



Pre-proposal Briefing:
2015 Strategic Astrophysics Technology (SAT)
Solicitation
Technology Development for Exoplanet
Missions (TDEM) Element

Introduction and Overview

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The Strategic Astrophysics Technology (SAT) Program

- The Strategic Astrophysics Technology (SAT) program was established by NASA's Astrophysics Division to support the maturation of key technologies that will enable future generations of space flight missions to:
 - *explore the nature of the universe at its largest scales and its earliest moments*
 - *study how galaxies and stars formed and evolved to shape the universe we see today*
 - *search out and characterize planets and planetary systems around other stars.*
- The SAT is Composed of three elements:
 - *Technology Development for Exoplanet Missions (TDEM)*
 - *Technology Development for the Cosmic Origins Program (TCOP)*
 - *Technology Development for the Physics of the Cosmos Program (TPCOS)*
- The three SAT elements are coordinated, but operate independently. Each has its own Program Officer and has its own funding line in the associated program—Exoplanet Exploration, Cosmic Origins, Physics of the Cosmos)
 - *TDEM Program Officer: Douglas Hudgins, Douglas.M.Hudgins@nasa.gov*
 - *TCOP Program Officer: Mario Perez, Mario.Perez@nasa.gov*
 - *TPCOS Program Officer: Rita Sambruna, Rita.M.Sambruna@nasa.gov*



- In general, the SAT Program is designed to support the maturation of technologies whose feasibility has already been demonstrated (i.e., TRL 3), to the point where they can be incorporated into NASA flight missions (TRL 6-7).
 - *“TRL” denotes the 9-level “Technology Readiness Level” (TRL) classification system NASA uses to rate the readiness of a particular technology for use in a flight mission.*
 - *TRL definitions are described in detail in the SAT 2015 solicitation and in Appendix E of NASA Procedural Requirement (NPR) 7123.1B (<http://nodis3.gsfc.nasa.gov>; search “7123.1B”).*
- The SAT Program is not intended to support:
 - *basic research into new technologies and initial demonstration of their feasibility (TRL 1-3).*
 - *development of flight hardware (TRL 7-9) for strategic missions*
- **This briefing is specifically for people interested in proposing under the TDEM element of the SAT solicitation.** People with questions about the other elements of the program should contact the appropriate program officer.



The ultimate goal for NASA's Exoplanet Exploration Program (ExEP) as envisioned by the Astro2010 Decadal Survey is a "*New Worlds Mission*" to conduct imaging and spectroscopy of rocky planets in the habitable zones of stars in the Solar neighborhood.

- The TDEM element of the SAT program solicits investigations that will undertake focused development of technologies that will be required to meet this challenge.
- Since its inception in 2009, more that \$25M in funding has been awarded under the TDEM element of the SAT.
- Details of current and past TDEM investigations can be found in the 2016 ExEP Technology Plan Appendix (<http://exep.jpl.nasa.gov/technology/>)



Scope of Program



Areas of technology development solicited under the SAT/TDEM 2015 include:

- **Starlight suppression**
 - *technologies for rejecting scattered starlight to the degree required to image an Earth-like planet around a sun-like star in the Solar neighborhood.*
 - **For coronagraphs**, this includes coronagraph architectures other than those being developed under the WFIRST-AFTA technology development program and includes performance demonstrations with obscured and/or segmented apertures suitable for operation with 10-m-class telescopes.
 - **For starshades**, this includes (a) deployment technologies, (b) shielding concepts and demonstrations, (c) stray light investigation and analyses, (d) systems suitable for operation with 10m-class telescopes.
- **Wavefront sensing and control of scattered starlight**
 - *control algorithms, sensing technology, and deformable mirror technology required to control light paths within coronagraphic systems;*
 - *sensors and algorithms that enable external occulter observatories to move from star to star, and that enable the system to meet and maintain positional stability during science observations.*
- **System performance assessment**
 - *development of high-fidelity, very high density models to infer expected picometer-level on-orbit performance based on nanometer-level ground measurements.*



Scope of Program



- Relevant technology development activities involving ground-based astronomical facilities are allowed, but proposals for suborbital programs are not solicited at this time due to budgetary constraints.
- In addition, proposals in the following areas are **not** solicited under SAT/TDEM 2015:
 - *general technology maturation activities without specific application to the requirements of a future exoplanet direct-detection mission;*
 - *development and maintenance of testing facilities and/or tools that substantively reproduce the capabilities of existing ExEP infrastructure.*
 - *Investigations that advance technologies for future strategic missions with goals other than the direct detection of extrasolar planets, or that would enable ancillary measurements with a direct detection mission that do not directly enhance the ability of the system to isolate and analyze the light from an exoplanet (e.g. astrometry, high-precision photometry, transit spectroscopy);*
 - *Investigations that advance technologies leading to the development of infrared interferometry as the basis for a future strategic exoplanet direct detection mission.*



- Proposals in the following areas are **not** solicited under SAT/TDEM 2015 (continued):
 - *Proposals for the development of technologies for potential competed (e.g., Explorer) exoplanet missions;*
 - *Development of technologies in the following areas:*

<i>Detector Technology</i>	<i>Telescope Assembly Technology</i>	<i>Mirror Technology (except AO as req. for WFSC)</i>
<i>S/C Pointing Control</i>	<i>Formation Flying Technologies**</i>	<i>S/C Sunshields/Thermal Control</i>
<i>Propulsion Systems</i>	<i>Vibration Isolation Systems</i>	

*** except as allowed under wavefront sensing and control of scattered light development area.*

- Additional caution: Proposers are reminded that all proposals must conform to the formatting requirements set forth in the ROSES 2015 NRA (Section IV) and the 2015 NASA Guidebook for Proposers (Section 2). Proposals found to violate these requirements will be penalized, even to the extent of being declined as non-compliant despite their intrinsic merit review.



Scope of Program



- Additional programmatic limitation under SAT/TDEM 2015:
 - *NASA has been studying the use of one of the Astrophysics Focused Telescope Assets (AFTA) telescopes as the basis for the implementation of the WFIRST mission.*
 - *The baseline design concept for this WFIRST-AFTA mission concept includes a coronagraph instrument (CGI).*
 - *NASA has initiated a directed technology development program to advance the technology readiness of the WFIRST-AFTA CGI.*
 - *To avoid redundancy, coronagraph technologies that will be substantively advanced under the WFIRST-AFTA technology development program are not eligible for funding under the auspices of the SAT Program.*
 - *Examples of excluded technologies are:*
 - Masks/apodizers for Shaped-pupil, hybrid Lyot, and Phase-Induced Amplitude Apodization Complex Mask (PIAA-CMC) coronagraphs;
 - Low-order wavefront sensing and control;
 - Data post-processing;
 - System-level performance demonstration and modeling of obscured aperture systems.



Scope of Program



- The ExEP is currently pursuing the establishment of a Starshade Technology Development Project (TDP) analogous to the WFIRST-AFTA coronagraph technology development project.
 - **Goal:** *Advance starshades to a comparable level of technology readiness (i.e. TRL ~ 5) to coronagraphs by the end of the decade.*
 - **Rationale:** *Focused technology development program is more efficient manner to mature a specified technology both in terms of time and in terms of resources.*
 - **Profile:** *Broad community (NASA, academia, industry) integrated into an organized technology development project that enables a systems-level approach to starshade technology development.*
- The establishment of a starshade TDP will not affect the review and selection of SAT/TDEM 2015 proposals.
 - *Relevant proposals that are sufficiently meritorious for selection will be integrated into the Starshade TDP.*
 - *Process entirely analogous to that successfully followed during the establishment of the WFIRST-AFTA coronagraph TDP.*



Programmatic Information



All SAT/TDEM proposals must:

- Provide a convincing case that the maturity of the subject technology falls in the range $3 \leq \text{TRL} < 6$.
 - *It is neither required nor expected that a technology will advance through this TRL range within the period of performance of a single SAT/TDEM investigation.*
 - *The expectation is that investigations will achieve objectively demonstrable advancement of the technology readiness within this range.*
- Make a compelling case that that subject technology is important and relevant to one or more of the SAT/TDEM development focus areas.
- Articulate the expected technology advancement:
 - *Identify initial state of technology readiness*
 - *Identify one or more quantitative milestones that will be achieved over course of proposed development project.*
 - *Identify success criteria for evaluating performance at end of project.*
 - *Provide a detailed schedule for achieving milestones.*



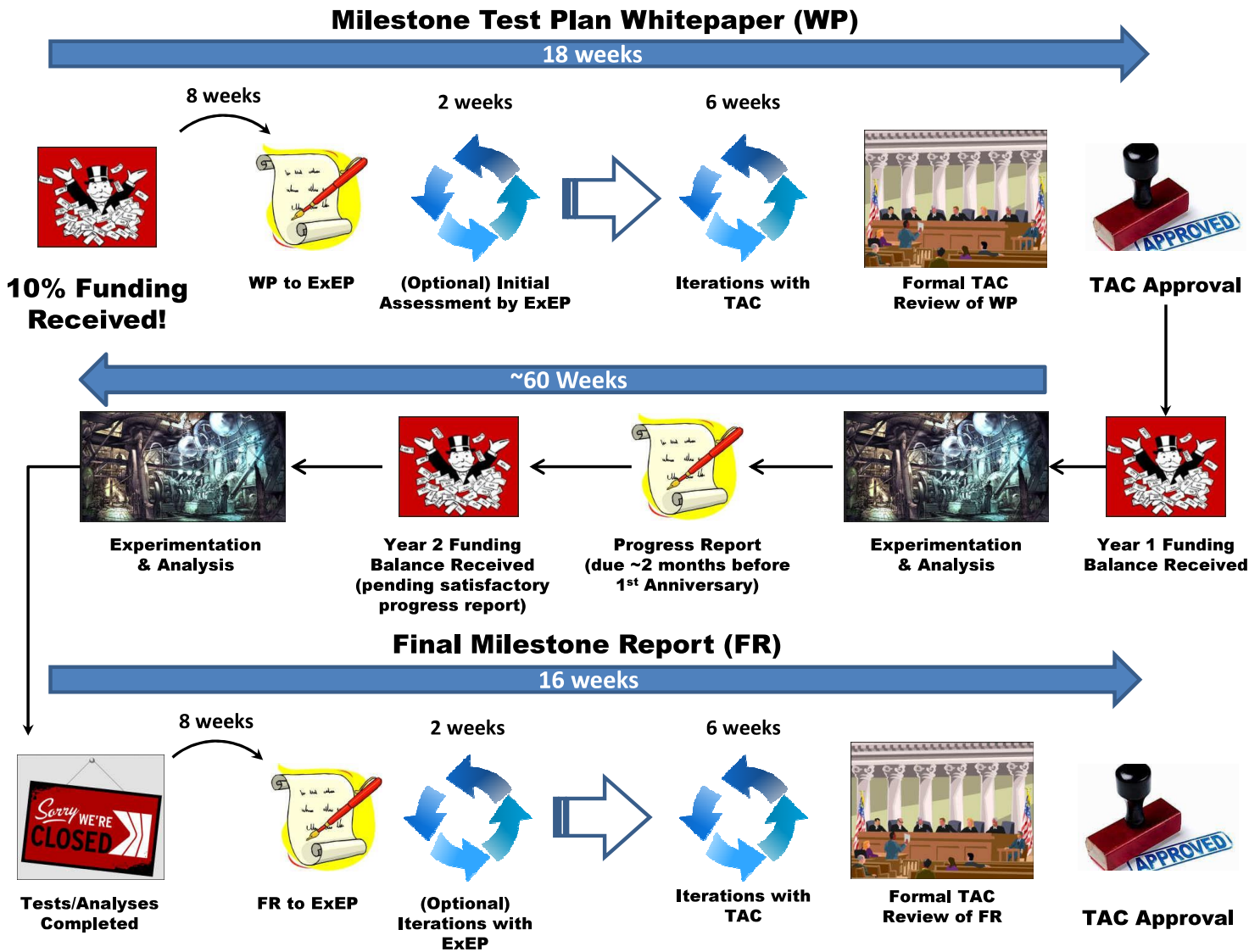
Reporting Requirements



- SAT/TDEM investigators will be contacted periodically by a scheduler from the Exoplanet Exploration Program Office to track the progress of their investigation and ensure timely completion of milestones.
- Annual Progress Report (NASA requirement)
 - A written report, submitted to the SAT/TDEM program officer, detailing the status of the project, progress over the preceding year, and plans for the coming year is required annually.
- Final Report (NASA requirement)
 - Written report submitted at end of second year detailing project performance against proposed success criteria.
- Formal Documentation of Milestones (ExEP requirement)
 - When work begins, success criteria of a technology demonstration is documented in a milestone whitepaper
 - *Reviewed by independent board appointed by NASA Headquarters, and revised as necessary according to review.*
 - Successful achievement of milestone is documented in a second report that shows success criteria have been met (Final Milestone Report)
 - *Also subject to review and verification by independent board.*

The SAT/TDEM White Paper Process

ExoPlanet Exploration Program





4. Summary of Key Information



- Total funding available for new awards: ~\$1.7M in FY17
- Expected number new awards: ~ 3–5
- Expected Period of Performance: 2 or 3 years
- Notices of Intent due: January 22, 2016
- Proposal due date: March 18, 2016
- Planning Date for start of new awards: January 1, 2017
- Website for proposal submission (NSPIRES):
 - <http://nspires.nasaprs.com/>
 - NSPIRES Helpdesk nspires-help@nasaprs.com or (202) 479-9376
- Detailed instructions for proposal preparation
 - NASA 2015 Guidebook for Proposers, <http://www.hq.nasa.gov/office/procurement/nraguidebook/>
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