LUMIO, a Lunar Meteoroid Impacts Observer

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Argotec Small Satellites

Argotec designs small satellites capable to **operate in different environments, from LEO to deep space**

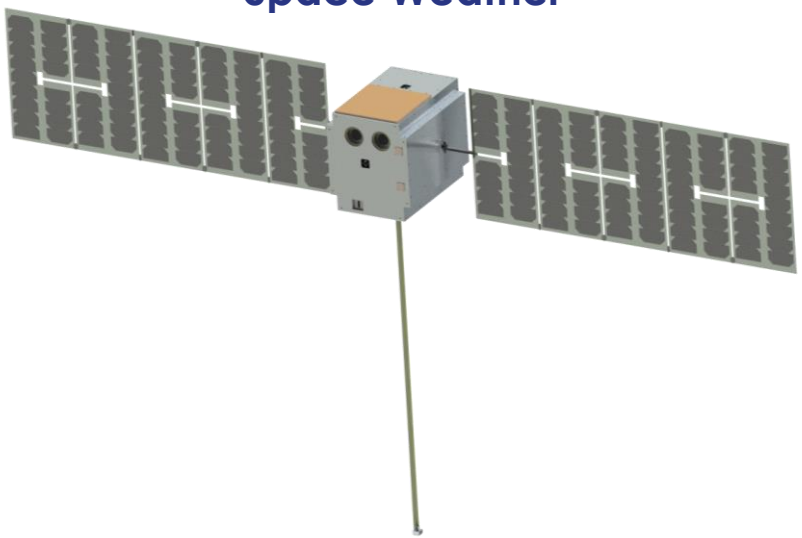
The company developed a proprietary scalable satellite platform called **HAWK**

In 2022, Argotec became the only company in the world to have performed **two small satellites missions in deep space**

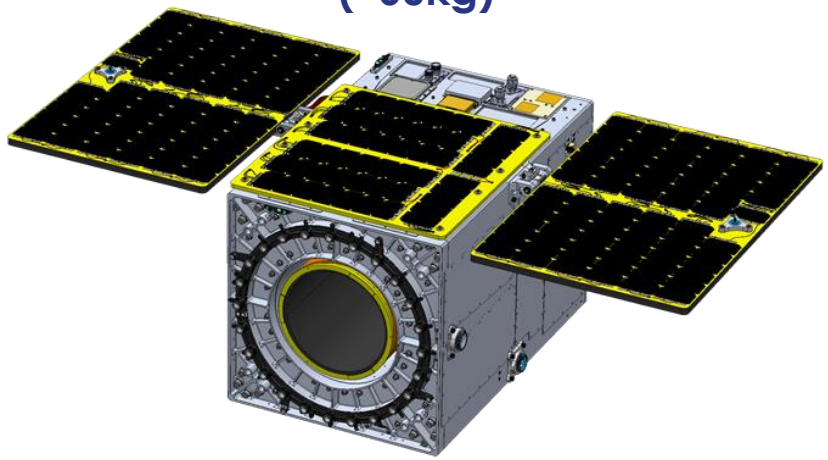
LICIACube
(DART)

ArgoMoon
(Artemis I)

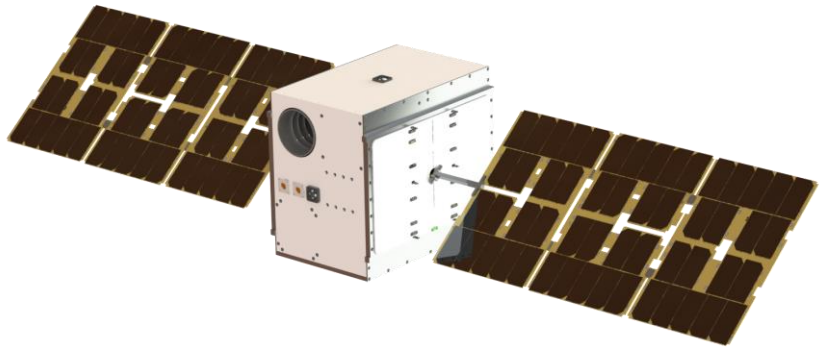
HENON (12U)
Space Weather



HAWK for Earth Observation
(≈60kg)



LUMIO (12U)
Lunar Science



LUMIO

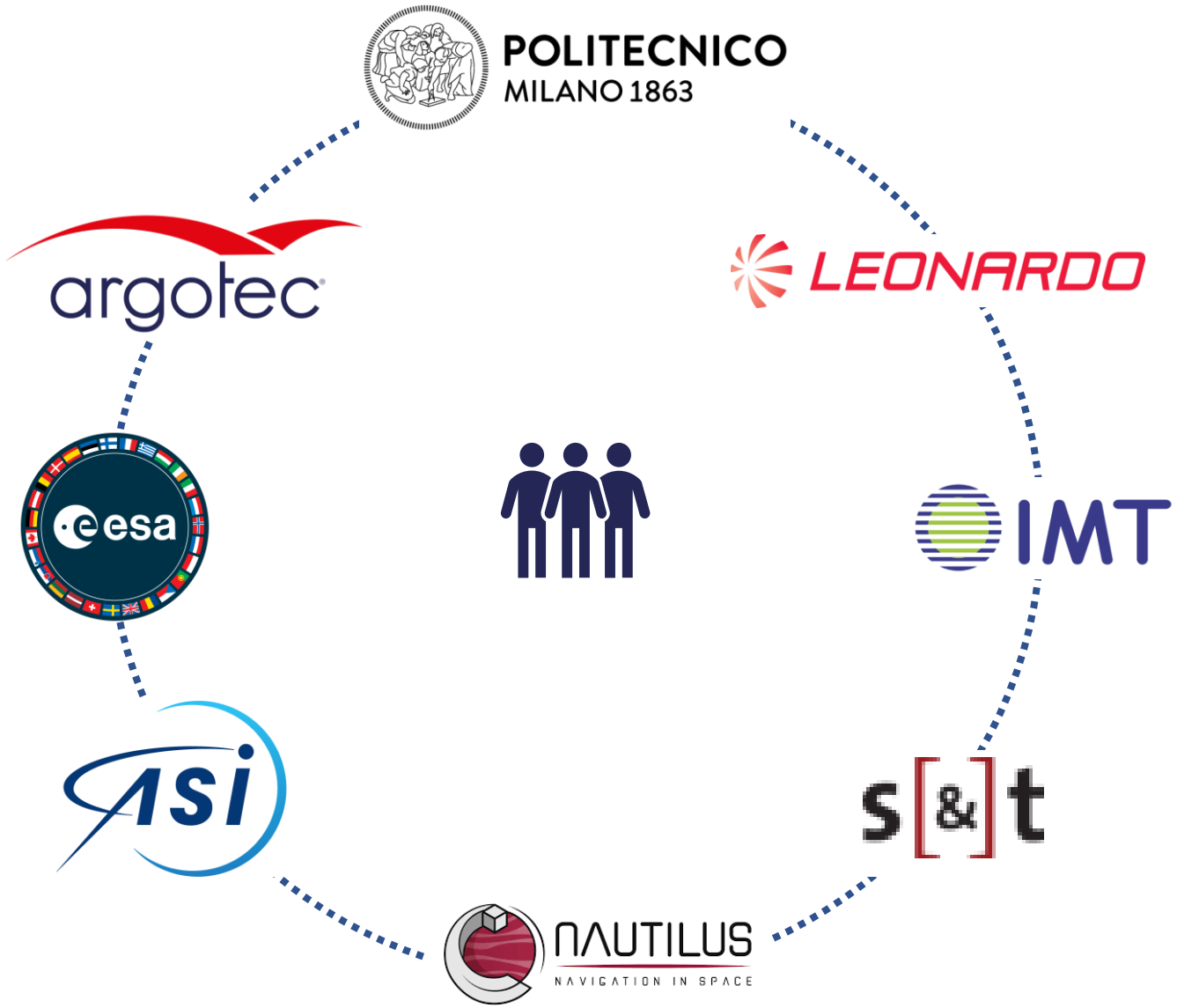
LUnar **M**eteoroid **I**mpacts **O**bserver

Main objective: Observation of meteoroids impacts on the far side of the Moon to complement Earth-based observations. Useful to refine models of lunar meteoroid environment for science and for future lunar exploration missions.

Secondary objectives: autonomous orbit determination based on optical observations of the Moon disk.

Technology validation in the lunar environment

LUMIO Team


POLITECNICO
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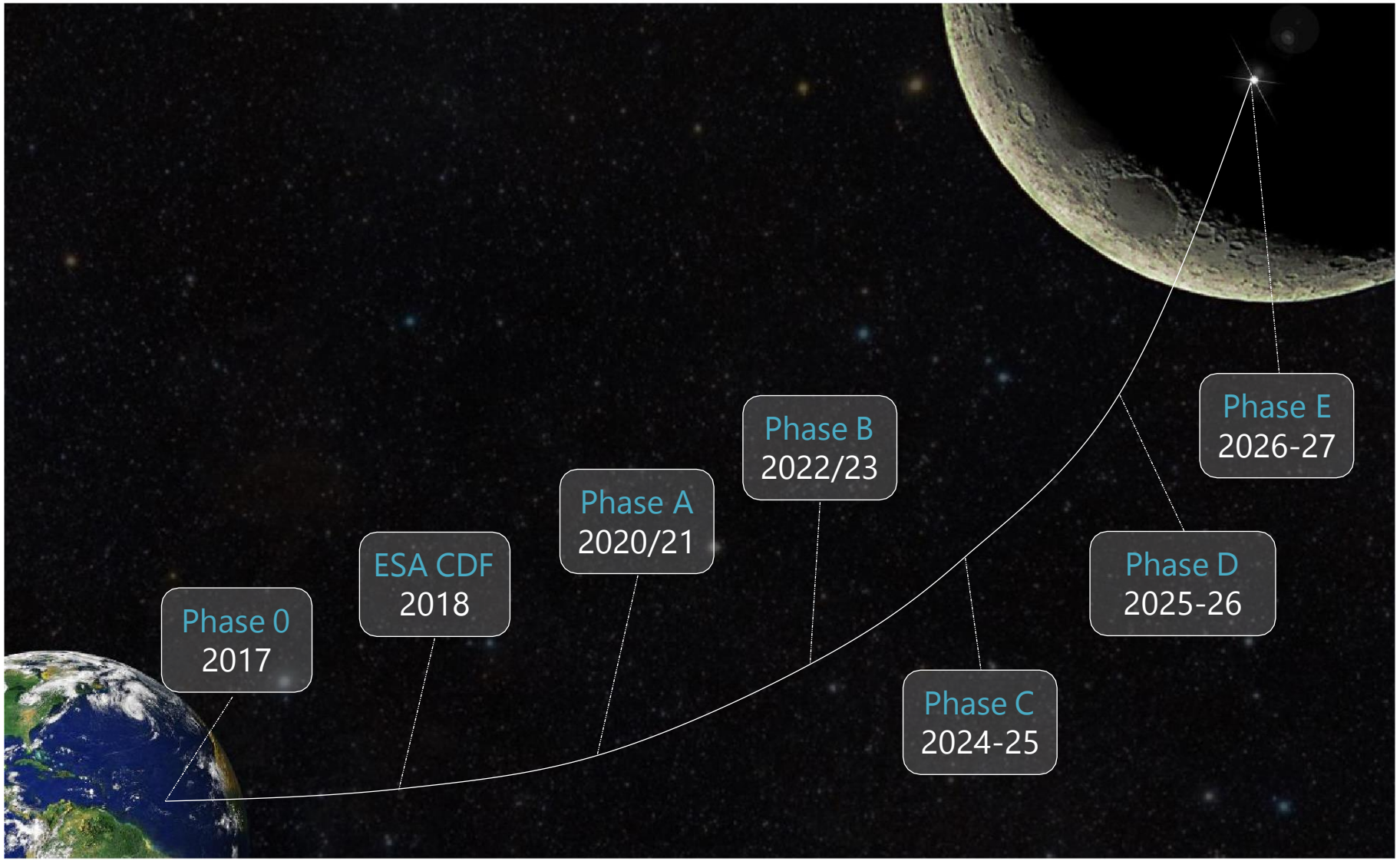
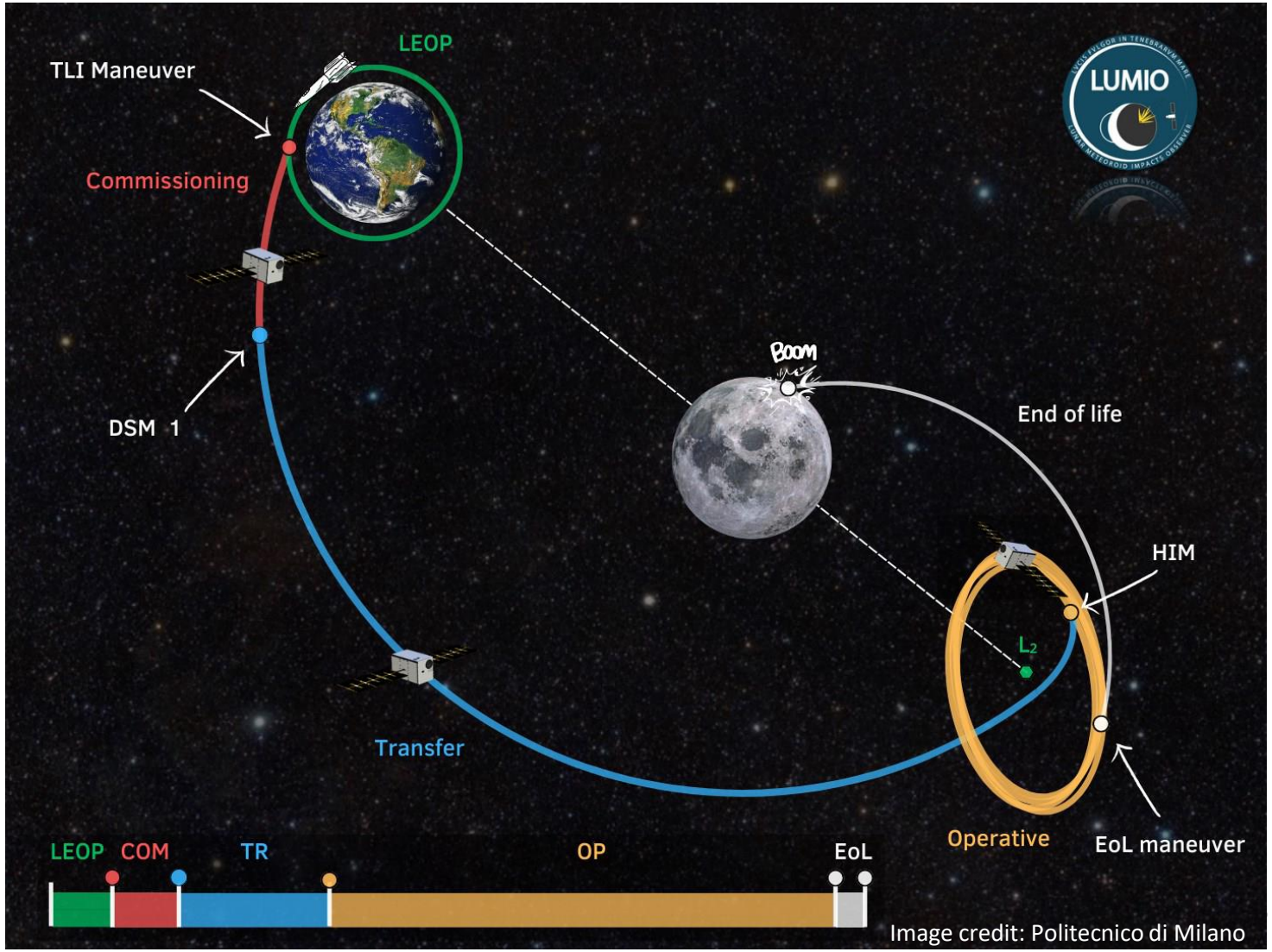
NAUTILUS
NAVIGATION IN SPACE

LUMIO Roadmap



LUMIO Mission Profile

- **WSB** transfer: ~ 120 days, up to 1.5 Million km away from Earth
- Up to 5 **Deep Space Maneuvers**
- **1-year** operative orbit: **Earth-Moon L2 HALO**
- About **25 HALO orbits performed**
- EOL: **crash on the Moon**



LUMIO - Operations

- **Optical** instrument in **Visible** and **NearIR** spectrum
- **On-board processing** of pictures to detect **flashes** due to **meteoroid impacts** on the dark side of the Moon
- ~ **14 days of observations** per HALO (Science cycle)
- ~ **14 days** per HALO for **data downlink, SK maneuvers and moon-based navigation experiment** (Nav & Eng cycle)

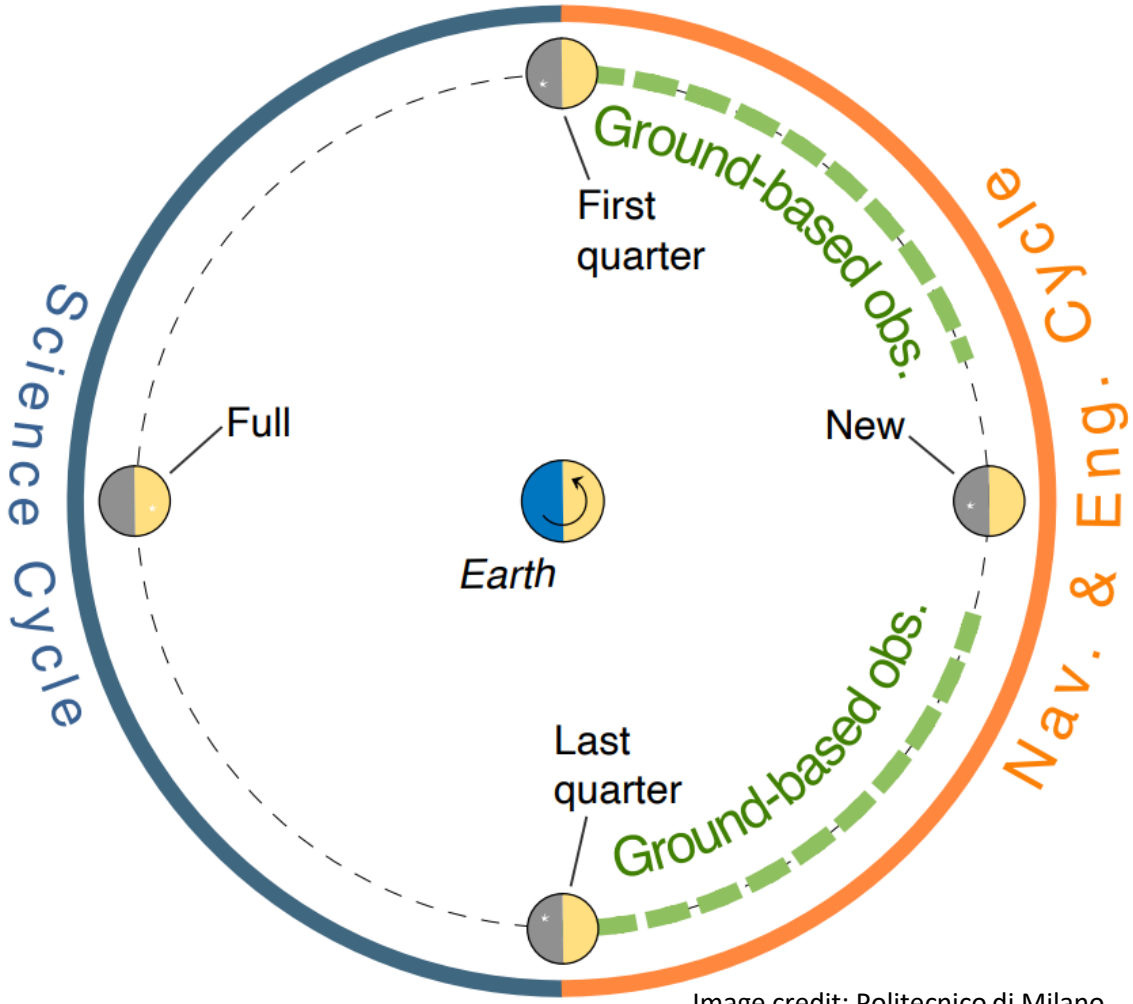
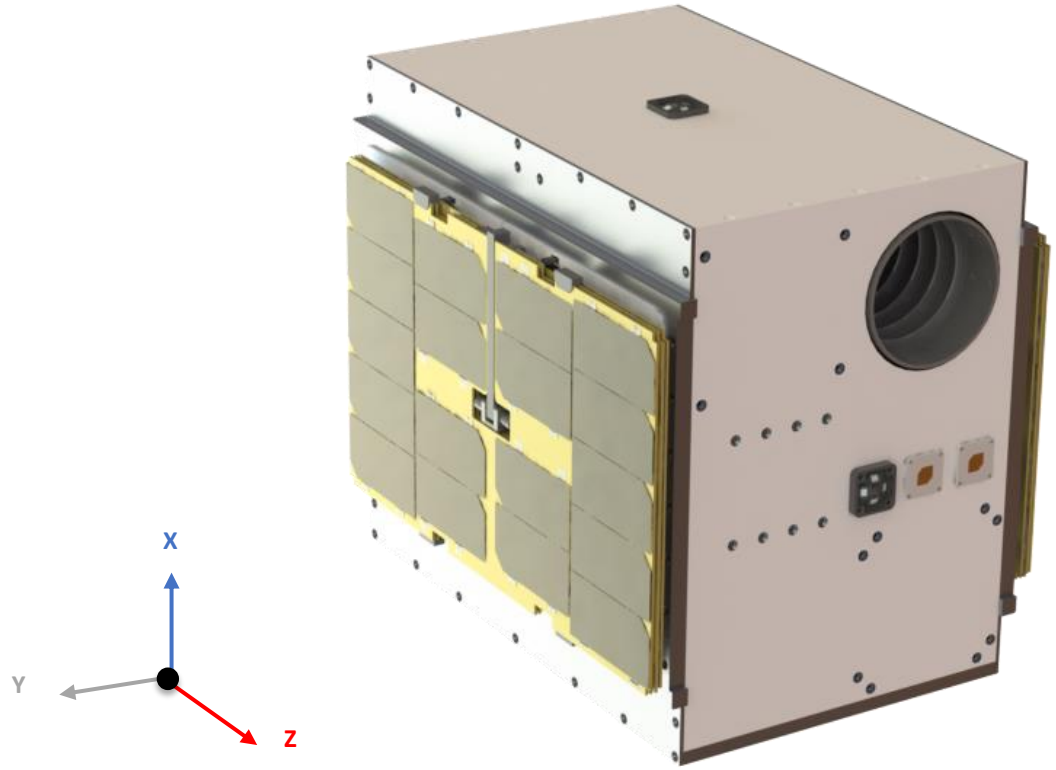
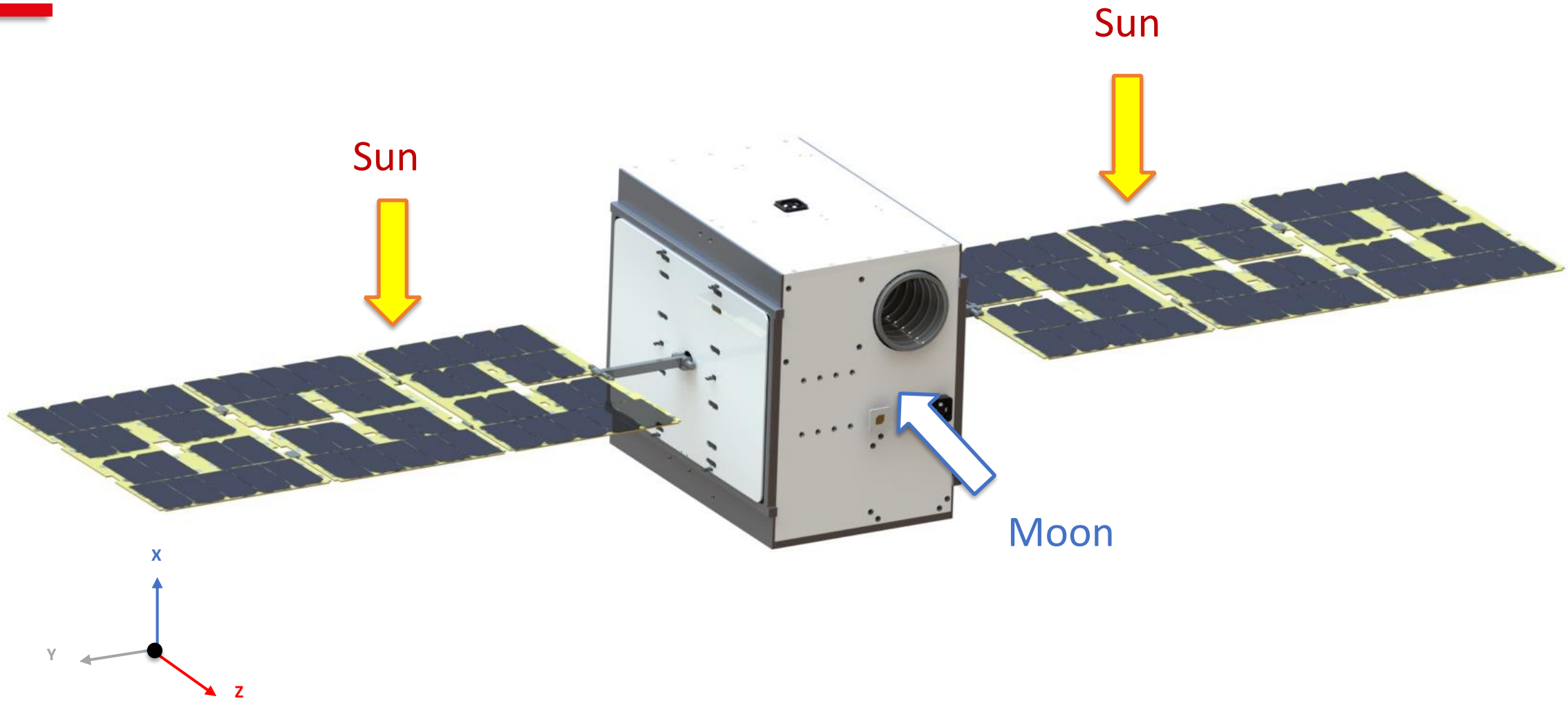


Image credit: Politecnico di Milano

LUMIO – Stowed Configuration

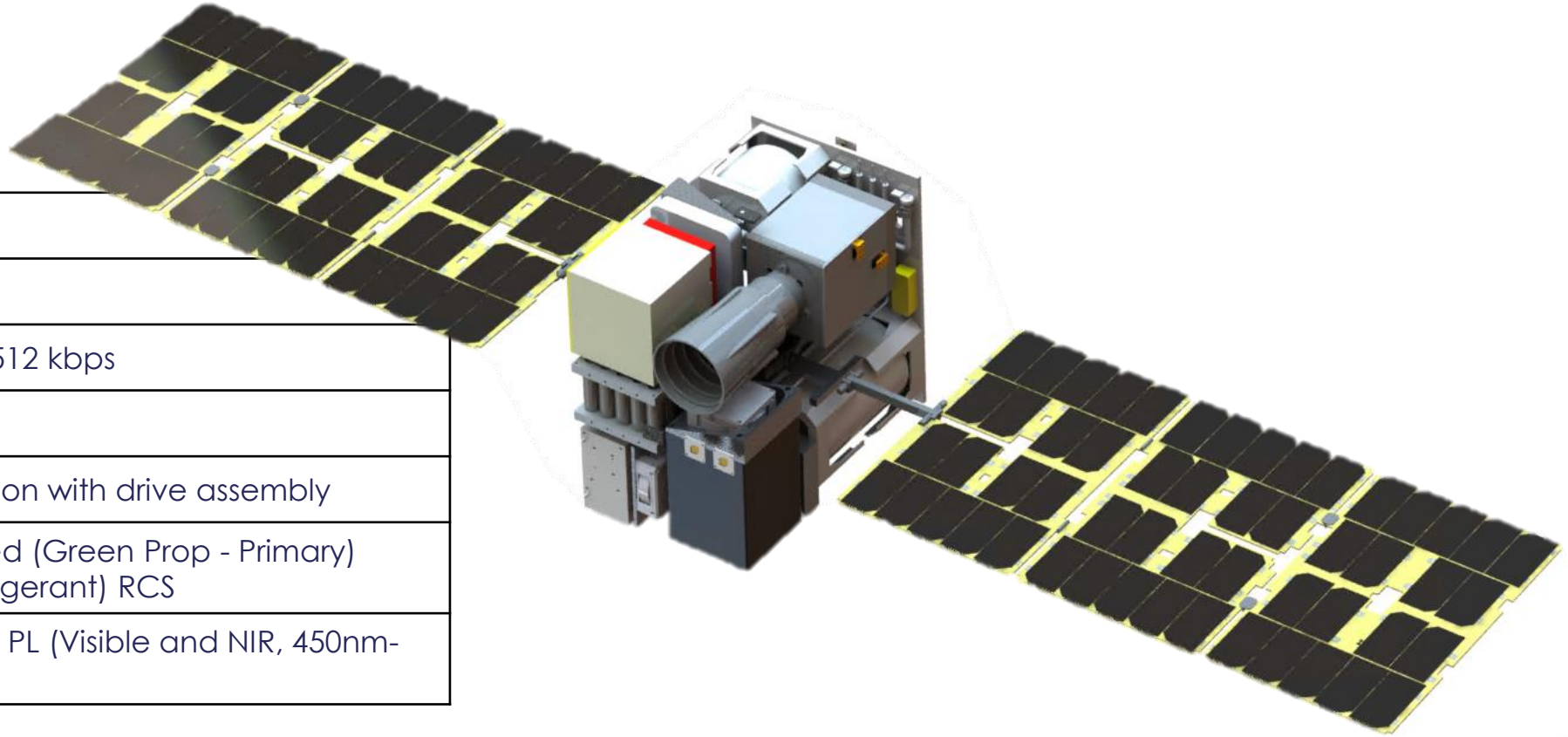


LUMIO – Deployed Configuration



LUMIO – General Overview

Mass	28 kg
Volume	12U XL
Downlink Band	X-Band up to 512 kbps
Lifetime	>1,5 years
Solar Arrays	120W generation with drive assembly
Propulsion	LMP-103s based (Green Prop - Primary) Cold Gas (refrigerant) RCS
Payload	6° FoV Optical PL (Visible and NIR, 450nm-950nm), 15fps



LUMIO - Key Technologies

- **FermiOBC & OSW**

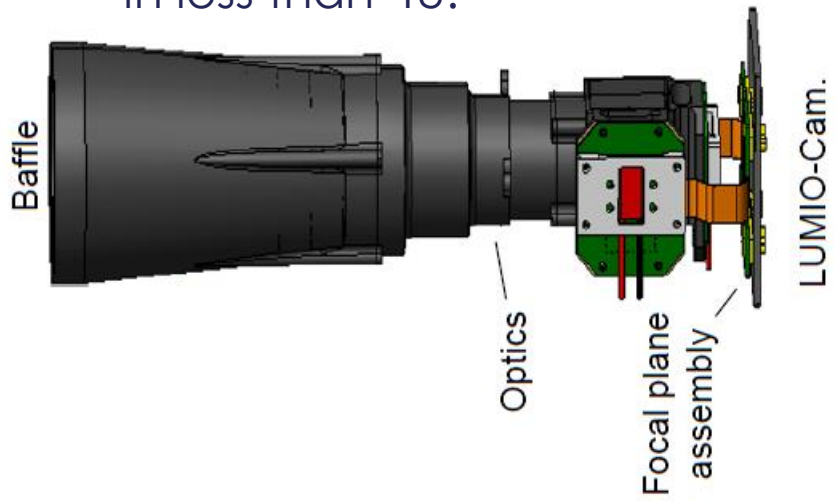
Designed for deep space and mission critical applications. Equipped with hardware acceleration. On board software developed in house, based on real time OS with custom scheduler.

- **VoltaPCDU**

Capable of managing 100+ W, SET/SEL-protection. Isolated secondary power rails (2.5V, 3.3V, 5V, 2x 12V), FDIR, SPA & end-of-life management.

- **LUMIO-Cam (Leonardo)**

High-performance camera with 2 channels (VIS & NIR). Equipped with a real-time on-board image processing. All the system is concentrated in less than 4U.

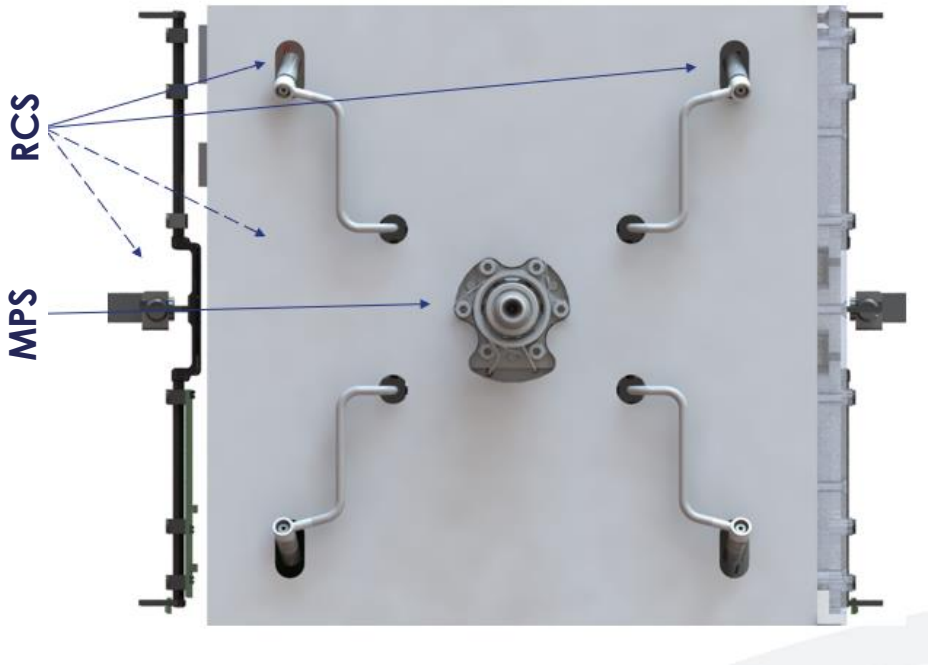


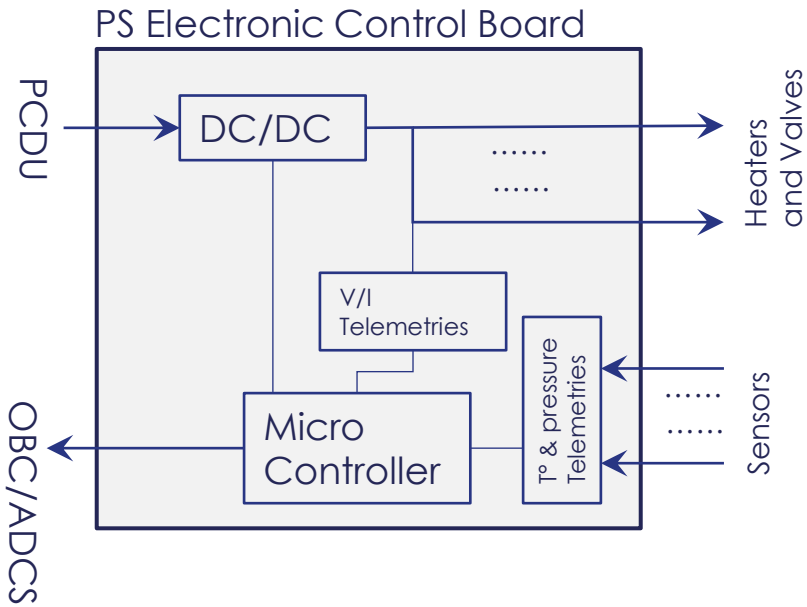
LUMIO - Key Technologies

- **MPS & RCS**

MPS Parameter	Value	
	BOL	EOL
Operative Pressure	22 bar	5.5 bar
Thrust	1.03 N	0.29 N
Specific Impulse	231 s	205 s
DeltaV	80 m/s	
Total Mass	3.9 Kg	

RCS Parameter	Value
Total Impulse	230 Ns
Specific Impulse	40 s
Operative Pressure	13.2 bar
Total Mass	2.6 Kg





- Breadboard Model Development
- Modular Design
- Rad-Hard Design – Lunar Environment

Conclusions

- LUMIO will provide a new perspective through space-based observations of the Lunar far side and complement Earth-based observations for a **comprehensive understanding of the lunar meteoroid environment**
- LUMIO serves as a platform to **demonstrate new miniaturized technologies in deep space** and advanced operations capabilities
- LUMIO will contribute to demonstrate the **effectiveness of small satellite platforms for scientific missions beyond Low Earth Orbit**. Opens possibilities for more cost-effective and efficient scientific explorations in space.


LUMIO
LUNAR METEOROID IMPACTS OBSERVER

THANK YOU