National Aeronautics and Space Administration

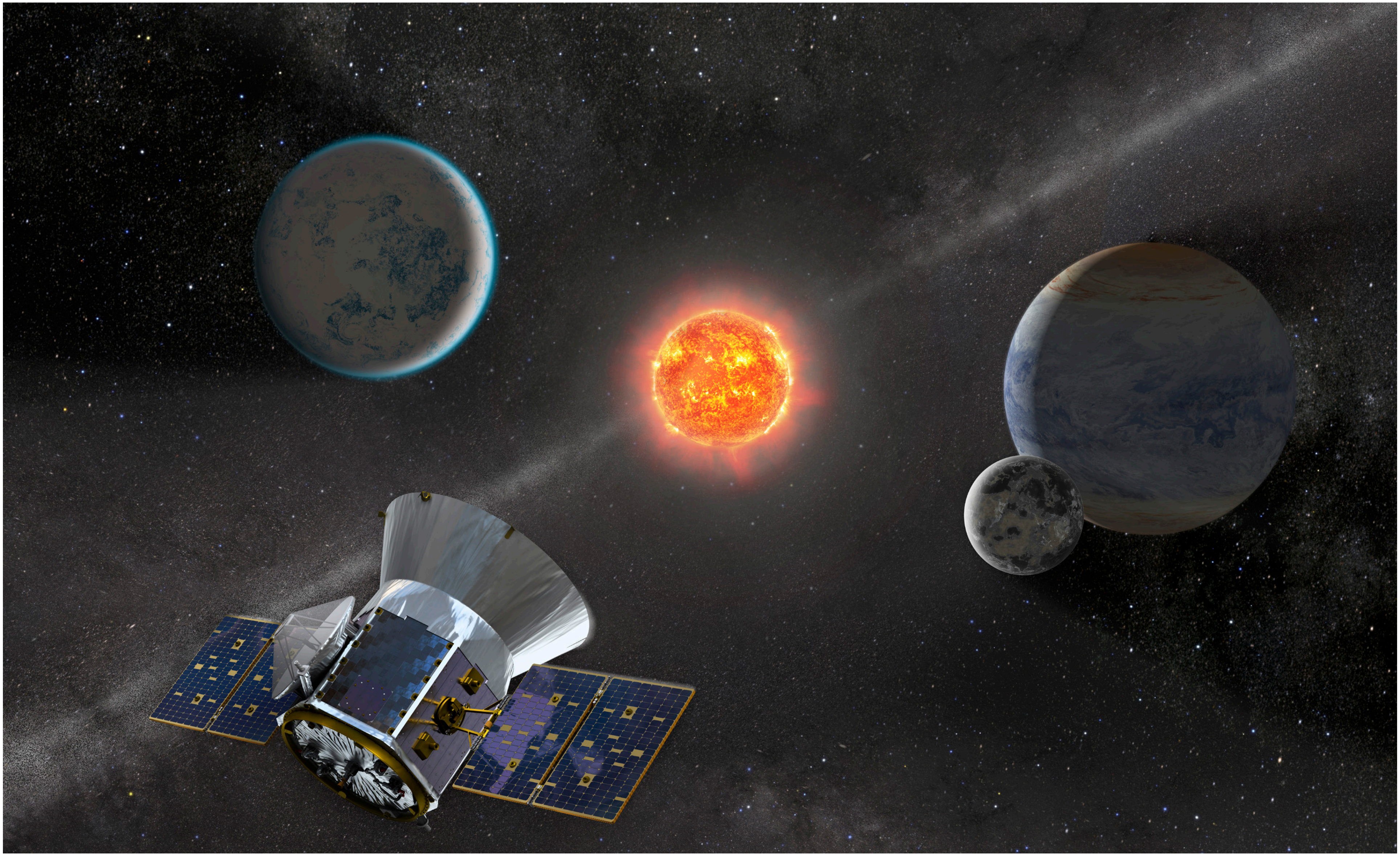


Illustration of NASA's Transiting Exoplanet Survey Satellite (TESS) observing an M dwarf star with orbiting planets. Credit: NASA's Goddard Space Flight Center

The Transiting Exoplanet Survey Satellite (TESS)

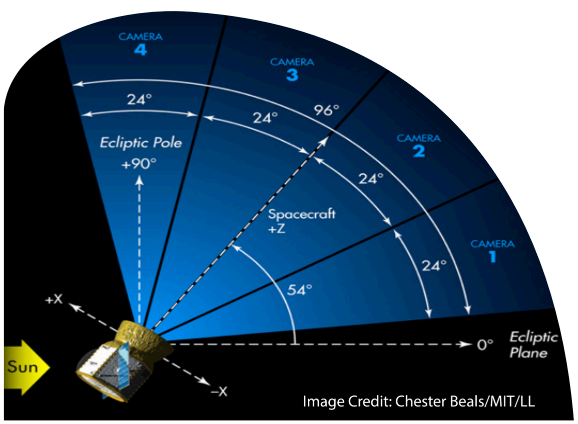
The Mission

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

The primary goal of the mission was to discover small planets transiting in front of small stars which are bright enough for follow-up spectroscopic observations. These additional measurements could provide information on a planet's mass or atmospheric composition.

Launched April 18, 2018, TESS completed its primary mission in July 2020. It then entered its extended mission.

In its extended mission, TESS is far more community-focused, with a large General Investigator program. The science now performed by TESS has expanded to include topics such as accretion physics, stellar flares, and transients like supernovae and tidal disruption events.



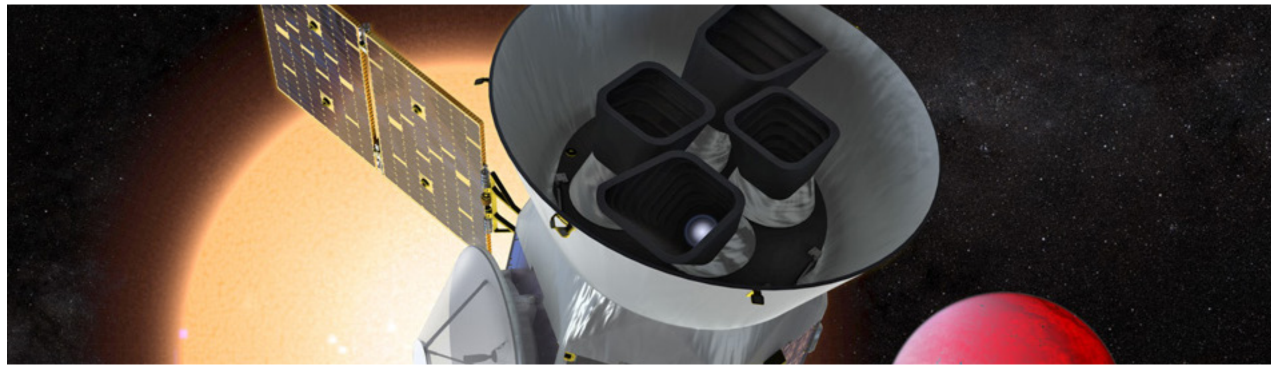


Illustration of NASA's Transiting Exoplanet Survey Satellite (TESS) in front of a lava planet orbiting its host star. Credit: NASA's Goddard Space Flight Center

Observations

TESS observes from a unique, high-altitude, lunar-synchronous orbit around the Earth; it is 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 shown at lower left. The cameras observe a particular part of the sky, known as a Sector, for approximately 27 days before moving on to the next Sector. The instrument observes in a broad red bandpass.

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-min. In the extended mission this cadence increased to 10-min, and as of September 2022, FFIs have a cadence of 200-sec.
- Target Pixel Files (TPFs): For a select number of targets, pixels from a small 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-min cadence in the primary mission, and in the extended, they can be made with either a 2-min or 20-sec cadence.
- Light Curve Files: These contain flux time series data and are produced for each 2-min and 20-sec cadenced target.

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

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