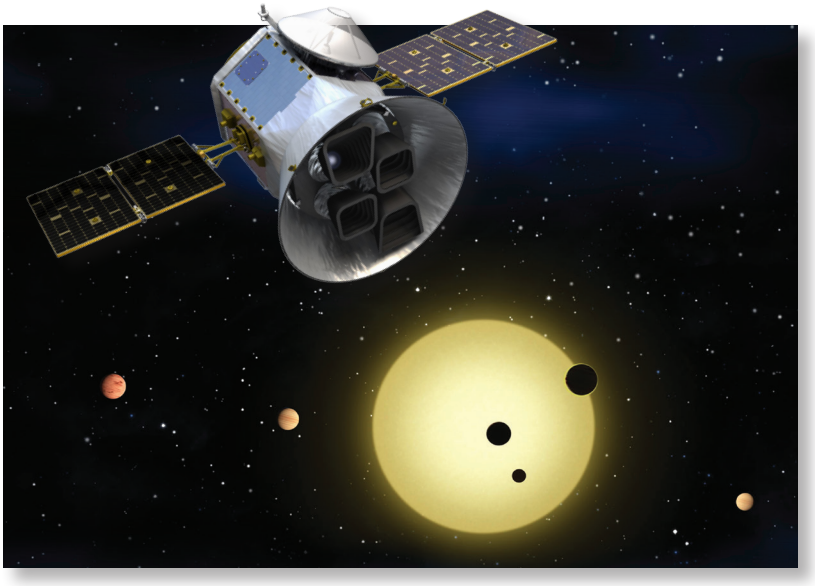
National Aeronautics and Space Administration

NASAfacts

TESS

Transiting Exoplanet Survey Satellite

DISCOVERING NEW EARTHS AND SUPER-EARTHS IN THE SOLAR NEIGHBORHOOD



The Transiting Exoplanet Survey Satellite (TESS) is an Explorer-class planet finder. In the first-ever spaceborne all-sky transit survey, TESS will identify planets ranging from Earth-sized to gas giants, orbiting a wide range of stellar types and orbital distances. The principal goal of the TESS mission is to detect small planets with bright host stars in the solar neighborhood, so that detailed characterizations of the planets and their atmospheres can be performed.

TESS will monitor the brightnesses of more than 500,000 stars during a two year mission, searching for temporary drops in brightness caused by planetary transits. Transits occur when a planet's orbit carries it directly in front of its parent star as viewed from Earth. TESS is expected to catalog more than 3000 transiting exoplanet candidates, including a sample of ~500 Earth-sized and 'Super Earth' planets, with radii less than twice that of the Earth. TESS will detect small rock-and-ice planets orbiting a diverse range of stellar types and covering a wide span of orbital periods, including rocky worlds in the habitable zones of their host stars.

TESS stars will be 30-100 times brighter than those surveyed by the Kepler satellite; thus,TESS planets should be far easier to characterize with follow-up observations. These follow-up observations will provide refined measurements of the planet masses, sizes, densities, and atmospheric properties.

TESS will provide prime targets for further, more detailed characterization with the James Webb Space Telescope (JWST), as well as other large ground-based and space-based telescopes of the future. TESS's legacy will be a catalog of the nearest and brightest stars hosting transiting exoplanets, which will comprise the most favorable targets for detailed investigations in the coming decades.

TESS team partners include the Massachusetts Institute of Technology (MIT) Kavli Institute for Astrophysics and Space Research (MKI), NASA's Goddard Space Flight Center (GSFC); MIT Lincoln Laboratory (LL); Orbital ATK (OA); NASA's Ames Research Center (ARC); the Harvard-Smithsonian Center for Astrophysics (SAO); and the Space Telescope Science Institute (STScI).

TESS has been selected by NASA for launch in 2017 as an Astrophysics Explorer mission.

TESS SCIENCE OBJECTIVES

DISCOVER TRANSITING EXOPLANETS ORBITING NEARBY, BRIGHT STARS

The NASA Kepler Mission showed that planets are abundant throughout the Galaxy, but most of the Kepler planets orbit stars too distant for further study. The NASA TESS Mission will find exoplanets transiting nearby, bright stars: the best targets for followup characterization with large ground telescopes, the Hubble Space Telescope, and the James Webb Space Telescope.

TESS is designed to:

- Monitor 500,000 nearby stars for planets
- Focus on Earth and Super-Earth size planets
- Cover 400X larger sky area than Kepler
- Span stellar spectral types of F5 to M5

Transiting exoplanets allow us to observe the following for those planets that transit nearby bright stars:

- Fundamental properties: mass, radius, orbit
- Dynamics: planet-planet interactions, mutual inclinations, moons, tides
- Atmospheric composition + structure: transmission spectrum, emission spectrum, albedo, phase function, clouds, winds

TESS MISSION OVERVIEW

ALL-SKY, TWO YEAR PHOTOMETRIC EXOPLANET DISCOVERY MISSION

TESS will tile the sky with 26 observation sectors:

- At least 27 days staring at each 24° x 96° sector
- Brightest 100,000 stars at 1-minute cadence
- Full frame images with 30-minute cadence
- Map Northern hemisphere in first year
- Map Southern hemisphere in second year
- Sectors overlap at ecliptic poles for sensitivity to smaller and longer period planets in JWST Continuous Viewing Zone (CVZ)

TESS observes from unique High Earth Orbit (HEO):

- Unobstructed view for continuous light curves
- Two 13.7 day orbits per observation sector
- Stable 2:1 resonance with Moon's orbit
- Thermally stable and low-radiation

TESS SCIENCE INSTRUMENT

FOUR WIDE FIELD-OF-VIEW CCD CAMERAS

Each of the four cameras has:

- 24° x 24° Field-of-View
- 100 mm effective pupil diameter
- Lens assembly with 7 optical elements
- Athermal design
- 600nm – 1000nm bandpass
- 16.8 Megapixel, low-noise, low-power, MIT Lincoln Lab CCID-80 detector

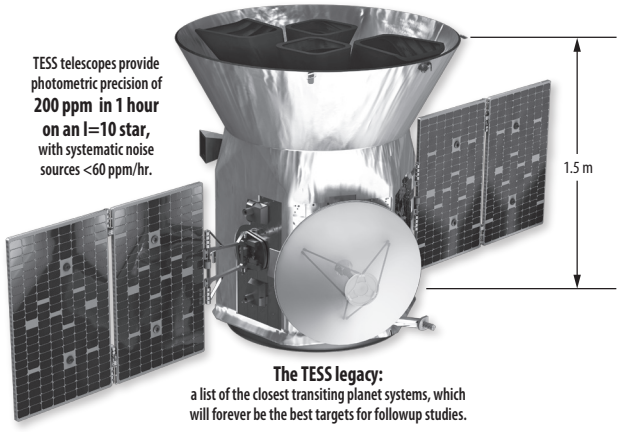
TESS SPACECRAFT

DESIGNED FOR PHOTOMETRIC STABILITY

Heritage Orbital LEOStar-2 spacecraft bus:

- 3-axis stabilized pointing, with ≤3 arc-sec performance
- Two-headed star tracker; 4 wheel zero-momentum system
- 400W single-axis articulating solar array
- Passive thermal control
- Mono-propellant propulsion system
- Ka-band 100 Mbps science downlink

TESS will launch in 2017, in time to find planets for JWST to observe.



The TESS legacy:
a list of the closest transiting planet systems, which will forever be the best targets for followup studies.

For more information, please visit our web site:
http://tess.gsfc.nasa.gov

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