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The Transiting Exoplanet Survey Satellite (TESS): Searching for Planets Around Nearby Stars

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Abstract

The Transiting Exoplanet Survey Satellite (TESS) is a NASA Explorer mission designed to find thousands of new exoplanets around bright, nearby stars. TESS was selected for Phase A (preliminary) design by NASA in 2011, and over the following seven years a wide array of partners worked together to make the mission a reality. TESS launched successfully on April 18, 2018, from Kennedy Space Center. Following the Commissioning period, TESS will enter science operation in June 2018. At this meeting, we will present the design of the TESS instrument along with the latest available information on instrument performance.

1. Introduction

At the time of this writing (May 15, 2018), TESS is still in the Commissioning phase. Early analysis of Commissioning data shows that the spacecraft and instrument are both performing well. Below, we briefly discuss the mission. A detailed discussion of the TESS instrument design can be found elsewhere [1].

2. The TESS Mission

The TESS instrument consists of four wide-field cameras, developed at Lincoln Laboratory and MIT's Kavli Institute, each with a field-of-view of 24°×24°; the four camera fields are lined up to give an instantaneous field of view of 24°×96°, extending from 6° above the ecliptic plane to 12° past the ecliptic pole. TESS stares at a given field, referred to as an observation sector, for two orbits (each orbit is 13.7 days), the advances forward to the next sector. In the first year of science operation, TESS will observe 13 sectors in the southern hemisphere, covering approximately 85% of the southern sky. This pattern will be repeated in the second year for the northern hemisphere.

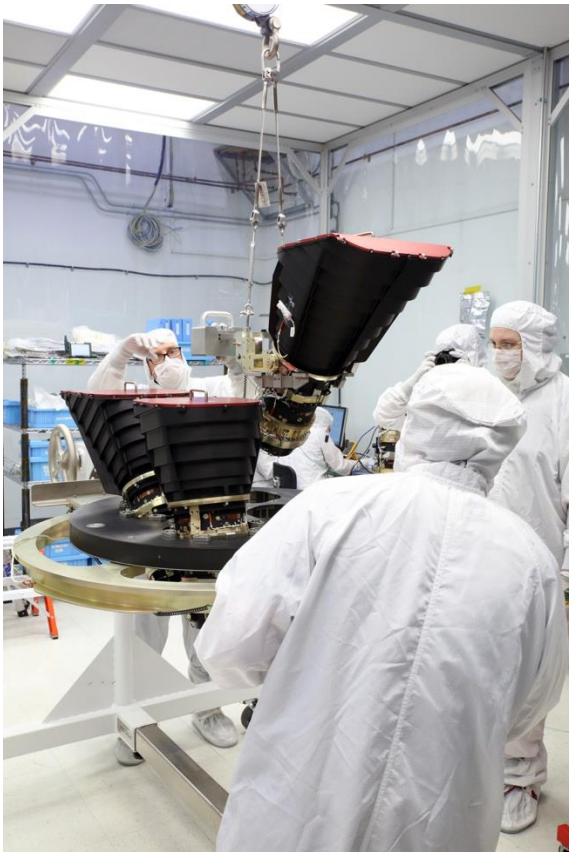

Figure 1: The TESS cameras were integrated into the spacecraft at Orbital/ATK in Sterling, VA.

During the two-year prime mission, TESS will operate with two simultaneous data modes; for 200,000 stars, TESS will collect "postage stamp" data at a 2-minute cadence, spread across all 26 observation sectors. It will also collect full-frame images, encompassing the entire field-of-view, every 30 minutes.

Data from the spacecraft is downlinked once per orbit, and is subsequently processed at NASA's Ames Research Center, using a data reduction pipeline developed upon the Kepler pipeline. Once data reduction is complete, the processed data goes to the TESS Science Office at MIT for validation and verification. The first data release will occur 6 months after the start of science operations.

Figure 2: TESS, fully integrated at Orbital/ATK.

3. Expectations

TESS is expected to find thousands of new exoplanet candidates, from both the postage-stamp data and the full-frame images [2, 3]. With follow-up observations, both funded through the TESS Project and through the efforts of the broader community, it will be possible to confirm a significant fraction of these candidates. And, because these planets will be around relatively bright stars (typically 30-100x brighter than Kepler targets), they will be ideal candidates for follow-up observations with JWST, Ariel, and future large ground-based telescopes.

Acknowledgements

TESS is a NASA Astrophysics Explorer mission led and operated by MIT in Cambridge, Massachusetts, and managed by NASA's Goddard Space Flight Center in Greenbelt, Maryland. Dr. George Ricker of MIT's Kavli Institute for Astrophysics and Space Research serves as principal investigator for the mission. Additional partners include Orbital ATK, NASA's Ames Research Center, the Harvard-Smithsonian Center for Astrophysics and the Space Telescope Science Institute. More than a dozen universities, research institutes and observatories worldwide are participants in the mission.

References

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