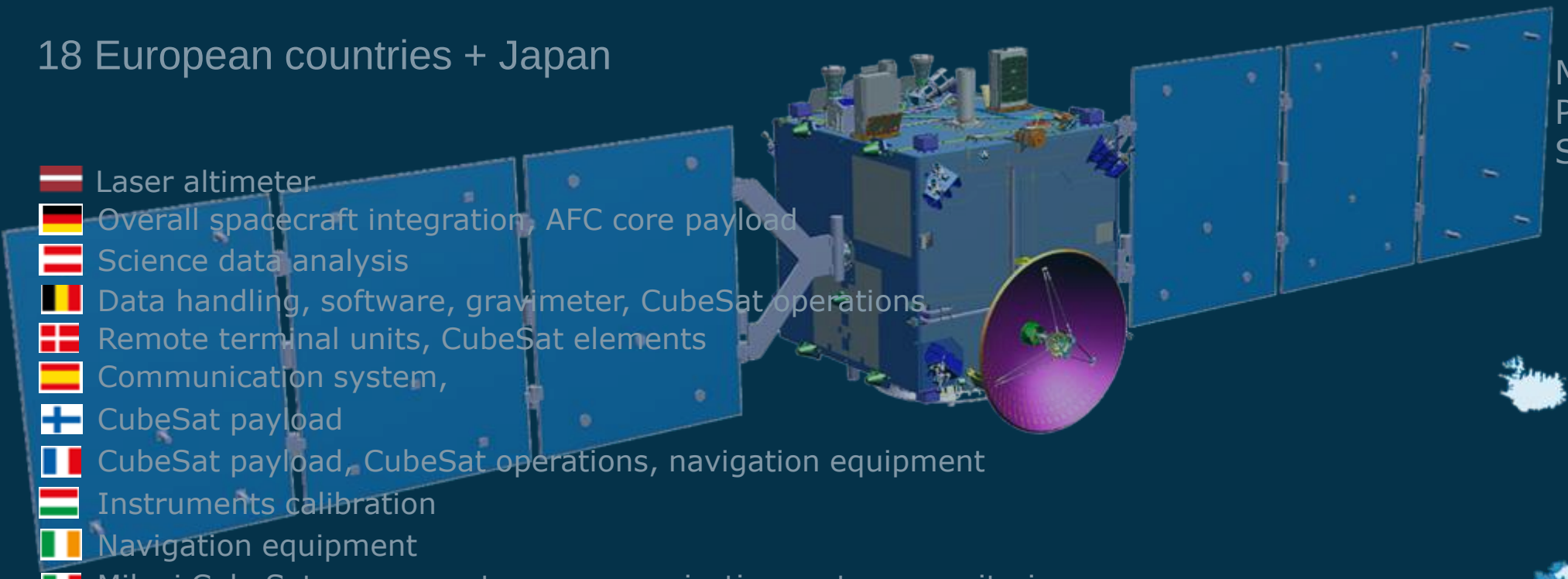
Hera mission timeline



- 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 spacecraft

18 European countries + Japan

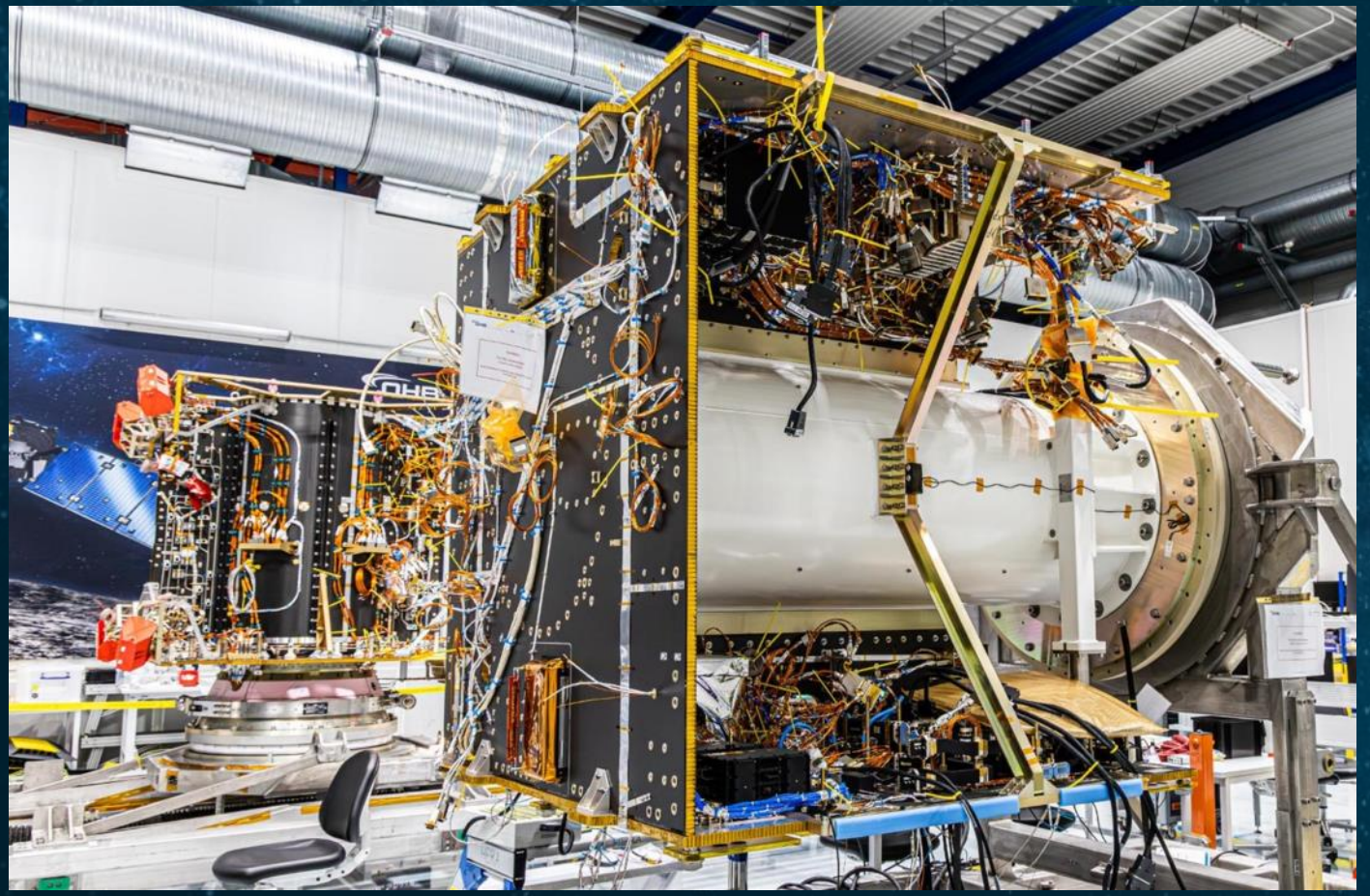


Mass: 1215 kg
Power: 826 W
Size: 2m × 13m × 2m

- Laser altimeter
- Overall spacecraft integration, AFC core payload
- Science data analysis
- Data handling, software, gravimeter, CubeSat operations
- Remote terminal units, CubeSat elements
- Communication system,
- CubeSat payload
- CubeSat payload, CubeSat operations, navigation equipment
- Instruments calibration
- Navigation equipment
- Milani CubeSat, power system, communication system, monitoring camera
- Juventas CubeSat lead
- Hyperscout instrument
- Juventas radar mechanisms, software
- Altimeter, thermal system, navigation
- Spacecraft structure, CubeSat payload
- Altimeter, navigation system
- Spacecraft structure, solar arrays

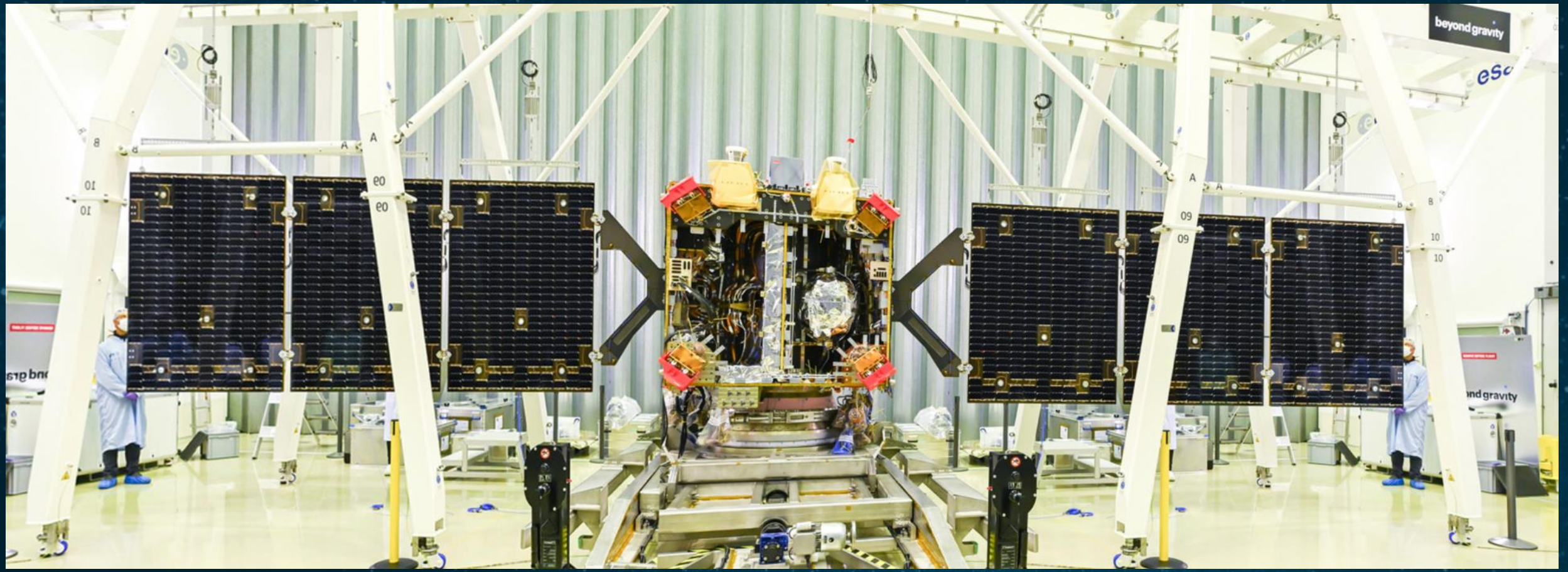
Satellite mechanical integration completed

- Propulsion and core modules mated
- All payloads delivered and integrated, except CubeSats to be integrated at launch site



Hera in launch configuration

Satellite mechanical integration completed

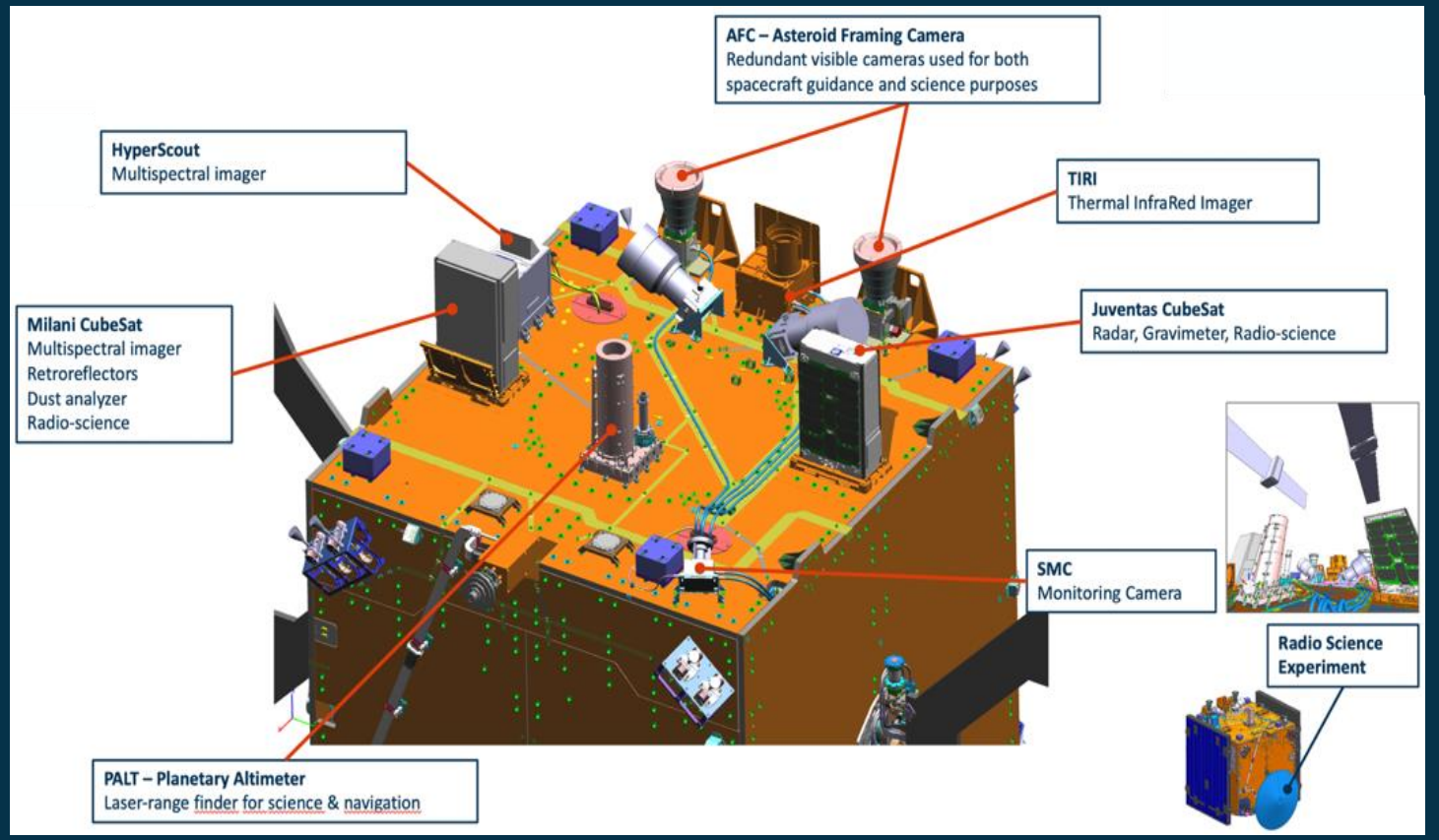


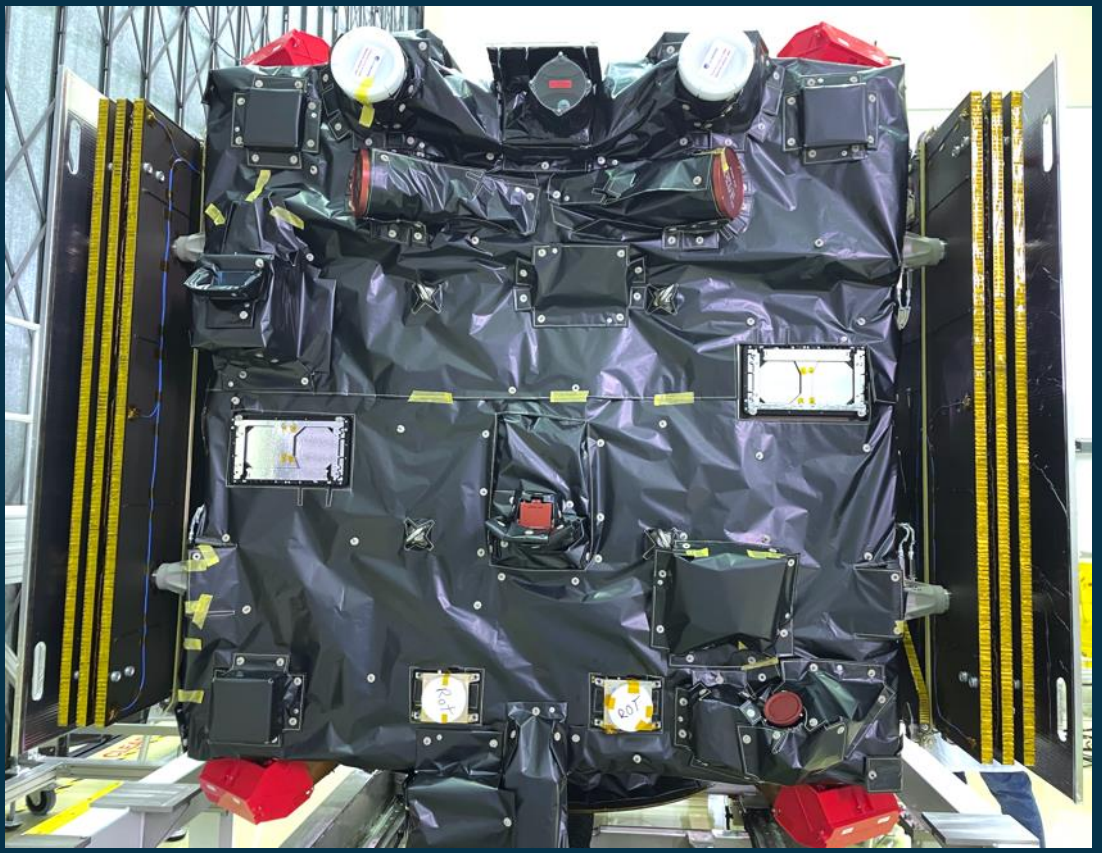
Hera in flight configuration (+z wing mirrored for size purposes)

Environmental test campaign

- ✓ Until 26 SEP: SAW cold deployment, thermistors and heaters crimping, LGA, HGA integration, MLI
- ✓ 28 SEP – 3 OCT: physical properties measurements
- ✓ 9 – 23 OCT: vibration tests
- ✓ 25 OCT – 2 NOV: acoustic test
- ✓ 3 NOV – 17 JAN: functional tests (ISSTs for TCS, COM, DHS, FDIR, GNC, EPS, FDIR, payload)
- 21 FEB – 18 MAR: TVAC
- 29 APR – 10 MAY: EMC

Hera instruments





CubeSats status

MILANI

- **STIM integrated** in the Hera spacecraft
- **rEM** delivered to OHB, **integrated** on ATB
- **PFM integrated**, EVT completed except EMC

JUVENTAS

- **STIM integrated** in the Hera spacecraft
- **rEM** delivered to OHB, **integrated** on ATB
- **PFM integrated,** EVT ongoing

Spacecraft and science operations preparation

- RFCT campaign completed compliance with ESTRACK.
  Delta-test to be performed in March at Goldstone for first acquisition by NASA DSN.
- LEOP simulations starting in June.
- CubeSat mission operations center in development @ ESA/ESEC (Belgium)
- Instruments pipelines preparation in progress
- Optical instrument calibrations ongoing
- Processing and archiving being put in place
- Launch service contract signed with SpaceX

Conclusions

- Hera is on track for launch between October 7th and 27th 2024
- Very dense test plan operations
- All payloads integrated
- Next **Hera community workshop 24-26 April at ESTEC**