

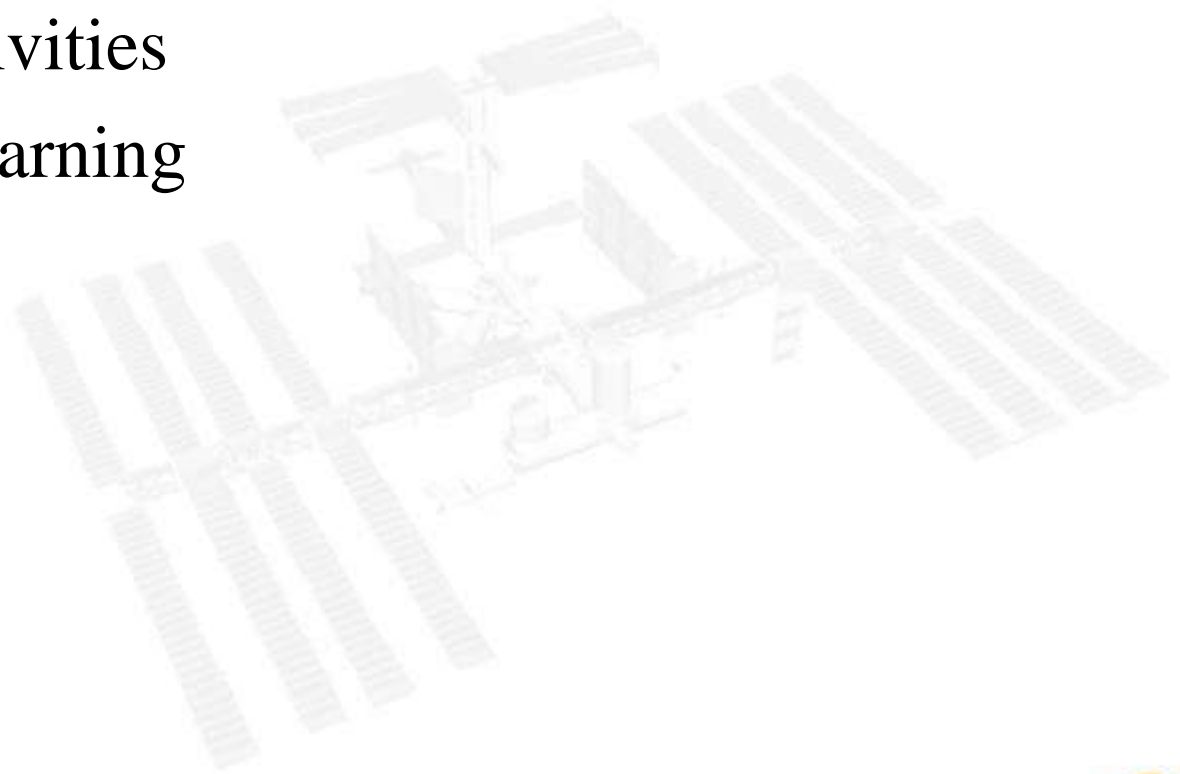
QBITO Development and Students Involvement

Ignacio Barrios Tascón
E-USOC, Universidad Politécnica de Madrid



Contents

- Who we are
- E-USOC
- Educational activities
- Project based learning
- QBITO



Who we are

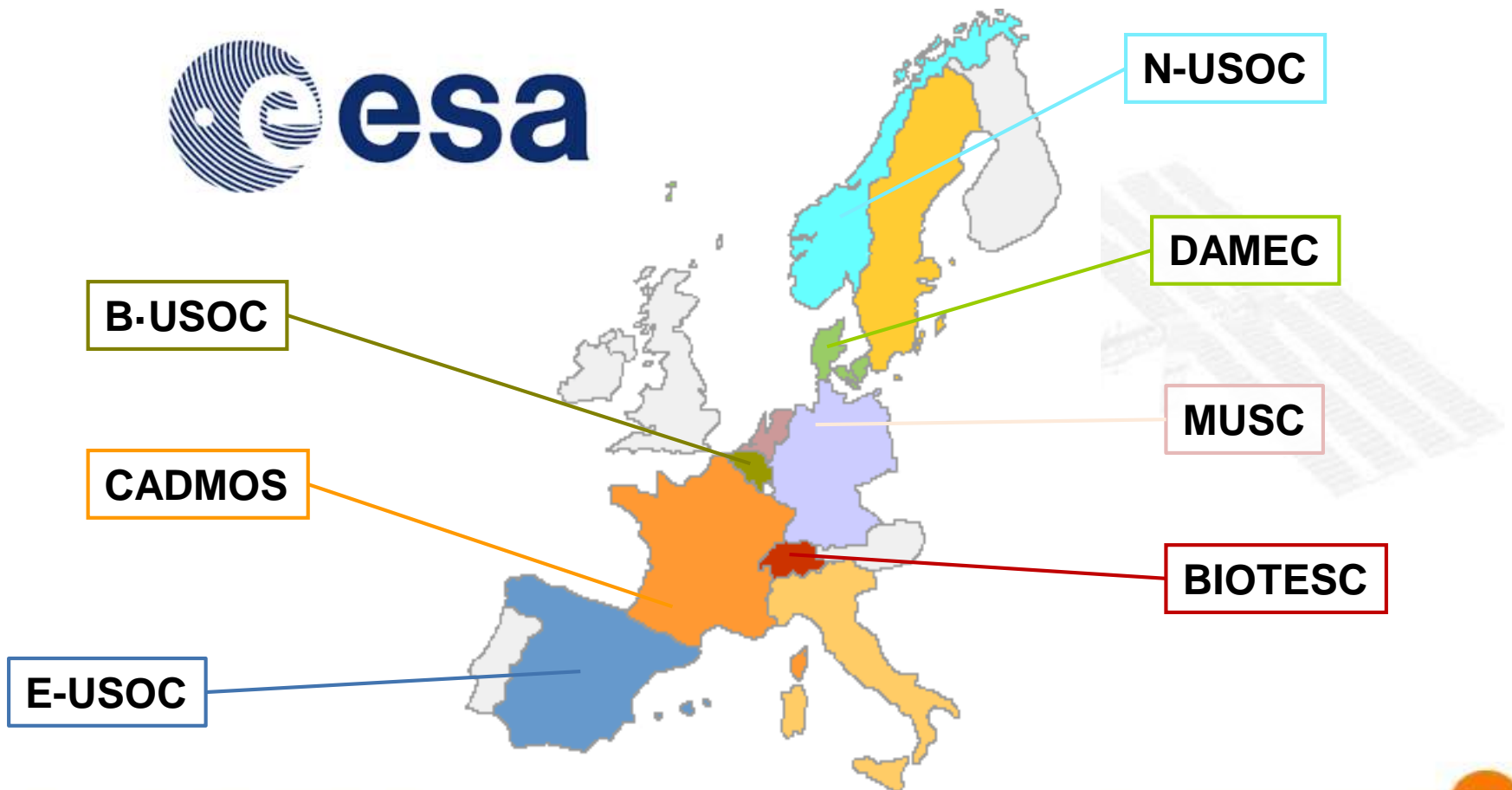


Aerospace Science
and Operations
Research Group



European Space Agency (ESA) USOCs

USOC: User Support and Operations Centre



E-USOC

- Responsible for the assigned payloads operations (laboratories or experiments)
- Information and support point for scientists performing or willing to perform an experiment onboard the ISS.



FSL (COLUMBUS)

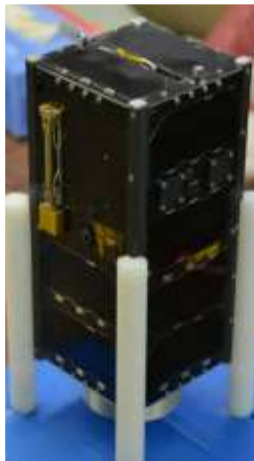


MSG (USLab 'Destiny')



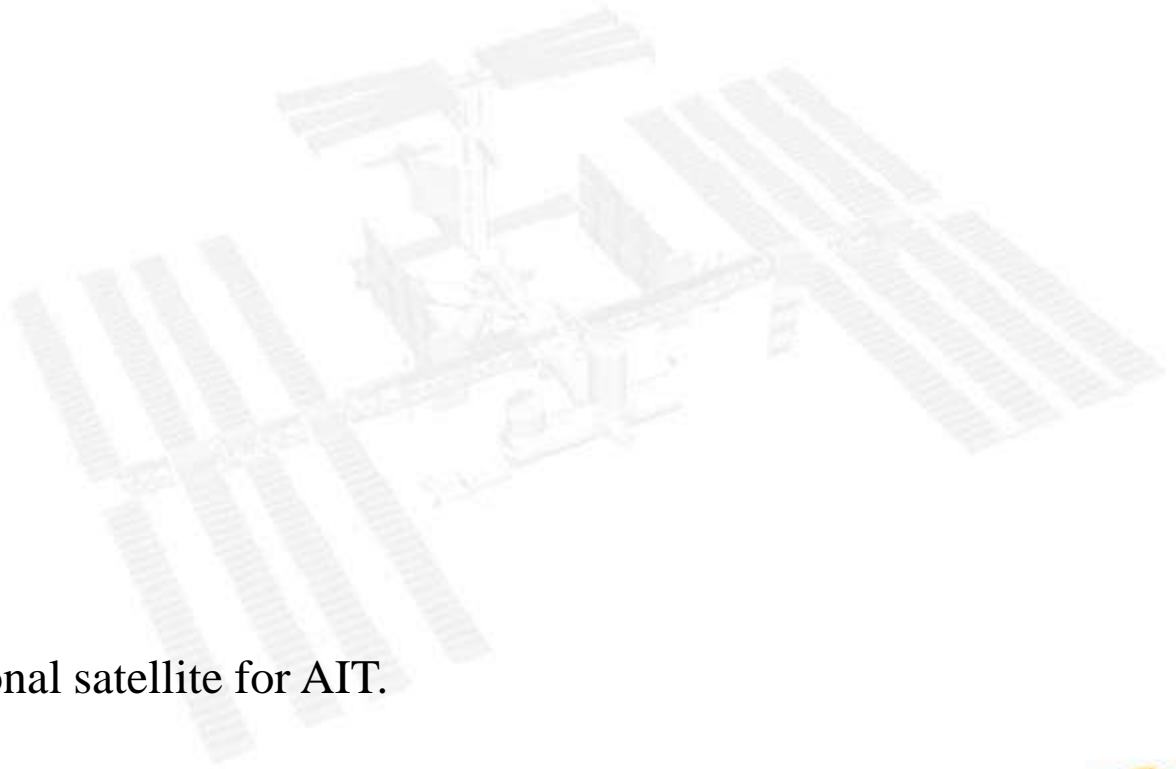
Educational activities

- Project based learning
- Conceptual design of satellite missions
- Educational satellite
- Satellite tracking ground station
- QBITO



Project based learning

- 2nd semester, last year.
- CDIO (Conceive-Design-Implement-Operate) syllabus.
- Preliminary design of a realistic satellite mission.
- Groups of 6 students where each of them get a role (manager, system, subsystem, payload).
- Documents:
 - Requirements
 - Mission analysis
 - Final report
- Final oral presentation.
- Objectives:
 - Subsystems interaction
 - System point of view
 - Technical reports
 - Oral presentations
 - Time management
 - Transversal skills
- Completed with educational satellite for AIT.



QBITO

- Comply with QB50 mission requirements
- Operate secondary payloads
- Involve university students
- Test in-house developments in space



- Industrial Sponsors



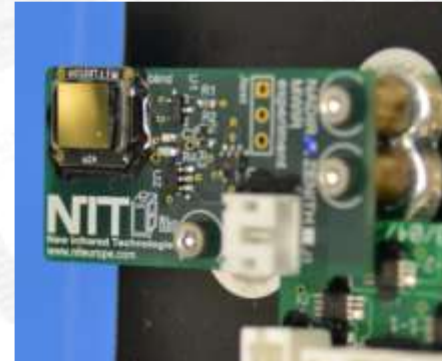
Schedule

Call for Proposals	November 2011
Submission of Proposal	April 2012
PDR	May 2013
CDR	September 2014
AIT Readiness Review	February 2015
FRR	February 2016
Shipment for Main Payload Integration	April 2016
Launch window start	July 2016

QB50 Precursor Flight launched in June 2014
We have received TM and we expect to
command in the coming weeks

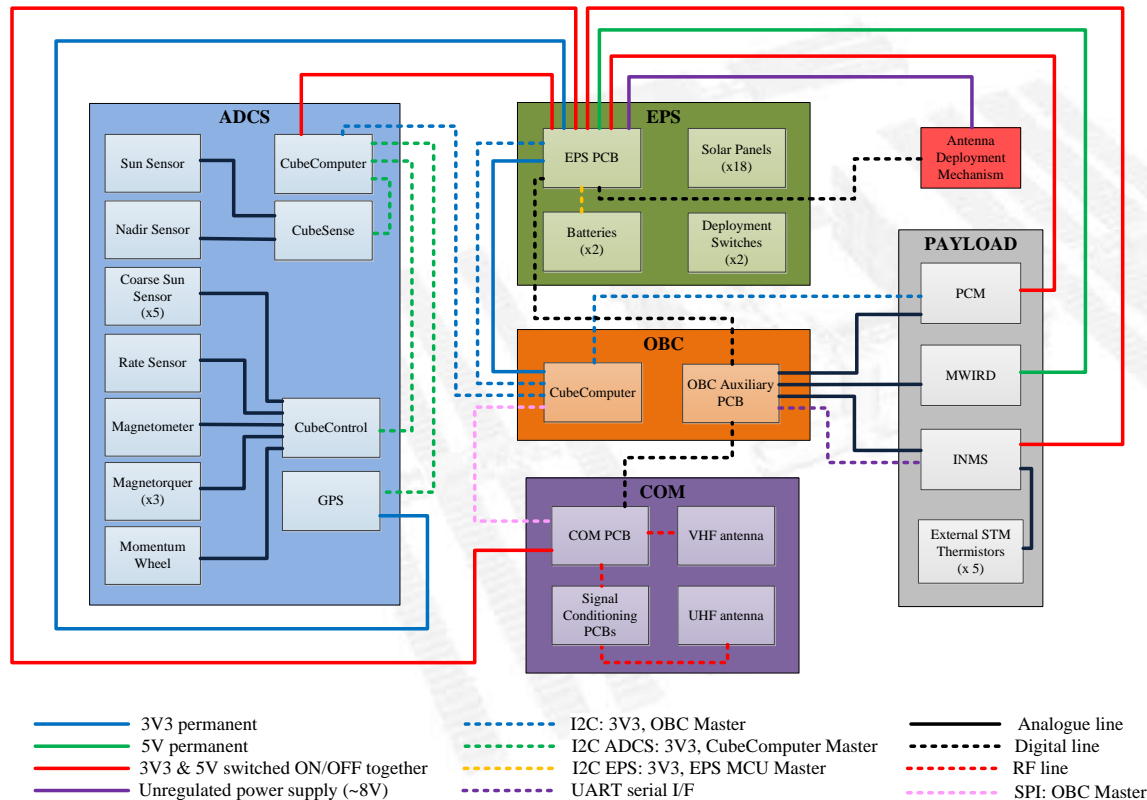
Payloads

- Ion and Neutral Mass Spectrometer (MSSL, UK)
 - Pointing accuracy +/- 10 deg, pointing knowledge +/- 2 deg
 - 2 Mbit/day
- **Phase Change Material** (in collaboration with WALOPT, Belgium)
- **Uncooled** Medium Wave Infrared Detector (New Infrared Technologies, Spain)
- ADCS Experimental Software based on **fuzzy logic** algorithms (UPM, Spain)



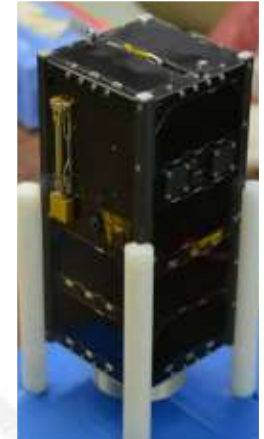
System configuration

- 2 Units, 1,8 Kg
- Max average power consumption = 2,1 W; 20 Wh storage;
- 3-axis attitude control (MTM, CSS, Rate Sensor, Nadir and Sun sensors, GPS, MTQ, Momentum wheel)
- COM: full duplex UHF downlink / VHF uplink

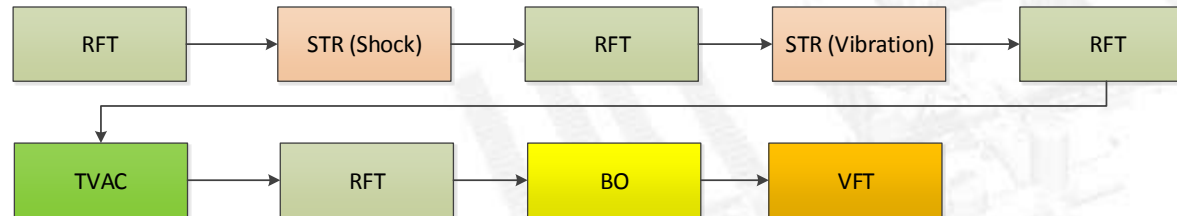


Test Activities

SM

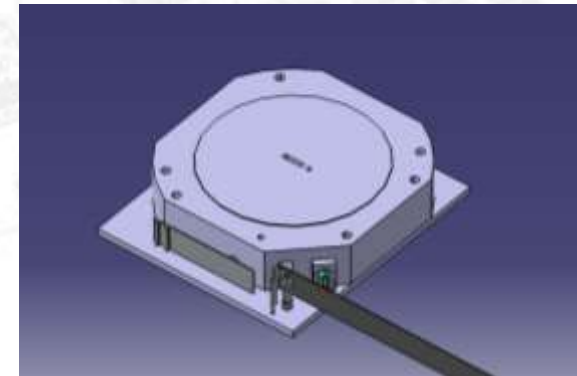
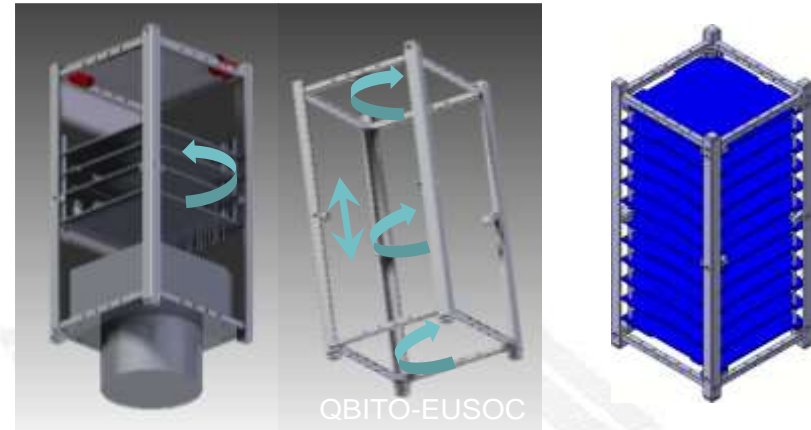


PFM



In-house developments

- **Structure**
 - Low mass (<150 g)
 - Maximum useful volume
 - Modular configuration, highly configurable
 - Fully qualified
- **EPS**
 - High efficiency
 - Advanced MPPT
 - Highly configurable
 - Different power supplies
- **Solar panels**
- **Antenna deployment mechanisms**
 - Minimum impact on CubeSat configuration
 - Can be located anywhere in the CubeSat
- **COM**
 - Full duplex
 - Downlink: UHF, 9600 bps, turnstile 4 monopole antenna
 - Uplink: VHF, 1200 bps, one monopole
- **Thermal Subsystem, Phase Change Material**



Students' involvement

Work group	Professor	Engineer/PhD	Student
System Engineering		1	1
EPS	0.5	1	4
OBC		1	5
ADCS	1	2	4
COM	1		3
Structure	0.5	1	3
TCS		1	1
Payloads		1	
Ground Segment		2	3
AIT		2	1
		TOTAL	25

Thank you!

Please visit us at
<http://www.eusoc.upm.es>

Ignacio Barrios Tascón
ibarrios@eusoc.upm.es