

Artist concept of NASA's Transiting Exoplanet Survey Satellite (TESS) observing an M dwarf star with orbiting planets. Image Credit: NASA's Goddard Space Flight Center

The Transiting Exoplanet Survey Satellite (TESS)

The Mission

The **Transiting Exoplanet Survey Satellite (TESS)** is a NASA-sponsored Astrophysics Explorer-class mission, operated by MIT that is performing a near all-sky survey to search for planets transiting nearby stars.

The primary goal of the mission was to discover a pool of small planets transiting small stars which are still bright enough to enable follow-up spectroscopic observations that could provide planet masses and atmospheric compositions.

Launched April 18th, 2018, TESS completed its primary mission in July of 2020. It then entered its first extended mission, which will complete in September 2022.

In its extended mission, TESS is far more community-focused, with a large Guest Investigator (GI) program. The science now performed by TESS focuses not only on exoplanets, but also on several other areas of astrophysics including accretion physics, stellar flares, and transients, like supernovae.

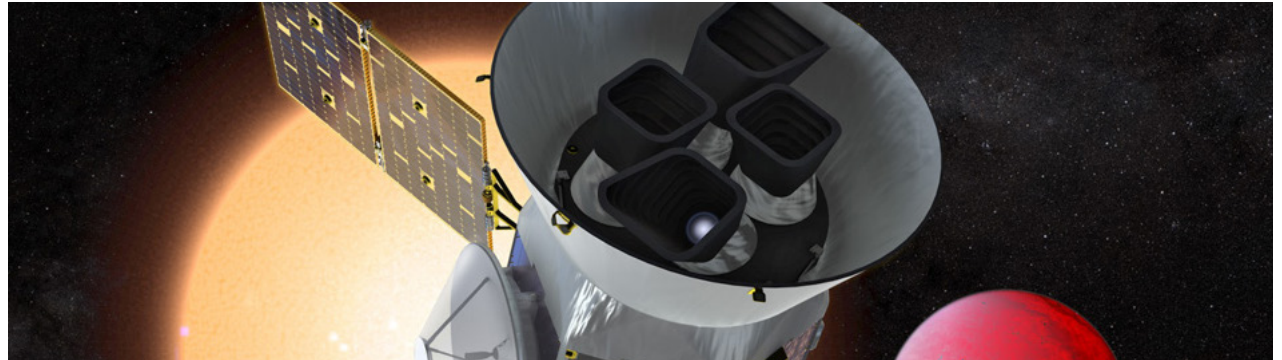
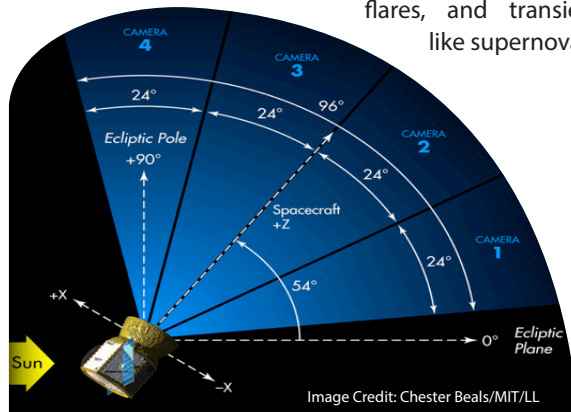


Illustration of NASA's Transiting Exoplanet Survey Satellite (TESS), in front of a lava planet orbiting its host star. Image Credit: NASA's Goddard Space Flight Center

Observations

TESS observes from a unique, high-altitude, lunar-synchronous orbit around the Earth: elliptical and tilted high above the plane of the Earth-Moon orbit. This orbit provides an unobstructed view of the sky for ~13 days, allowing the mission to obtain continuous light curves over long periods.

The instrument has four CCD cameras, each with a field-of-view of 24 x 24 degrees, arranged in a 4 x 1 array, creating a combined field-of-view of 96 x 24 degrees, as illustrated to the left. The cameras observe a particular part of the sky for two orbits, or one Sector, for approximately 27 days. The instrument observes in a broad red bandpass.

Data Products

The mission produces several kinds of data products:

- Full Frame Images (FFIs): These are stacked images from each of the four TESS cameras. Individual two-second

exposures are summed to form images with longer exposure times. In the primary mission, these images were created at a cadence of 30 minutes. In the extended mission, the cadence is 10 minutes.

- Target Pixel Files (TPFs): For a select number of targets, pixels from a small (11x11 pixel) region of the CCD, centered on the object of interest, are stacked to create TPFs, which are a time-series of images for that object. TPFs were created at a 2-minute cadence in the primary mission, and in the extended, they have a 2-minute or 20-second cadence.
- Light Curve Files: These are files that contain flux time series data and are produced for each 2-minute and 20-second cadenced target.

TESS's ~27 day continuous coverage per Sector, wide field of view, and high-cadenced observations, make it extremely useful for the study of all kinds of astrophysical phenomena. It will continue to yield significant scientific results in its extended mission and beyond.