UVigo SpaceLab

OLLO

Open Little Luminary Observatory

Agenda

03 About the team

04 The OLLO Mission

05 Payload requirements

06 The pointing Challenge

07 Open Source ADCS

08 Other Challenges

ABOUT THE TEAM

UVigo SpaceLab is a multidisciplinary team of students from the University of Vigo dedicated to the **design, manufacture, verification and operation** of **small satellites** and **space missions**. Our members are students from all the engineering schools of the University.

Our objective is to develop **educational** satellites to apply and develop the skills acquired during our academic training.

We have the support of our advisors **Fernando Aguado Agelet, Fermín Navarro Medina** and **Arno Formella**, who have ample experience leading and participating in several space projects, some of them coordinated by the European Space Agency (ESA).

Fig 1. OLLO Concept of Operations

The OLLO Mission

Open Little Luminary Observatory (OLLO) is a mission to create an open, interactive tool for everyone to access and request images of astronomical objects, such as planets, nebulae or star clusters.

Space Segment:

A 3U CubeSat telescope in LEO.

Ground Segment:

Ground Station at university of Vigo
Server to access observations

User Segment

You !

OLLO Payload requirements

Due to the volume constraints in a 3U CubeSat, the telescope will be a f/1.25 80mm aperture lens.

The sensor is a 1.4 MP B&W CCD. This would give us a reasonable balance of angular resolution and field of view.

Parameter	Value
Aperture	80 mm (f/1.25)
Focal length	100 mm
Sensor size	1392 x 1040 pixels
Pixel size	6.45 x 6.45 µm
Field of view	5.1 x 3.8 degrees
Angular resolution	13.3 arcseconds
Detectable magnitude	12

Table 1. Telescope requirements

Expected resolution of the imager (simulation)

Original courtesy of John Matthew Sadler

Expected Field of View of the imager (simulation)

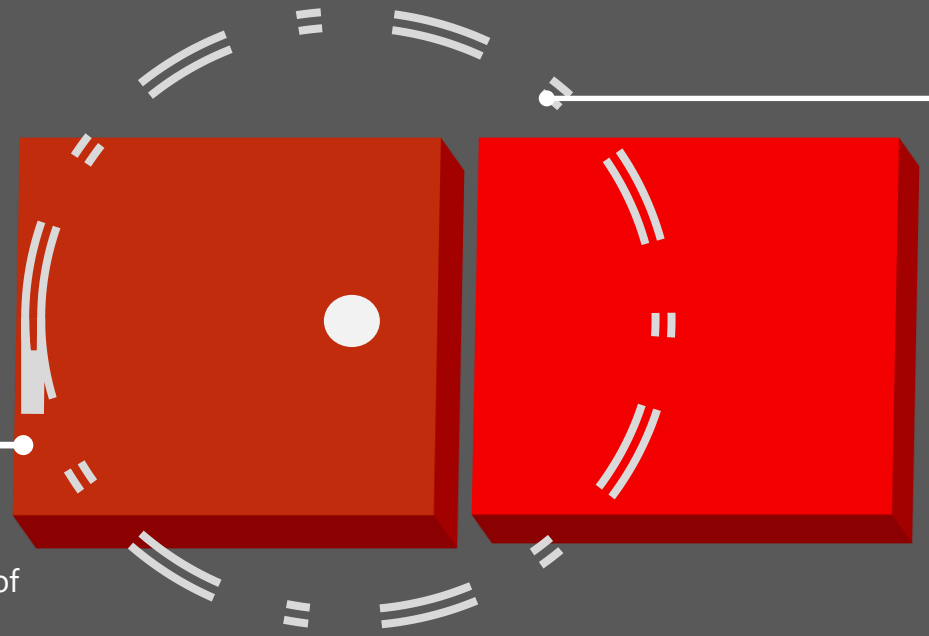
The pointing Challenge

ADCS

The pointing requirements are determined by the angular resolution of the payload

Pointing stability

To avoid motion blur during the 5 minute long exposures, the observatory must achieve a pointing stability higher than the angular size of a single pixel.



Capture

To capture images with detail of the faintest objects, a long enough exposure is necessary…

Fig 2. Two pixels in the CCD sensor

Parameter	Value
Angular resolution	13.3 arcseconds
Pointing stability	10 arcseconds @ 5 min
Pointing accuracy	0.1º

Table 2. Pointing requirements

These strong requirements on the ADCS subsystem remain one of the biggest challenges of the OLLO mission.

Open Source ADCS Subsystems

Attitude Sensors:
- 3 axis gyro
- Magnetometer
- Sun tracker
- GNSS

Actuators:
- 3 axis magnetorquer
- 1 spin torquer

UPSat

Attitude Sensors:
- Gyroscope
- Two magnetometers
- Fine sun sensor
- GNSS

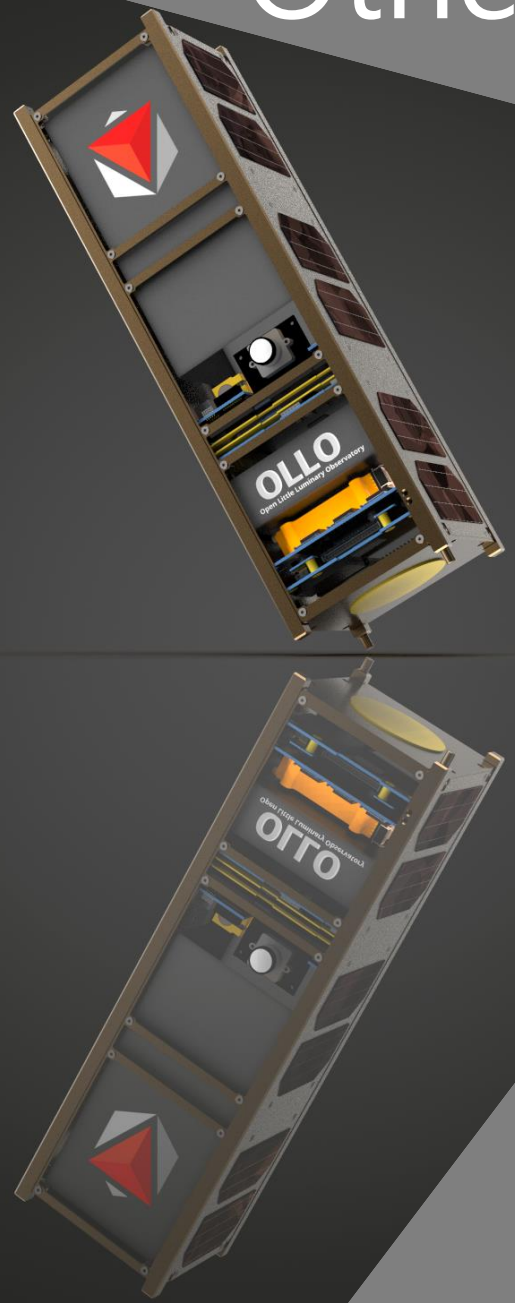
Actuators:
- 3 axis magnetorquer
- 1 Reaction wheel

AcubeSat

OLLO requires a sensor accuracy better than 10 arcseconds => Star tracker or a combination of sensors to comply with this requirement is needed.

OLLO requires **3 axis reaction wheels** to maintain stability

Other Challenges



Data download requirements

A single image of the proposed payload would weight 11.6 Mb (with an 8-bit color depth)

The downlink rate can be a limiting factor on the quantity of observations made each day.

The UHF band, which is very common in CubeSats, cannot accomodate the download data rates needed. At least an S-Band transmitter is needed.

THANK YOU

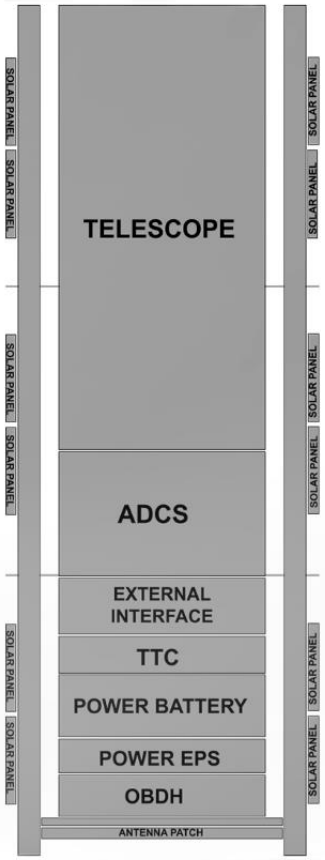
Q&A

Acknowledgement

This concept has been selected to participate in the ESA Academy's Concurrent Engineering Workshop in 2021

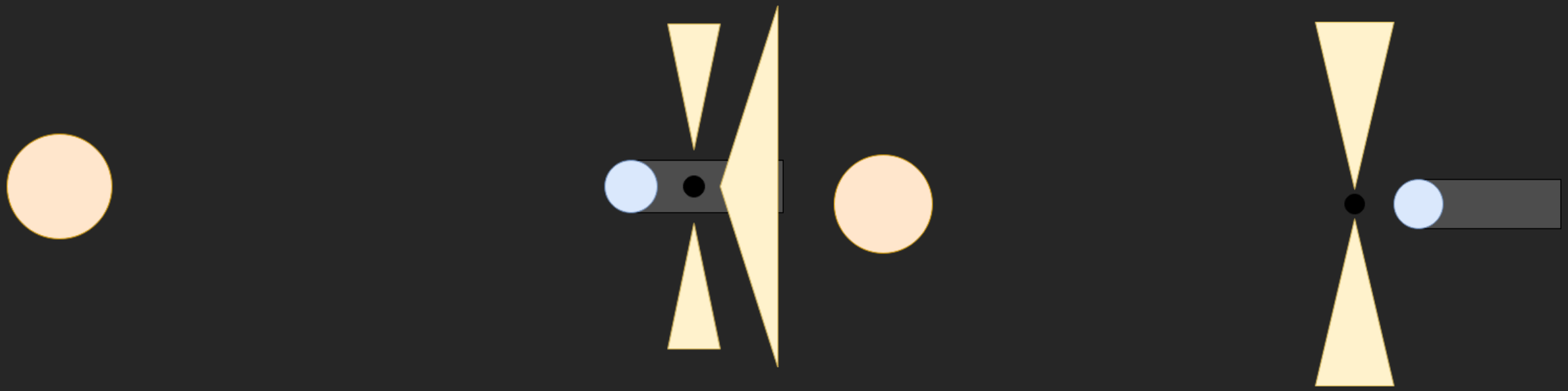
Additional slides

Preliminar CubeSat configuration



UVigo SpaceLab

Observation modes



UVigo SpaceLab