

SCIENCE & EXPLORATION


plato

Terrestrial planet hunter

Current status

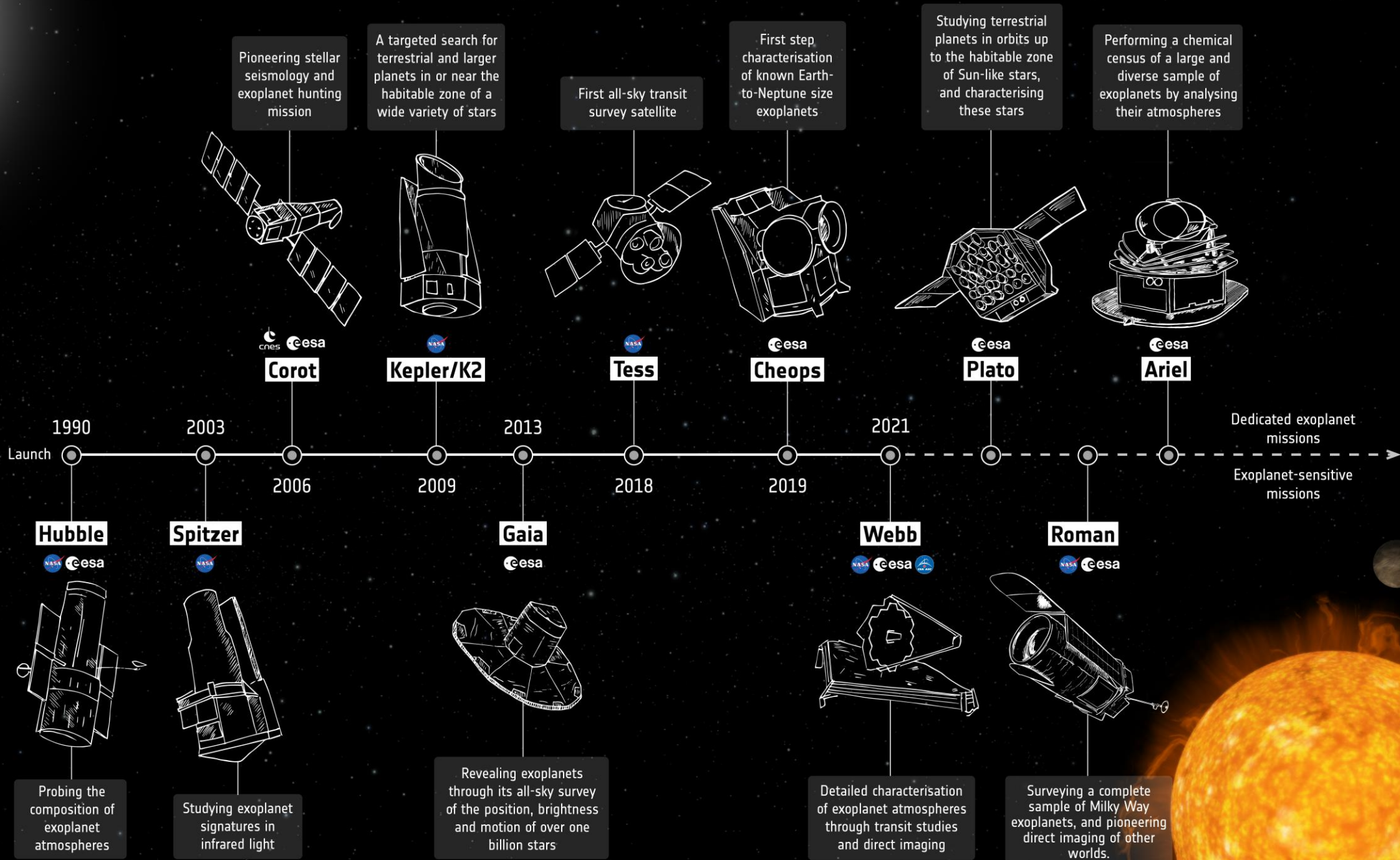
Don Pollacco

University of Warwick



Ground-based observatories

First discoveries of exoplanets in the 1990s opened up the field of exoplanet research. New innovations and discoveries continue to this day

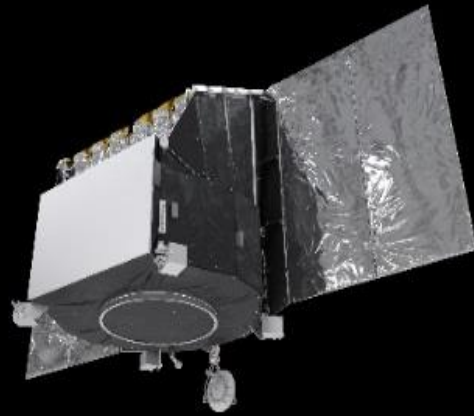
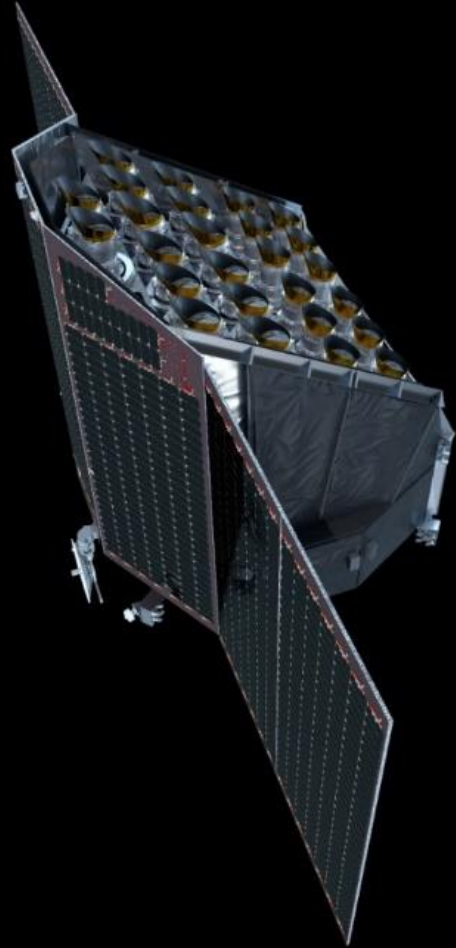


Science Reminder: PLATO will detect transit signals of thousands of planets which are bright enough for radial velocity spectroscopy to determine their masses.

PLATO will provide:

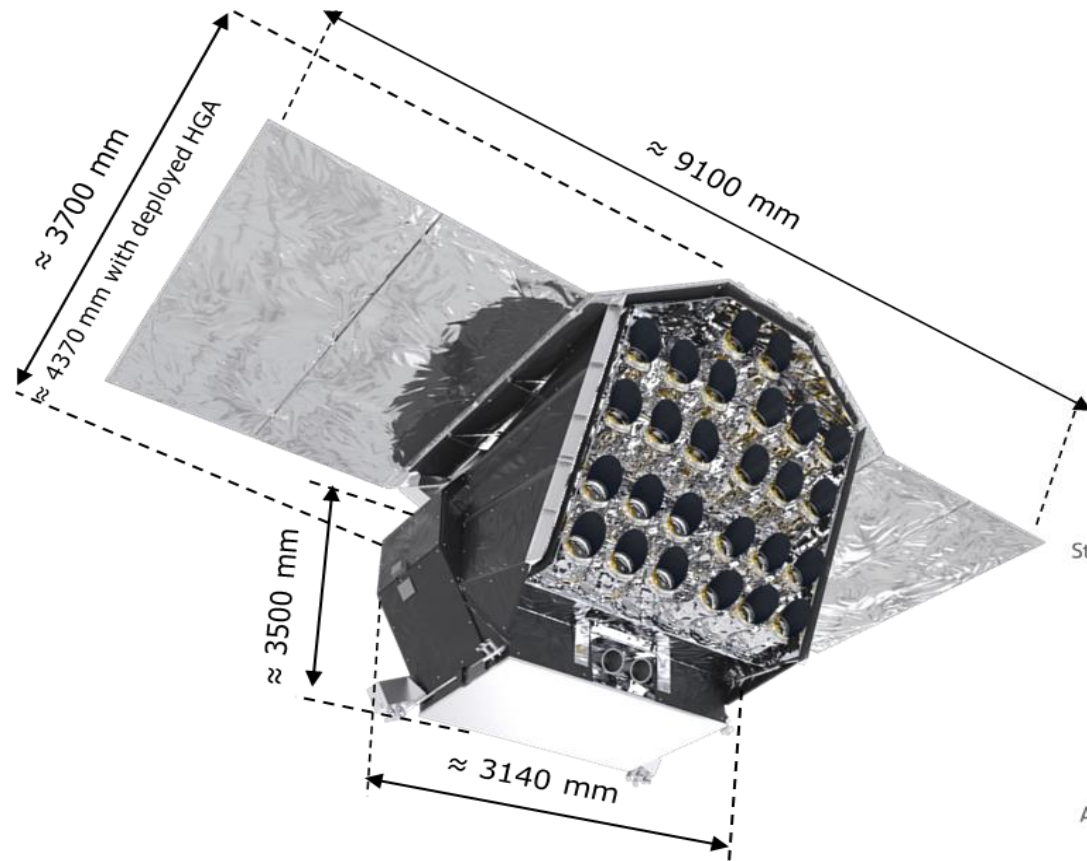
- A sample of well characterized “Earth-Sun” analogues
⇒ **Unique to PLATO**
- Small planet diversity ⇒ **How unique is the Earth**
- Planets at all ages, understand planet evolution ⇒ **Unique to PLATO**
- Provide a target list for atmosphere spectroscopy ⇒ **JWST, ARIEL, ELT etc**





Spacecraft Overview

Modular spacecraft design: PLM and SVM separation



24 Normal Cameras
2 Fast Cameras



CRFP Optical Bench
Assembly (OBA)



Central Module
Structure and Propulsion



Avionics and electronics
panel



Payload Electronics
panel



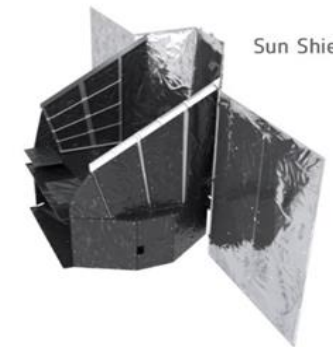
High Gain Antenna



P/L Thermal Shield



Sun Shield



Solar Array



Spacecraft mass and power generation:

2267.3* kg Spacecraft at launch (w/o system margin)

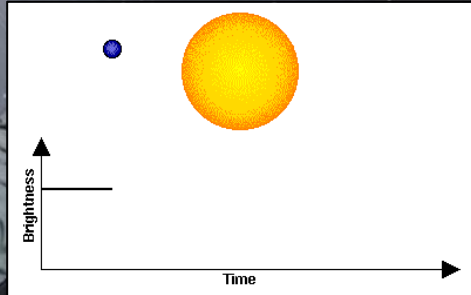
2595 kg Launcher Performance (SRD and SC sizing mass)

2922 W min available power SA nom science ops

*including 80 kg LVA and 170 kg propellant and 10 Kg balancing mass

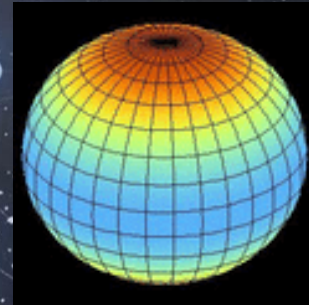
PLATO Methods

Satellite photometry



Transit detection

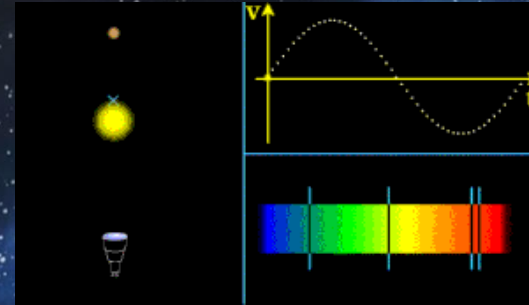
- radius ratio
- Inclination Planet / star



Asteroseismology

- Stellar radius, mass
- Stellar age

Ground-based spectroscopy



RV spectroscopy

→ **Planet mass**

→ **Planet radius**
→ **Planet age**

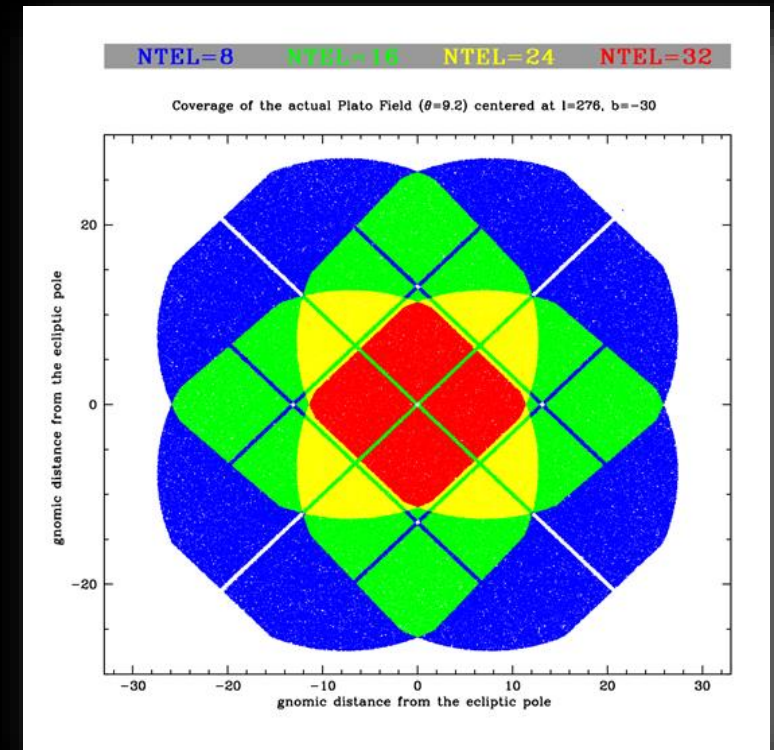
characterized

PLATO precisions: The benchmark case: An Earth around a Sun at V= 10 mag

→ **3% radius**; → **10% mass**; → **10% age**

The Mission Basics I

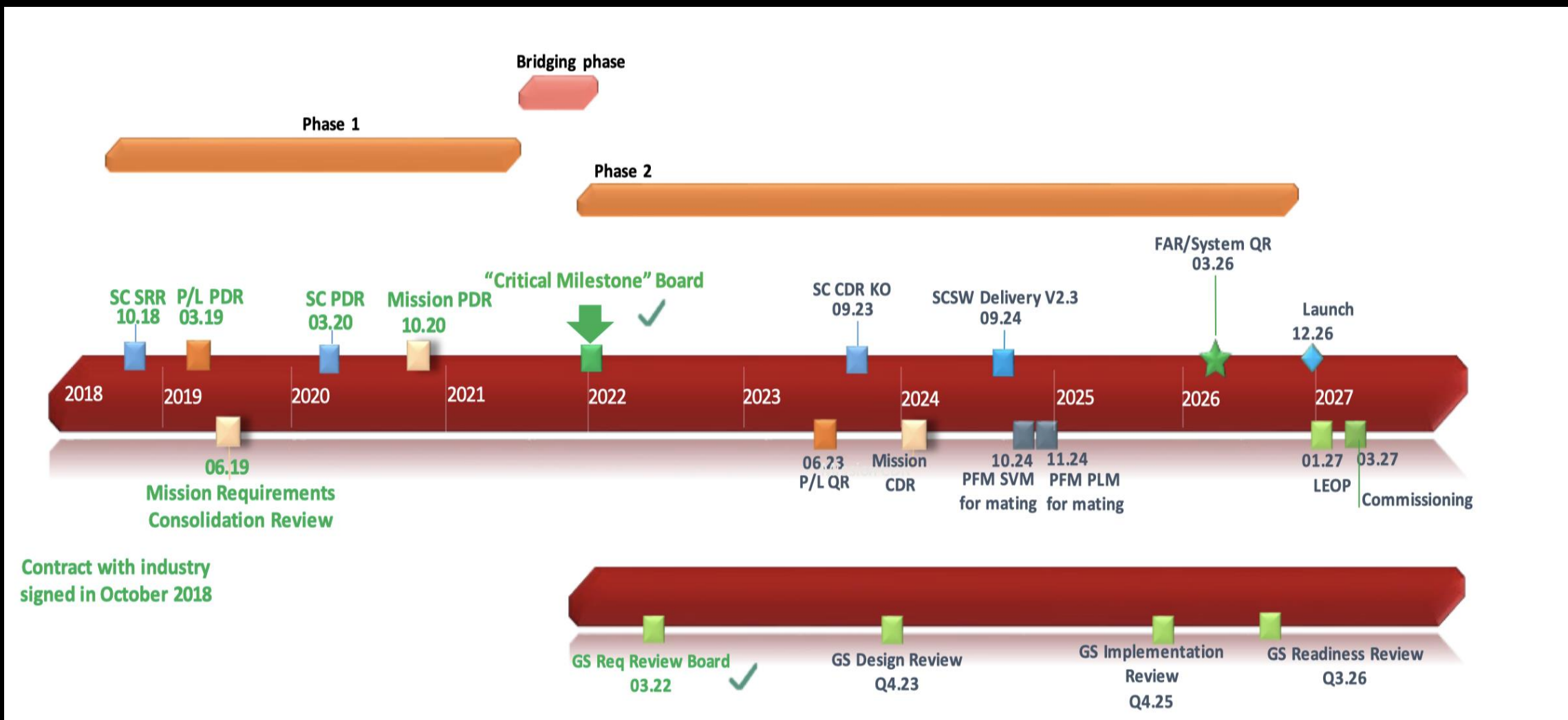
- Launch Q4 2026
- **L2 Orbit**
- Baseline strategy is 2x2yr observations, consumables for 6.5yr
- 24 “normal” cameras (25sec exposures), 2 “fast” cameras (2.5sec exposures for guiding and bright targets, overlapping fields of view => greater dynamic range
- FoV $49 \times 49 = 2132 \text{ deg}^2$



The Mission Basics II

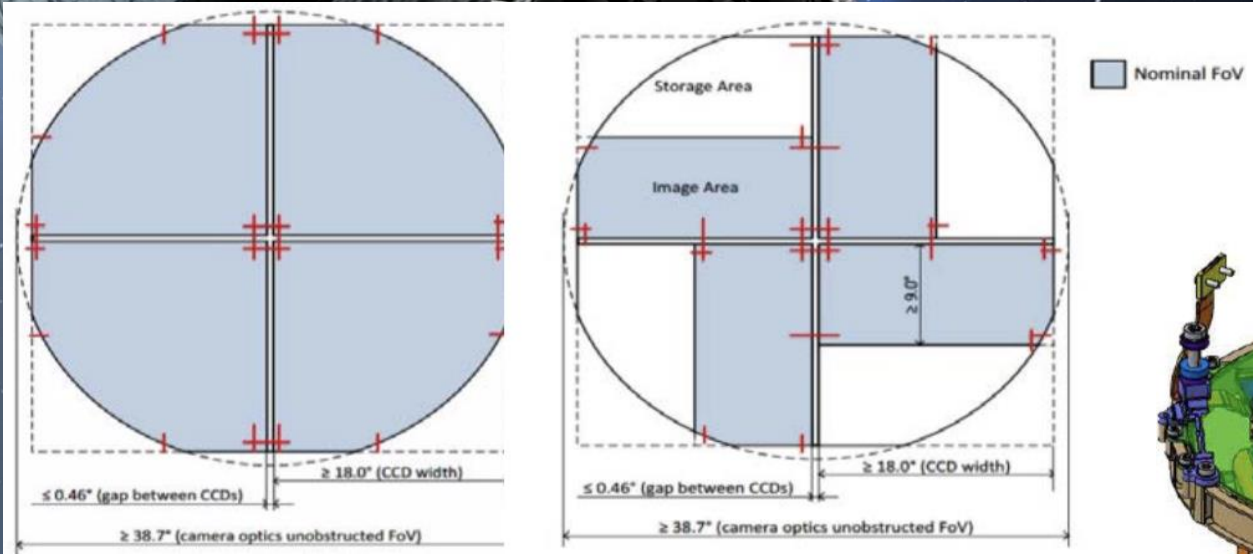
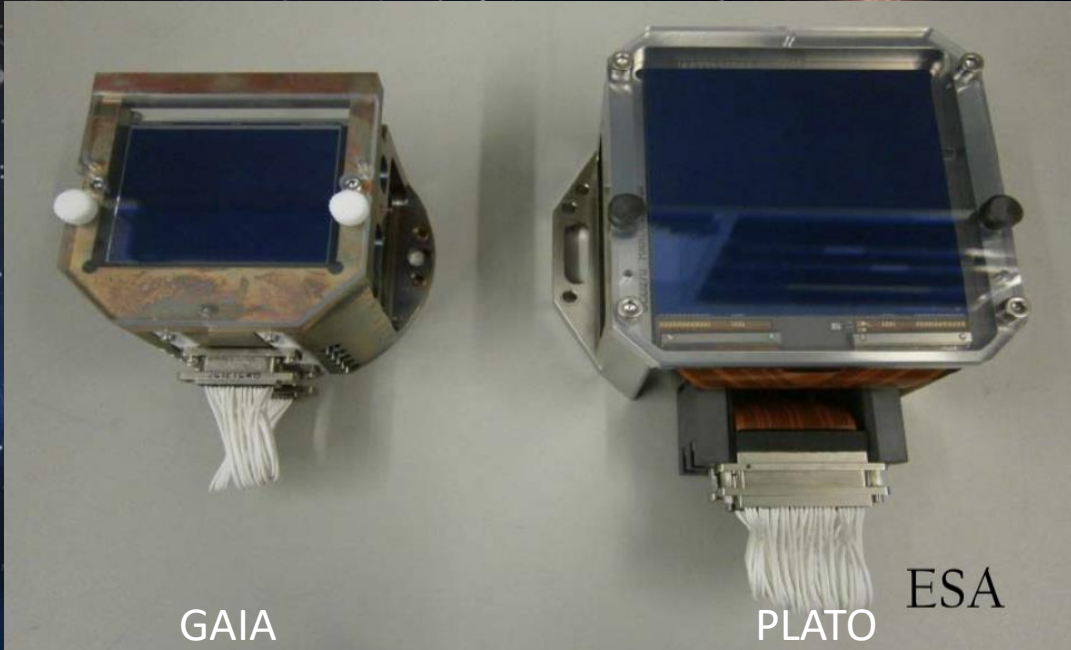
- Magnitude range 5th-13th Mag (spectral types F5-K7), <16th Mag M-type
- Sensitivity 50ppm/hr for targets brighter than M=11, Earth detection possible to 13th Mag (16th Mag for M dwarfs)
- Gaia informed PIC
- Stellar samples L1~ 15000, L5~ 250000
- Most data publicly available 3mon after download
- Original PLATO Project Paper – *The PLATO 2.0 Mission*, Rauer et al 2014, *Experimental Astronomy* 38, 249
Updated and New paper going through the publication process

Project Timeline and Milestones



PLATO Focal Plane

- Each Camera has 4xCCD, each 4510x4510 pixels
- N-Cams - full frame mode (MSSL)
- F-Cams – frame transfer mode (DLR)
- Flight Model CCDs (104 pcs, 2 Gpixels, 0.74m² Silicon area produced in batches until 2022)



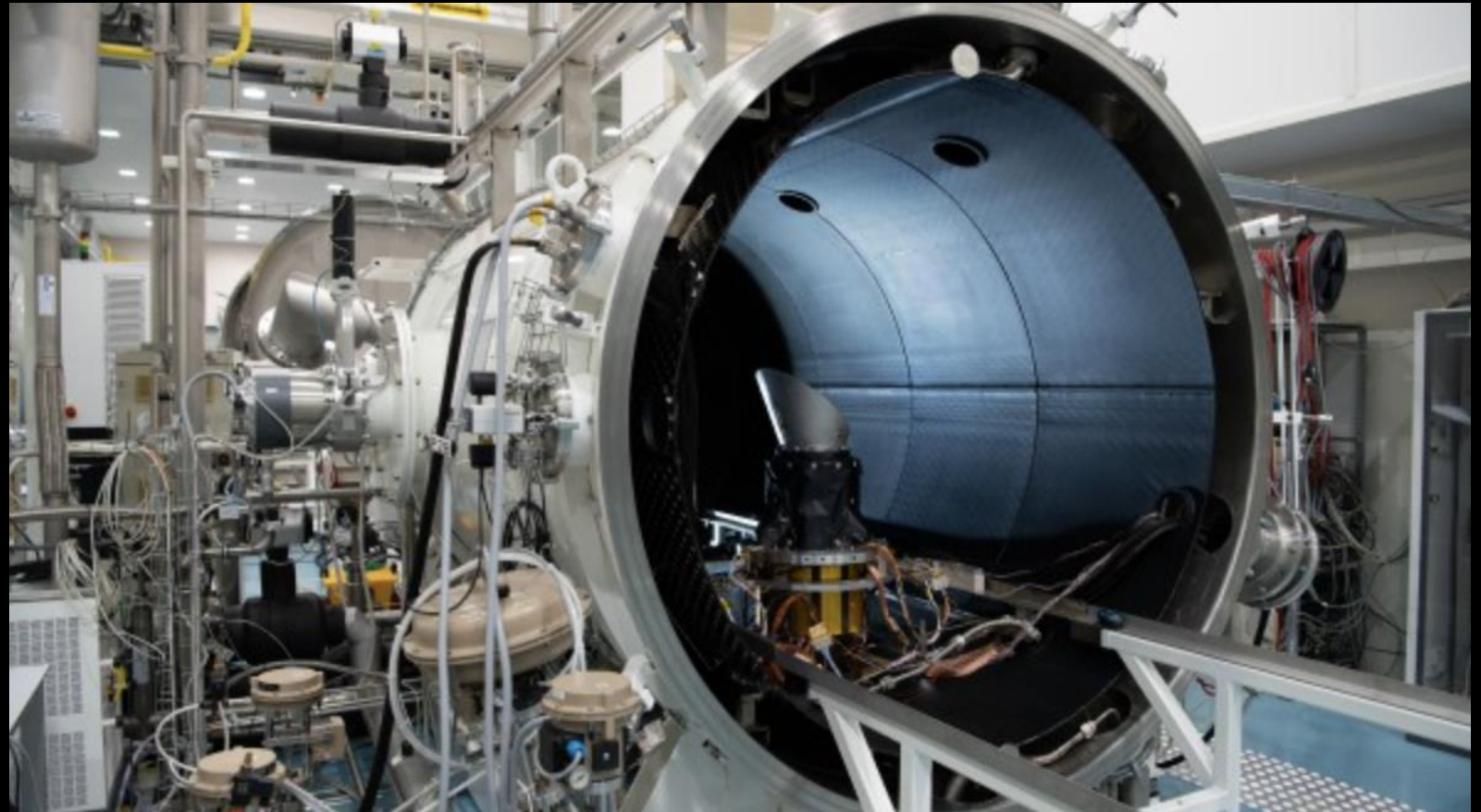
N-Cam

F-Cam

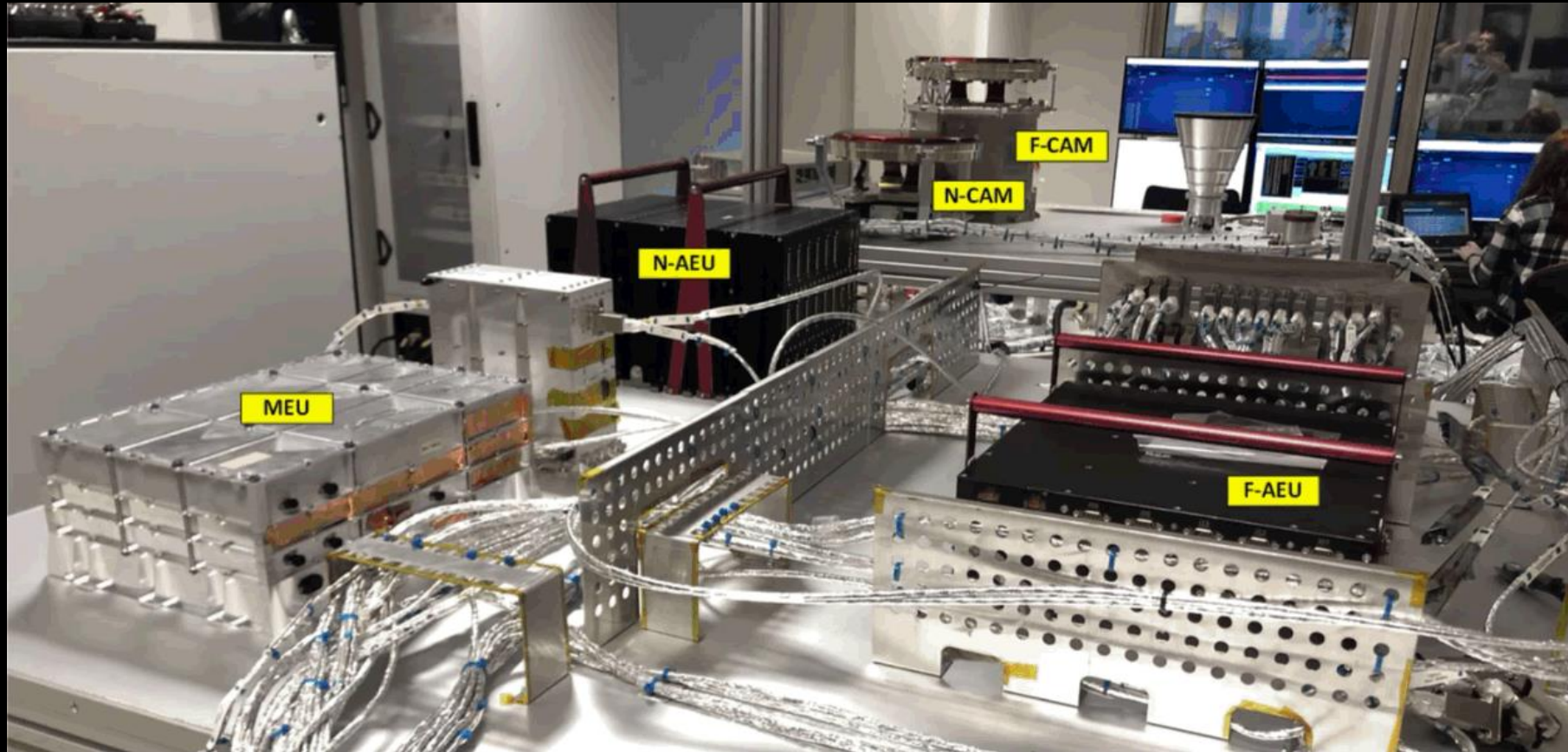


First Models

First camera model undergoing thermal tests in 2021 at ESTEC



Onboard computing



Testing 06-07/2023 at ESTEC

WARWICK

Models undergoing
Testing.

Construction of flight
hardware ongoing.



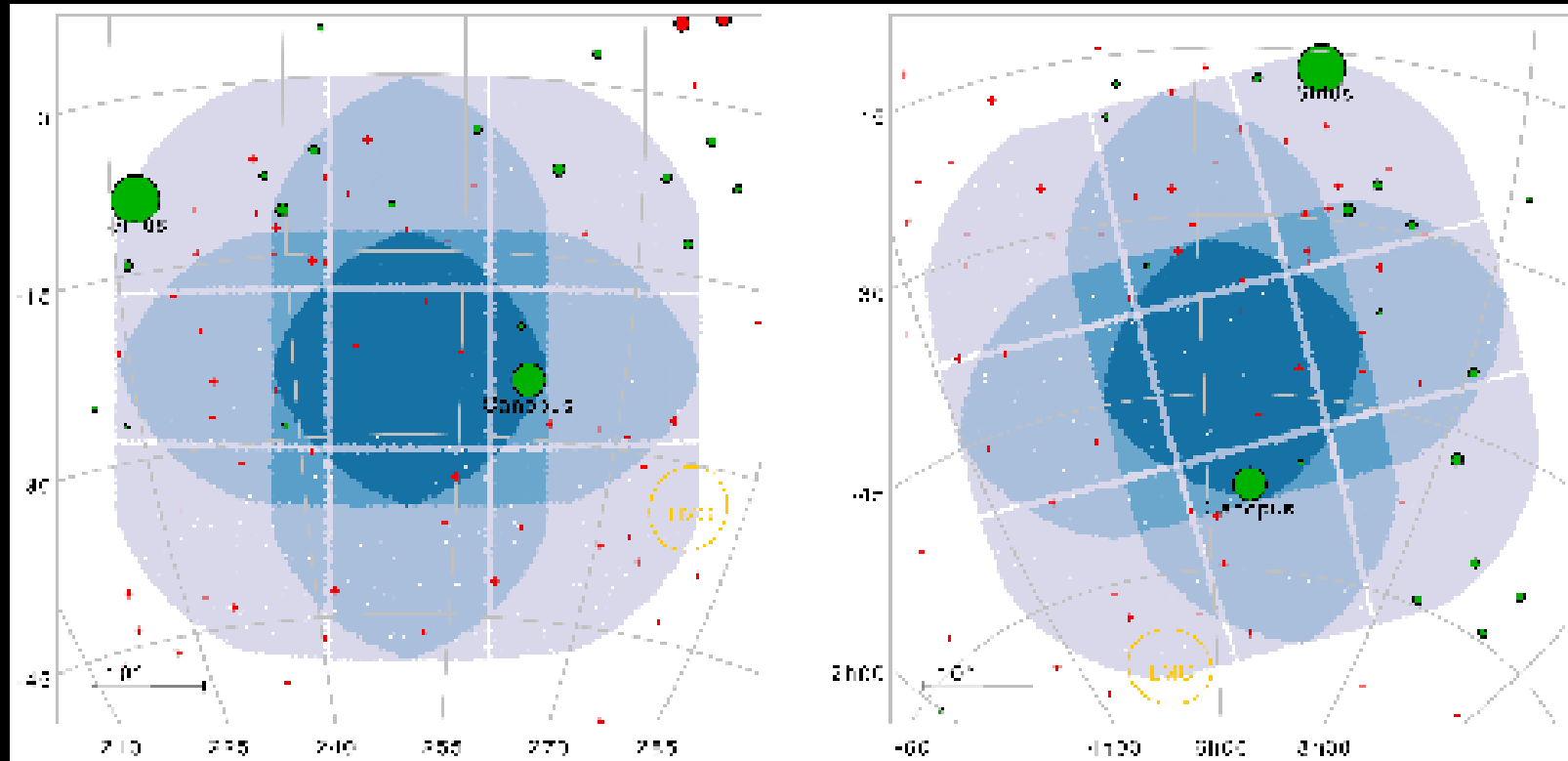
Current Status

- Payload passed Critical Milestone review
- Payload passed CDR etc
- Serial production of cameras continuing more or less as expected

- Ground based requirements review completed
- Working towards ground based design review
- Ground based segment (pipelines etc) under construction

- Agreement signed with 4MOST consortium for high resolution, high snr spectra of all L1-L5 stars
- Ground based observation programme currently being defined
- First field has been selected (Southern Hemisphere)

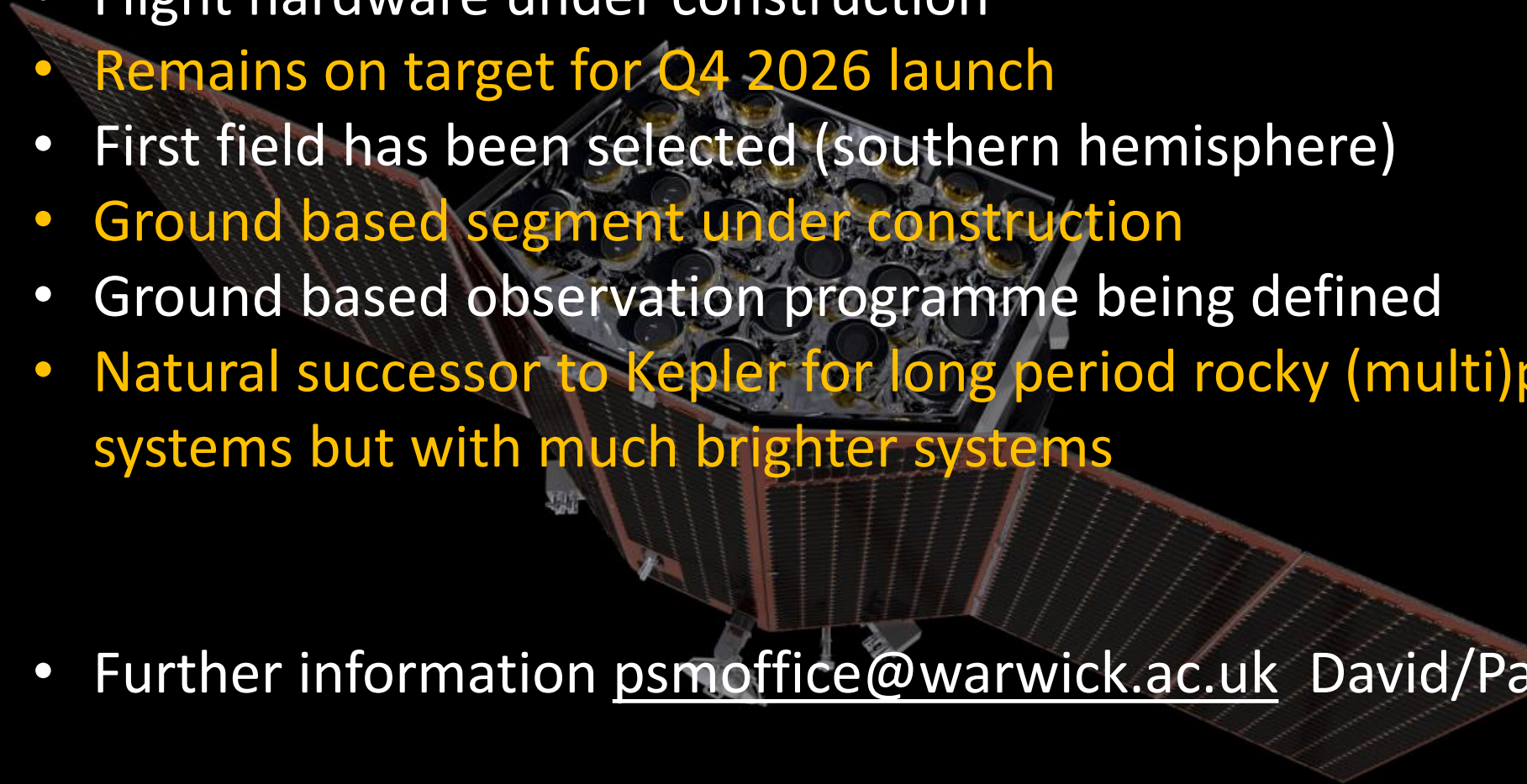
First Field – Southern Hemisphere



Time to think/implement “follow up” campaigns on PLATO stars

Summary

- Flight hardware under construction
- Remains on target for Q4 2026 launch
- First field has been selected (southern hemisphere)
- Ground based segment under construction
- Ground based observation programme being defined
- Natural successor to Kepler for long period rocky (multi)planet systems but with much brighter systems
- Further information psmoffice@warwick.ac.uk David/Paul/Tom



Relevant Upcoming Meetings

- *PLATO Planets: formation to current architectures*

ESP2024, *Date to be finalised 2024*, Catania, Sicily

Details available from September/October on platoesp.org

The PLATO Mission has always been completely open to new consortium members



