TESS Update:
Data Release & Candidate Identification

Natalie Batalha (JSTUC)

With slides from George Ricker (APAC presentation), Paul Hertz (APAC presentation), Sara Seager, Ian Crossfield, and Eliza Kempton
<table>
<thead>
<tr>
<th>Sun</th>
<th>Mon</th>
<th>Tue</th>
<th>Wed</th>
<th>Thu</th>
<th>Fri</th>
<th>Sat</th>
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<td>CRS-14 Launch LC40</td>
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<td>Launch Rehearsal</td>
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<td>Encapsulate</td>
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<td>Encapsulate</td>
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<td>Dress Rehearsal</td>
<td>FRR</td>
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<td>15 Reserve</td>
<td>16 Roll Out</td>
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<td>LRR</td>
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<td>Launch 6:32 pm EDT</td>
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<td>25</td>
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<tr>
<td></td>
<td>No Launch Opportunity</td>
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<td>Launch 12:03 am EDT</td>
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<td>45 Day Stand Down Through June 9th For InSight Launch</td>
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</table>

**Current TESS Schedule Flow - April 2018**

- **5/6/18**
- **Today's Events:**
**APR 2018**: Launch
-- 4/25: Ka Transmitter turned on
-- 4/25: Received packets at DSN without errors
-- 4/30: All four cameras powered on
-- 5/01: Spacecraft put into fine point

**JUN 2018**: Sci Ops
Two Year Interval Between TESS & JWST

NASA’s Exoplanet Missions

TESS
16 April 2018

Harbuck
Spitzer
Kepler

TESS Prime Mission Duration = 2 years

Ground-based Observatories

Webb 2020

WFIRST

Future Exoplanet Missions
<table>
<thead>
<tr>
<th>Sector</th>
<th>Observations Start</th>
<th>Observations Stop</th>
<th>Notional Date for Data Availability at MAST</th>
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<tbody>
<tr>
<td>Commissioning</td>
<td>launch</td>
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<tr>
<td>S001</td>
<td>launch + 2 months</td>
<td>launch + 3 months</td>
<td>6 months after start of S001</td>
</tr>
<tr>
<td>S002</td>
<td>launch + 3 months</td>
<td>launch + 4 months</td>
<td>6 months after start of S001</td>
</tr>
<tr>
<td>S003</td>
<td>launch + 4 months</td>
<td>launch + 5 months</td>
<td>6 months after start of S001</td>
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<tr>
<td>S004</td>
<td>launch + 5 months</td>
<td>launch + 6 months</td>
<td>6 months after start of S001</td>
</tr>
<tr>
<td>S005</td>
<td>launch + 6 months</td>
<td>launch + 7 months</td>
<td>7 months after start of S001</td>
</tr>
<tr>
<td>S006</td>
<td>launch + 7 months</td>
<td>launch + 8 months</td>
<td>8 months after start of S001</td>
</tr>
<tr>
<td>S007</td>
<td>launch + 8 months</td>
<td>launch + 9 months</td>
<td>9 months after start of S001</td>
</tr>
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<tr>
<td>S013</td>
<td>launch + 14 months</td>
<td>launch + 15 months</td>
<td>15 months after start of S001</td>
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</table>

JUN | JUL | AUG | SEP | OCT | NOV | DEC |

Table is from TESS SDMP
TESS Data Timeline

-27 days Sector Observations Start

+0 Raw Data Transfer POC to SPOC

+ 55 days Level 1-5 SPOC to POC (to TSO)

+ 7 days Level 1-5 Delivery to MAST

+ < 60 days TOI List Delivery to MAST

From TESS SDMP
*Sectors 1 through 4 delivered 6 months after sector 1 downlink
These yield numbers are the highest expected per sector; the average will be about half

- Yields based on simulations paper (Sullivan et al. 2015).

A vetting team reviews all the available data and identifies ~100 planet candidates per sector

- Lists of TOIs are delivered to MAST
- The TSO coordinates follow-up observations by funded facilities and the Community
Candidate Identification Process

1. **TOI Process**
   - SPOC products
   - 2 minute cadence
   - PV/DV vetted manually and by computer

2. **TOI QLP Process**
   - MIT QLP for an early look at FFI and 2 minute cadence data
   - TOI Alerts

3. **TOI List Delivered to MAST**

**NASA-funded formal process of record**

**MIT-internal informal process**
**Milestones**

**APR 2018:** Launch
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-- 5/01: Spacecraft put into fine point

**JUN 2018:** Sci Ops

**AUG 2018:** First TOI Alerts (sector 1)

**DEC 2018:** S1-S4 Data Released, including TCE, TOI lists

**FEB 2019:** JWST Cycle 1 Proposal Deadline
TESS Sector pointings are in the anti-Sun direction; fields will set relative to ground-based observatories shortly after the data take. RV mass determinations immediately after candidate identification are not likely.
- Search over 200,000 stars to discover transiting exoplanets with periods < 10 days and radii < 2.5 Re orbiting the brightest stars in the solar neighborhood and discover transiting exoplanets with radii at least 2.5 Re distributed across the celestial sphere.

- Search for transiting exoplanets with periods up to 120 days among the ~10,000 stars in regions surrounding the ecliptic poles;

- Determine the masses for at least 50 transiting exoplanets with radii < 4 Re using ground-based follow-up resources or other methods.
TESS will find hundreds of super-Earths to Neptune-size planets capable of producing higher S/N than known exoplanets but only a few terrestrial-size planets better than TRAPPIST-1, etc...
TESS planet yield is dominated by cooler host stars.

Louie+2018
The best RV targets aren’t necessarily the best JWST targets
- TESS will find very few terrestrial-size planets with NIRISS S/N better than known exoplanets like TRAPPIST-1, GJ1132b, LHS1140b (though dependent on assumed planet occurrence rate).
- TESS will find hundreds of super-Earths to Neptune-size planets capable of producing higher S/N than known exoplanets.
- Predicted S/N is sensitive to assumed planet composition. Mass determinations are important for target selection and the interpretation of JWST data.
- RV target selection based on TESS science goals are not necessarily synergistic with future needs of JWST community.
Spitzer, HST, other transit observations will be important for maintaining accuracy of transit ephemerides.

Spitzer ops extended until Webb is operational (2016 Senior Review)
Dear Members of the JWST Users Committee (JSTUC),

We write to you as members of the transiting exoplanet community to express a concern with the JWST time allocation process and how it may affect the optimal return of high-impact science from the limited-lifetime JWST mission. Our concern initially arose during panel presentations on transiting exoplanet science with JWST at the most recent ExoPAG meeting in January. The issue is related to the balance between small PI-driven proposals and large community-backed legacy proposals. The discussion at the ExoPAG meeting rested on resolving two contradictory facts: 1) the total allocation of JWST time per sub-field is expected to be proportional to proposal pressure and 2) the community (represented at that time by the ExoPAG participants) desires a strategic survey of exoplanets that uniformly samples a range of properties. The latter is not easily achieved by numerous small and independent proposals.

- Legacy exoplanet science with JWST: demographics of exoplanet atmospheres over a range of star types, planet sizes, and instellation levels.
- Proposal-pressure driving telescope allocation across sub-disciplines seems to be at odds with the desire for a strategic survey.
Conclusions

- Successful launch, nominal commissioning and orbit insertion to date. Science ops scheduled to begin late June, early July.
- Sector 1 – 4 “quick-look” pipeline and rapid follow-up may yield interesting targets in time for Cycle 1 proposal deadline.
- Sector 1 – 4 data and TOI catalog will be released December 2018, in advance of the Cycle 1 deadline. Monthly cadence thereafter (assuming nominal instrument and pipeline performance).
- Separate Follow-Up and JWST Working Groups may have competing interests, different requirements, and different priorities.
- Community has raised concerns about the feasibility of long-term, large surveys and time allocation across disciplines.