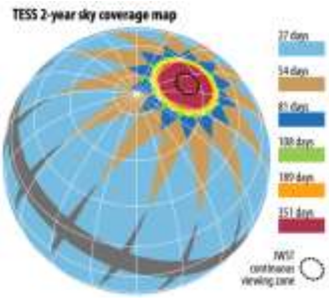
TESS and PLATO at a glance

PLATO Science Management Office, 3rd March 2019

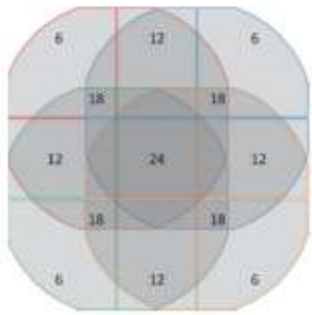
With the imminent launch of the Transiting Exoplanet Survey Satellite (TESS), it is useful to remind ourselves of the similarities and differences between this and our own PLATO Mission. When TESS is launched there will be considerable publicity, some of which will be ill-informed, so it's worth having at our finger tips the differences both technically, and especially scientifically, between the two missions.

Superficially, TESS and PLATO appear to have similar aims, i.e. the detection of exoplanets via the transit technique, and both place particular emphasis on bright stars as targets. While TESS is prioritizing the detection of rocky planets around M-dwarfs, PLATO is designed for the detection and accurate characterisation of Earth-sized planets in the habitable zones of Sun-like stars. These science drivers inform the different spacecraft designs.

The TESS payload comprises 4 identical cameras of 10cm aperture with their fields of view consecutively aligned (covering 90 degrees of latitude). The spacecraft will be inserted into a highly eccentric and inclined orbit moving between the Earth and the Moon's orbit. While each orbit takes 13.5 days, the spacecraft will be able to spend 27 days looking at a single band of celestial longitude before moving to the next. In this way, an entire hemisphere can be mapped in a single year. Most of the sky will receive 27 days of continuous observations, while a small area around the poles will get more or less continuous coverage for the entire year. While the brightest TESS targets are naked eye stars, the bulk of M-dwarfs are relatively faint for the instrument, and simulations show that in its prime mission, TESS may expect to detect a small handful (maybe 2) of M-dwarf habitable zone rocky planets. There is controversy in the literature as to whether these planets would be good abodes for life. On the one hand, M-dwarfs are the most common stars, and spend many billions of years in their main sequence state. On the other hand, many of them are highly active, with frequent large flare events. It is not at all clear whether planets around these stars can retain their atmospheres under the intense UV and X-ray bombardment from flare activity. Also, the rotation of these planets is gravitationally captured by the host star and so one side of the planet is in perpetual star light and the other darkness. Small planets around M-dwards may be another new planet, providing exciting discoveries in the years to come.



The final design for the PLATO spacecraft has 24 cameras of 12cm entrance pupil diameter, arranged in four groups of 6 with overlapping fields of view. This configuration gives increased sensitivity with an effective lens diameter of >60cm in the central area. PLATO will be placed at L2 and will not survey the whole sky, instead staring for two or more years at a single, large area of sky. This enables PLATO to obtain long data streams (years) and detect long period, small planets around Sun-like stars. These stars are generally less active, and for the orbits explored by PLATO this low level of stellar radiation should not be a hindrance to habitability. PLATO data will also be ideal for obtaining seismology information on the host stars, enabling *accurate*, highly precise physical parameters for the star *and planet* to be determined (radii and ages). Furthermore, the PLATO data products include accurate planetary masses - for many planets this will be achieved through an extensive ground-based campaign, which will be organised within the PLATO project.



For more information, please contact the PSM Office (psmoffice@warwick.ac.uk).

	PLATO	TESS
Telescope aperture	12cm	10cm
Telescope field of view	1037 deg^2	576 deg^2
Number of telescopes	24	4
Telescope arrangement	Four groups of six. Each group points together. Groups have overlapping fields-of-view.	Adjacent pointing to give strip-like field-of-view
Total field of view (per pointing)	2232 deg^2	2304 deg^2
Time per pointing	2+ years	27 days
Number of pointings	2	30
Pixel size	15 arcseconds	21 arcseconds
Wavelength range	500-1000nm	600-1000nm
Cadence	25s (for main sample, M-dwarfs, brightest stars) 600s (for statistical sample of ≥245,000 stars)	120s (for brightest 200,000 stars) 1800s (full frame images)
Main targets	Bright, Sun-like stars	Bright, M-dwarf stars
Main objective	Earth-sized planets in the habitable zone	Rocky planets
Number of stars	≥265,000	≥500,000
Noise	≤34ppm in 1hr (for main sample) ≤800ppm in 1hr (for M-dwarfs)	≤200ppm in 1hr
Predicted yield	>4,000 planets 2-120 small planets in habitable zone of solar-like stars	~1,700 planets 640-1340 planets around M-dwarfs 1-4 small planets in the habitable zones around M-dwarfs
Nominal mission duration	4 years	2 years
Location	L2 (1.5 million km from Earth)	Orbiting between Earth and the Moon's orbit (384,000km from the Earth)