

**SSC21**

**UPMSat-2 Micro-satellite: In-orbit  
Technological Demonstration for Education  
and Science.**

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## The 'Ignacio Da Riva' Research Institute (IDR/UPM)

- Research Institute within Universidad Politécnica de Madrid, Spain
- Research activities focused on:
  - Space systems: ROSETTA (OSIRIS), ESA Solar Orbiter (PHI y EPD), ExoMars 2020 Rover (Raman, SM – Dust Sensor), Mars 2020 Rover (MEDA ATS, TIRS), ARIEL, Payload CPLM (MINISAT 01).  
SUNRISE I, II and III
  - Experimental aerodynamics.
- Teaching and Education in Aerospace Engineering: Master in Space Systems (MUSE).
- **Micro-satellite projects for in-orbit technological demonstration**

## **STRAS** group (Real-Time Systems and Architecture of Telematic Services)

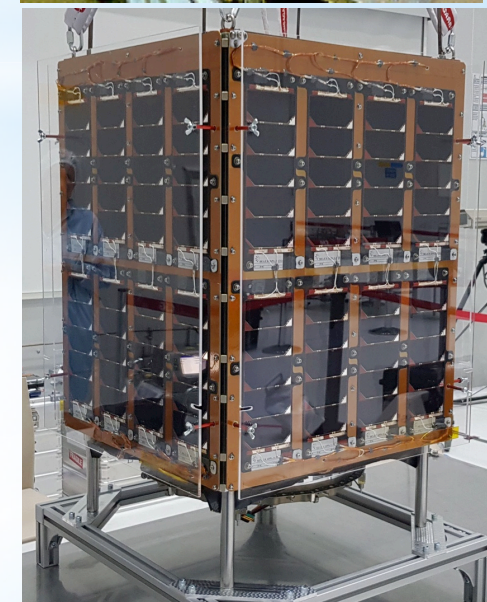
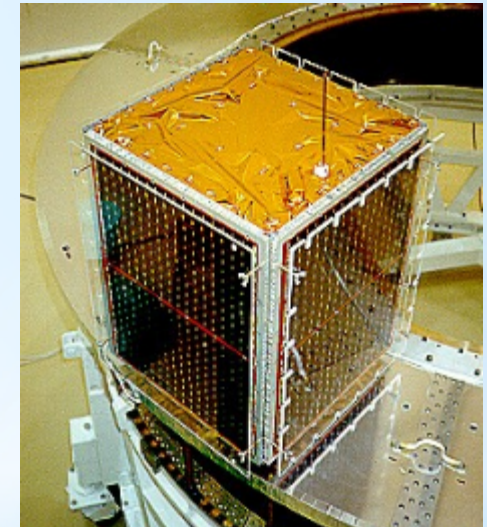
- Research group within Universidad Politécnica de Madrid, Spain
- UPMSat 2 software responsible

## UPMSat 1

- First Spanish satellite from university.
- **Launched on July 7<sup>th</sup> 1995**, as secondary payload on the V-75 Ariane IV flight
- Sun-synchronous orbit (670 km). 213 days of in-orbit operational life.

## UPMSat 2

- **Launched on September 3<sup>rd</sup> 2020** in the VV-16 Vega flight, a low Earth orbit rideshare commercial flight.
- Sun-synchronous orbit (500 km).
- Operative



## Objectives of UPMSat-2:

- Educational tool to involve engineering students in real projects of the aerospace sector, as a part of the Project Based Learning (PBL) philosophy of MUSE.
- In-orbit technological demonstration platforms.
- Confirmation of UPM capacity to develop, manufacture, integrate, test and operate a space platform with modern features in an academic environment.

## UPMSat-2 specifications (I):

<b>Mission Life</b>	2 years
<b>Mass</b>	50 kg
<b>Dimensions</b>	0.5 x 0.5 x 0.6 m <sup>3</sup>
<b>Orbit</b>	Sun-synchronous, 500 km Inclination 97 deg LTAN 10:30 am
<b>Structure</b>	Aluminum 0.5 x 0.5 x 0.25 m <sup>3</sup> available for payload



## UPMSat-2 specifications (II):

<b>Thermal control</b>	Passive Active for battery thermal stability
<b>Power</b>	Five Ga/As body mounted solar panels. Li-Ion battery (18 Ah) Direct Energy Transfer (DET)
<b>On-board Electronic BOX (E-BOX)</b>	OBC based on FPGA. EBOX includes: <ul style="list-style-type: none"> <li>• OBDH</li> <li>• Power supply control and distribution, DAS</li> </ul>

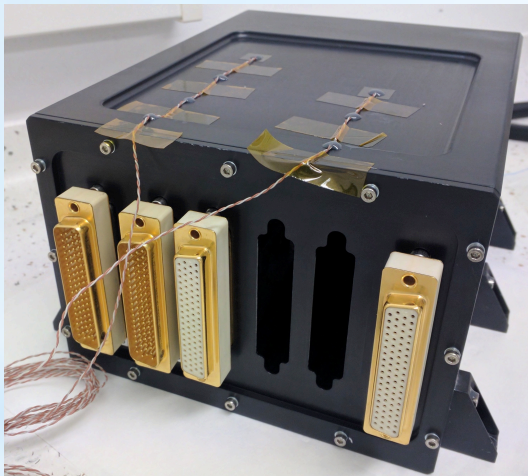


## UPMSat-2 specifications (III):

<b>Attitude control</b>	<b>Purely magnetic:</b> Magnetometers Magnetorquers Magnetic control law
<b>Comms</b>	Up/downlink 437 MHz Downlink 400 MHz 4 monopole antenna system Ground Station in Madrid, Spain.



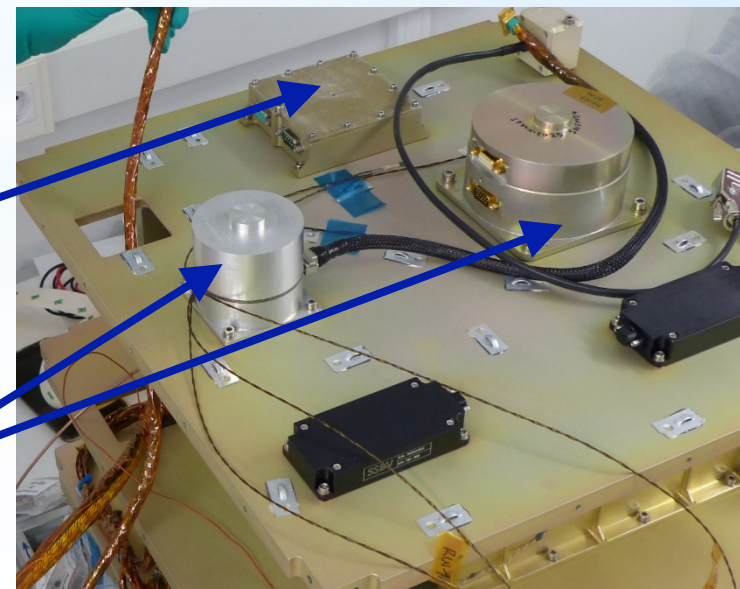
# UPMSat-2 Payloads and experiments (I):



**EBOX**  
(Tecnobit S.L., Oesia)

**Bartington Magnetometer**  
(Bartington Instruments Ltd.)

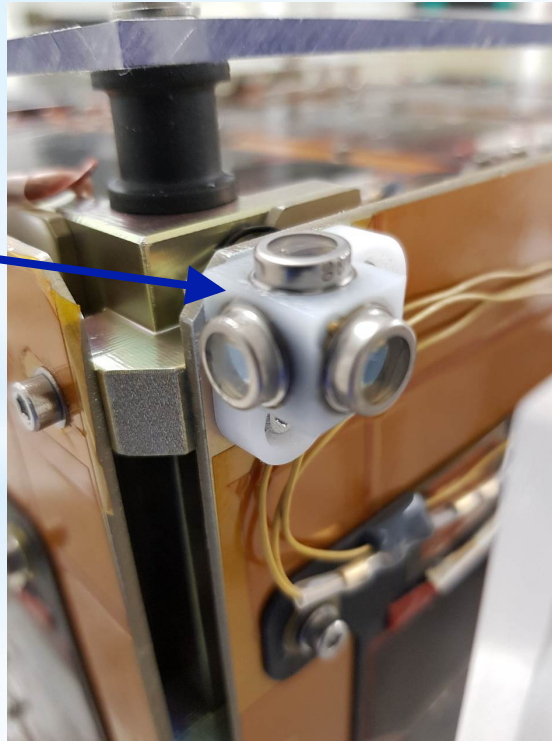
**Reaction wheel**  
(SSBV Space & Ground Systems)



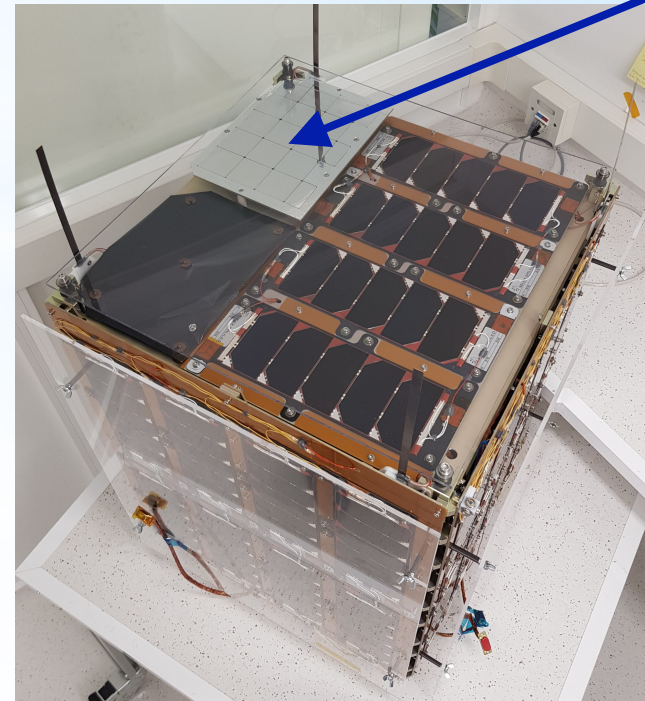


## UPMSat-2 Payloads and experiments (II):

**Solar Sensors**  
(IDR/UPM)

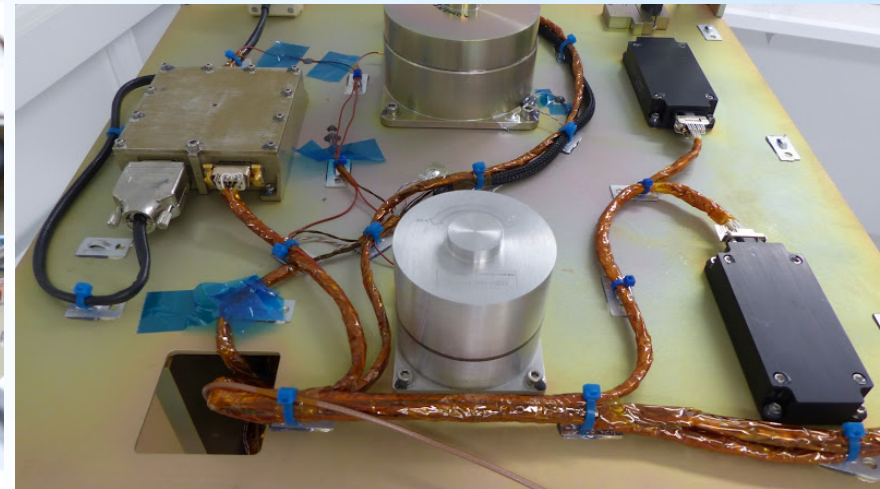
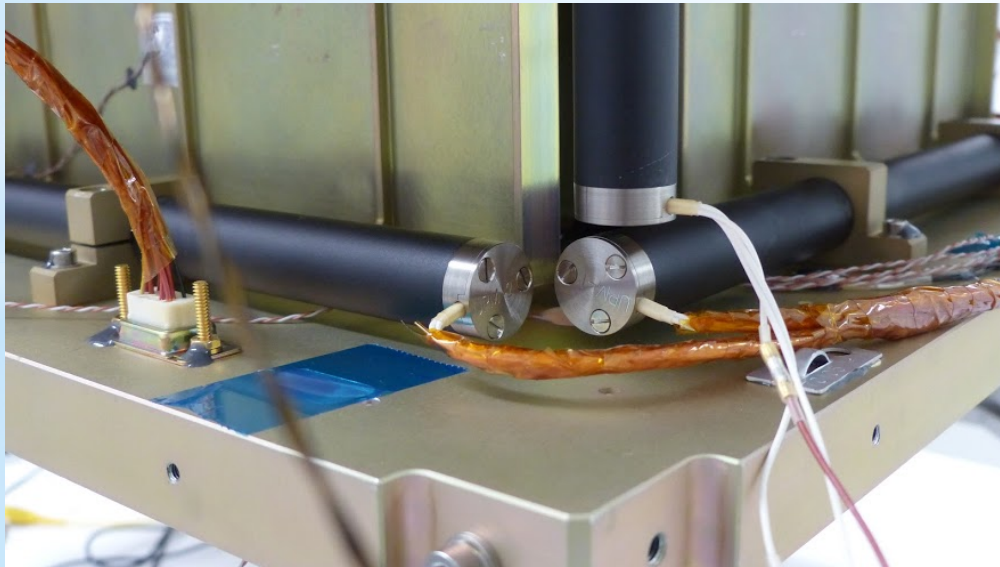


**Micro-Thermal Switch**  
(Iberespacio)



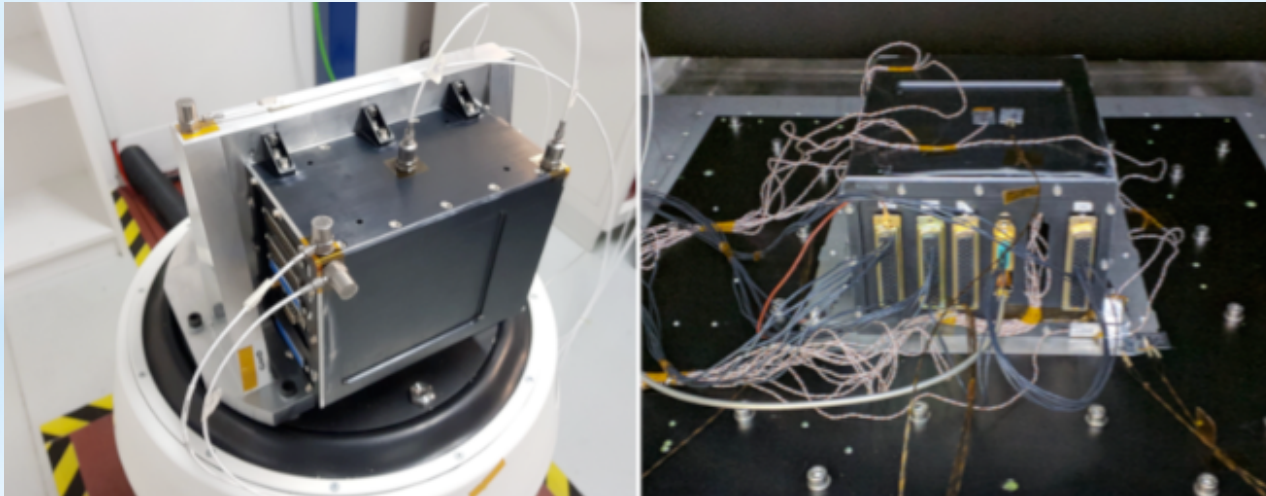
## UPMSat-2 Payloads and experiments (III):

- Purely magnetic attitude control law (IDR/UPM)



## AIT campaign:

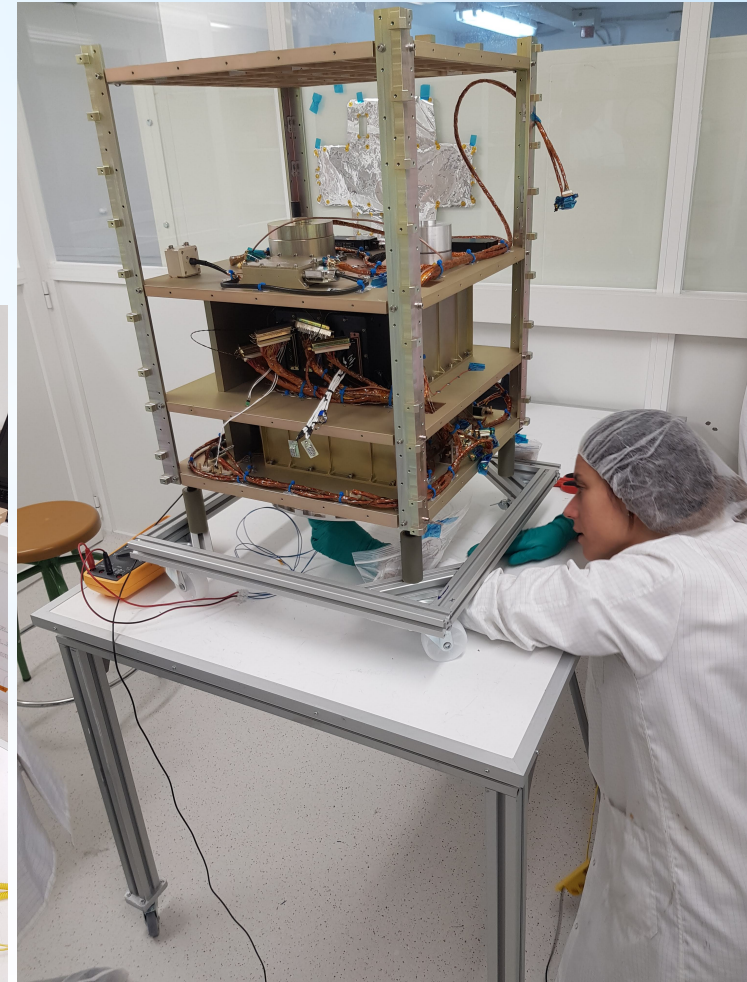
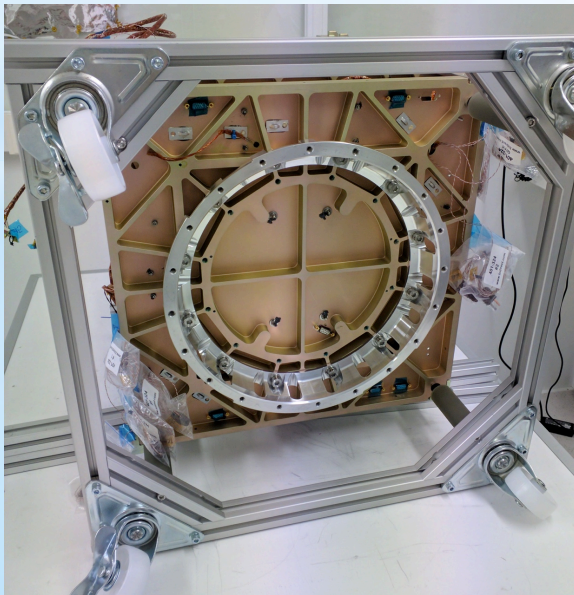
- Three model philosophy: STM, EM, PFM
- Qualification at equipment level



- UPMSat-2 AIT campaign: Starting on January 2019 and performed in the Space Environment Testing Laboratory of IDR/UPM (Madrid, Spain)

## AIT campaign:

- **Assembly and integration** within the ISO 8 clean room of IDR/UPM



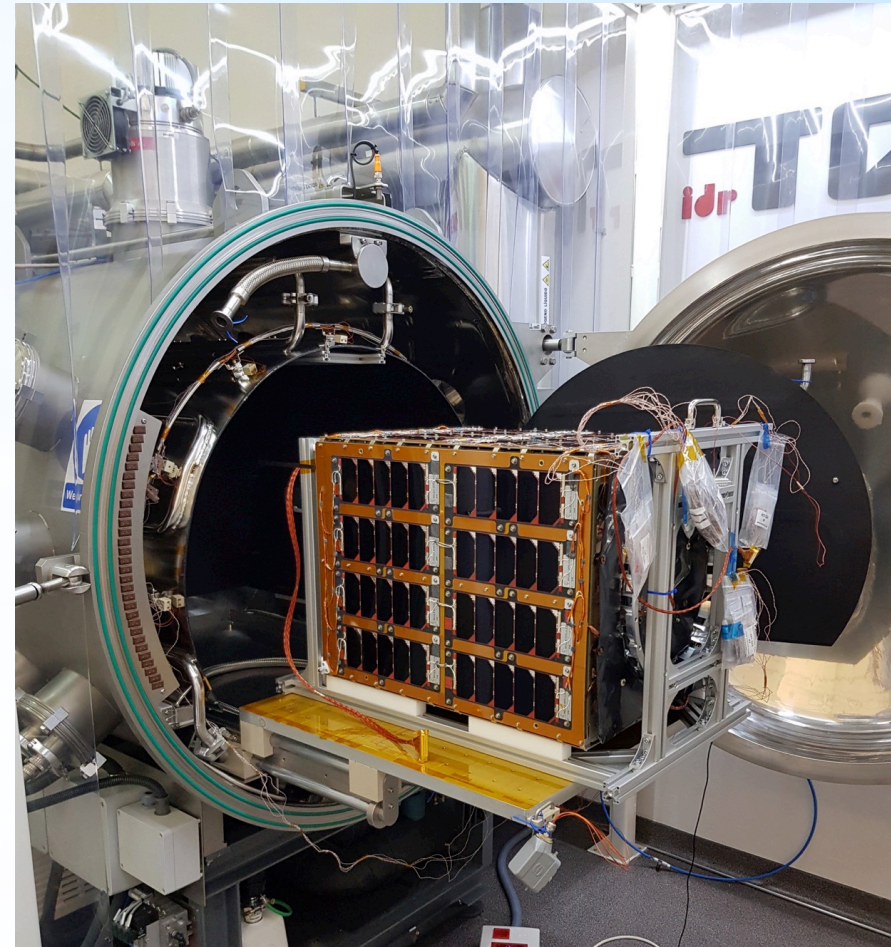
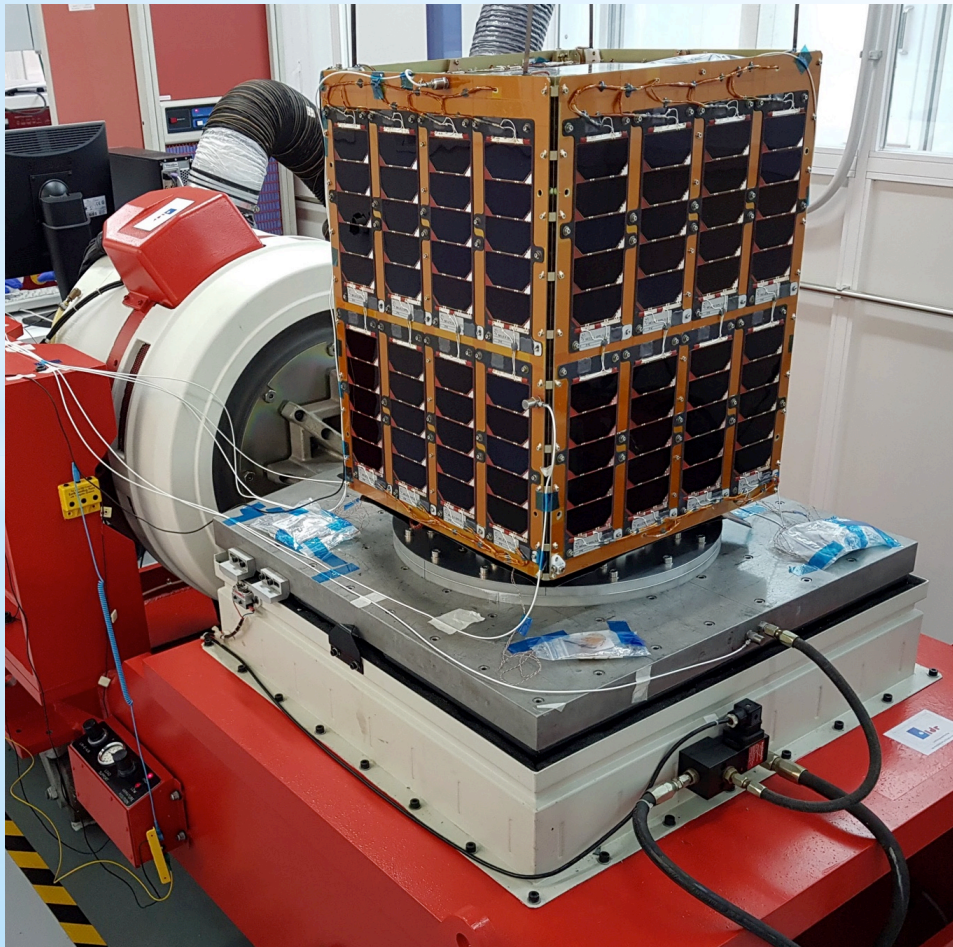
## AIT campaign:

- **Qualification/acceptance.**

For the PFM model:

- i. Non-functional tests**, for the determination of the satellite mass and center of gravity;
- ii. Functional tests**, focused on the verification of the functional requirements of the mission; and
- iii. Environmental tests**, focused on two main topics: Mechanical resilience and vacuum thermal performances.

# AIT campaign:



## Launch campaign:

**SSMS dispenser:** Small Satellite Mission Service module.

- Mission used as Proof of Concept
- 53 small satellites launched to space (7 microsattellites)

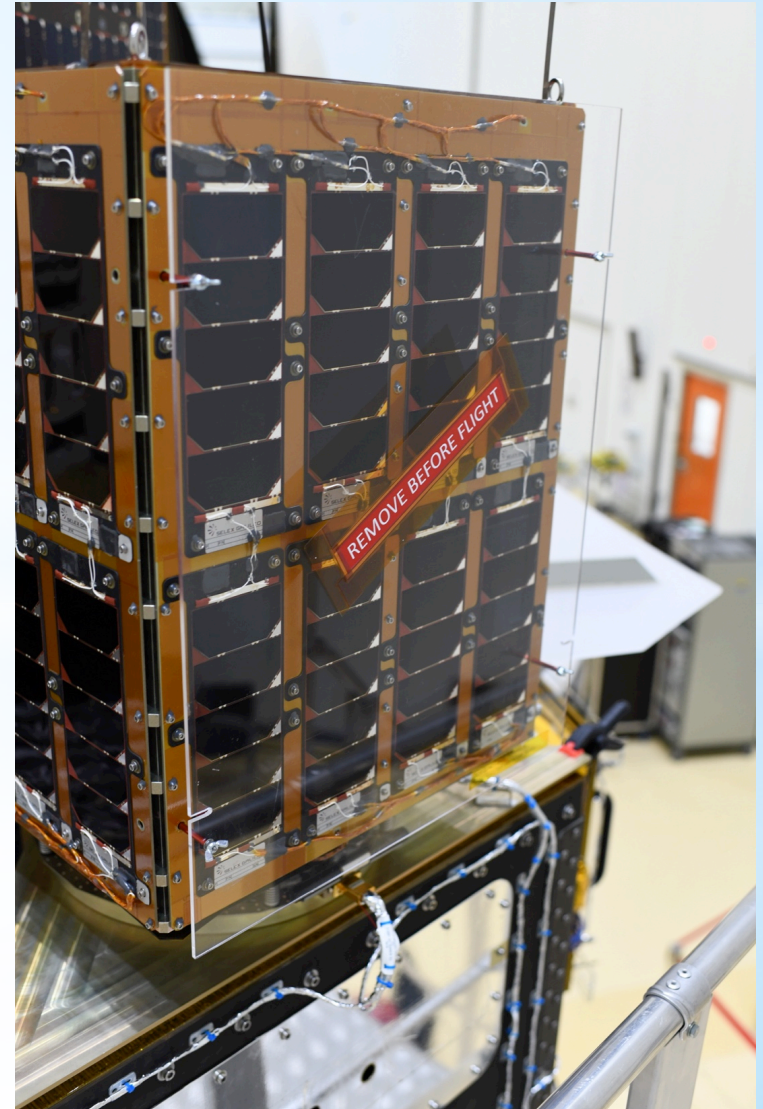


# Launch campaign:

## Chronology

- Vega's VV-16 launch campaign started in February 2020 (initially planned launch by end of March).
- Activities stopped in March 2020 (due to Covid-19 pandemic).
- Activities were resumed on May 11, 2020.
- UPMSat-2 was finally launched\* onboard Vega flight VV-16 on September 3, 2020 at 1:51 am (UTC).

\* Launch funded by the European Union in the frame of the Horizon 2020 IOD/IOV Program

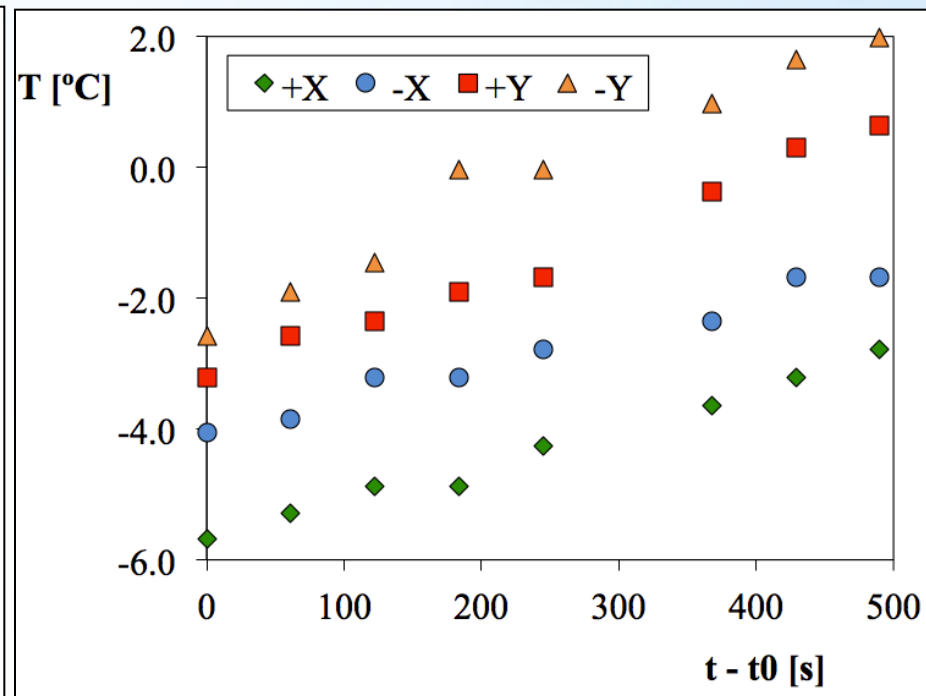
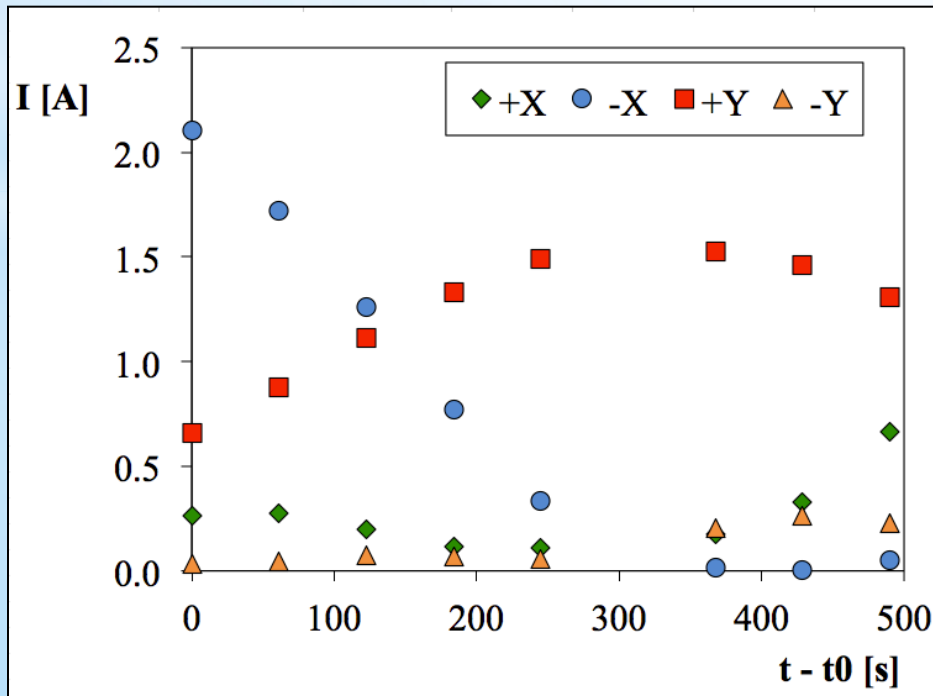




# Operational phase:

- Currently receiving data 4 times a day in the IDR/UPM Ground Station.
- Additional data received form observers all around de world (SatNOGS DB).

Follow UPMSat 2: NORAD catalog number: 26276





# Thank you for your attention

Sponsors/Partners:

