

## Milani CubeSat for ESA Hera mission

Tomáš Kohout<sup>1,2</sup>, Margherita Cardi<sup>3</sup>, Antti Näsiliä<sup>4</sup>, Ernesto Palomba<sup>5</sup>, Francesco Topputo<sup>6</sup>, and the Milani team\*

<sup>1</sup>University of Helsinki, Faculty of Science, Helsinki University, Finland (tomas.kohout@helsinki.fi)

<sup>2</sup>Institute of Geology of the Czech Academy of Sciences, Prague, Czech Republic

<sup>3</sup>Tyvak International, Torino, Italy

<sup>4</sup>VTT Technical Research Centre of Finland, Espoo, Finland

<sup>5</sup>INAF-IAPS, Rome, Italy

<sup>6</sup>Politecnico di Milano, Milano, Italy

\*A full list of authors appears at the end of the abstract

Hera is the European part of the Asteroid Impact & Deflection Assessment (AIDA) International collaboration with NASA who is responsible for the DART (Double Asteroid Redirection Test) kinetic impactor spacecraft. Hera will be launched in October 2024 and will arrive at Didymos binary asteroid in January 2027. Milani CubeSat (fig. 1) is developed by Tyvak International with a consortium of European universities, research centers and firms from Italy, Czech Republic and Finland. At arrival it will be deployed and will do independent detailed characterization of Didymos asteroids at distances 5 to 10 km supporting Hera observations. Milani mission objectives are:

1. Map the global composition of the Didymos asteroids.
2. Characterize the surface of the Didymos asteroids.
3. Evaluate DART impacts effects on Didymos asteroids and support gravity field determination.
4. Characterize dust clouds around the Didymos asteroids.

The scientific payloads supporting the achievement of these objectives are “ASPECT”, a visible - near-infrared imaging spectrometer (table 1), and “VISTA”, a thermogravimeter (table 2) aiming at collecting and characterizing volatiles and dust particles below 10 $\mu$ m.

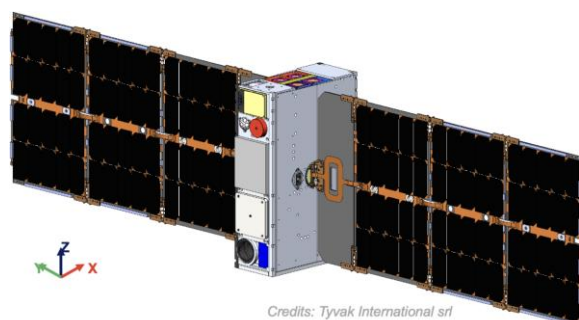


Figure 1. Milani CubeSat

Table 1. ASPECT specifications

Channel	VIS	NIR1	NIR2	SWIR
Field of View [deg]	10° x 10°	6.7° x 5.4°	6.7° x 5.4°	5° circular
Spectral range [nm]	500 – 900	850 – 1275	1225 - 1650	1600 - 2500
Image size [pixels]	1024 x 1024	640 x 512	640 x 512	1 pixel
Pixel size [ $\mu$ m]	5.5 $\mu$ m x 5.5 $\mu$ m	15 $\mu$ m x 15 $\mu$ m	15 $\mu$ m x 15 $\mu$ m	1 mm
No. spectral bands	Ca. 14	Ca. 14	Ca. 14	Ca. 30
Spectral resolution [nm]	< 20 nm	< 40 nm	< 40 nm	< 40 nm

Table 2. VISTA specifications

Sensor Type	Quartz Crystal Microbalance (QCM)
Resonance frequency	10 MHz
Volume	50mm x 50mm x 38mm
Sensitive area	1.5cm <sup>2</sup>
Particles size detection range	5-10 $\mu$ m to sub- $\mu$ m particles
Methods/Technique used	1. Dust and contaminants accumulation (passive mode) 2. TGA cycles (active mode)
Mass	90g