



Pre-proposal Briefing:
2016 Strategic Astrophysics Technology (SAT)
Solicitation
Technology Development for Exoplanet
Missions (TDEM) Element

Introduction and Overview

January 26, 2017

Douglas M. Hudgins

SAT/TDEM Program Officer, NASA HQ

Presentation materials from this briefing can be downloaded at:
<https://exoplanets.nasa.gov/exep/events/190/>



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 than \$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 2017 ExEP Technology Plan Appendix (release imminent).



Scope of Program



Areas of technology development solicited under the SAT/TDEM 2016 include:

- **Starlight suppression demonstrations**
 - *Demonstration of technologies that will enable a space observatory to reject scattered starlight to the degree that the light of an exoplanet can be separated from that of its parent star (10^{10} contrast ratio at visible wavelengths). For coronagraph technologies, this includes interest in demonstrations with obscured and unobscured, segmented apertures suitable for operation with large space telescopes.*
- **Wavefront stability demonstrations and assessments**
 - *In order to achieve the goal of imaging and characterizing habitable, rocky planets around solar-type stars, future telescope/coronagraph systems will need to conduct long integration observations requiring sub-nanometer wavefront stability. There are many important component and subsystem contributors to achieving this stability goal, and many of those subsystem performances are interdependent and can be traded between each other. Therefore, there is particular interest in end-to-end integrated telescope and coronagraph systems-level engineering design and modeling studies that optimize system-level performance. While there is a focus on system-level investigations, component-level investigations that can be shown to have wavefront and structural stability applications across multiple telescope/coronagraph architectures are also of interest.*



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 2016:
 - *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 2016 (continued):
 - *Proposals for the development of technologies for potential competed (e.g., Explorer) exoplanet missions;*
 - *Development of technologies in the following areas, with the exception of those being part of a systems-wide coronagraph/telescope study:*

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

- Additional caution: Proposers are reminded that all proposals must conform to the formatting requirements set forth in the ROSES 2016 NRA (Section IV) and the 2016 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 limitations under SAT/TDEM 2016:

- Investigations that advance coronagraph technologies to the performance levels being targeted under the WFIRST CGI development which include:
 - masks/apodizers for Shaped-pupil and hybrid Lyot coronagraphs;
 - low-order wavefront sensing and control;
 - data postprocessing;
 - system-level performance demonstration and modeling of obscured, monolithic aperture systems.

Note: The Phase-Induced Amplitude Apodization Complex Mask (PIAA-CMC) coronagraph architecture is no longer subject to this exclusion.

- *NASA has established a directed Starshade Technology Development Activity with the goal of advancing starshades to a technology readiness level suitable for inclusion in a space flight mission beginning in the 2020s.*
 - *Work conducted under this activity will address all aspects of starshade technology, and be prioritized according to the technology gap list published in the ExEP's annual Technology Plan appendix.*
 - *Information about the Starshade Technology Development Activity can be found in the 2017 ExEP Technology Plan appendix.*
 - *Consequently, investigations that advance starshade technologies are not eligible for funding under the SAT program.*



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

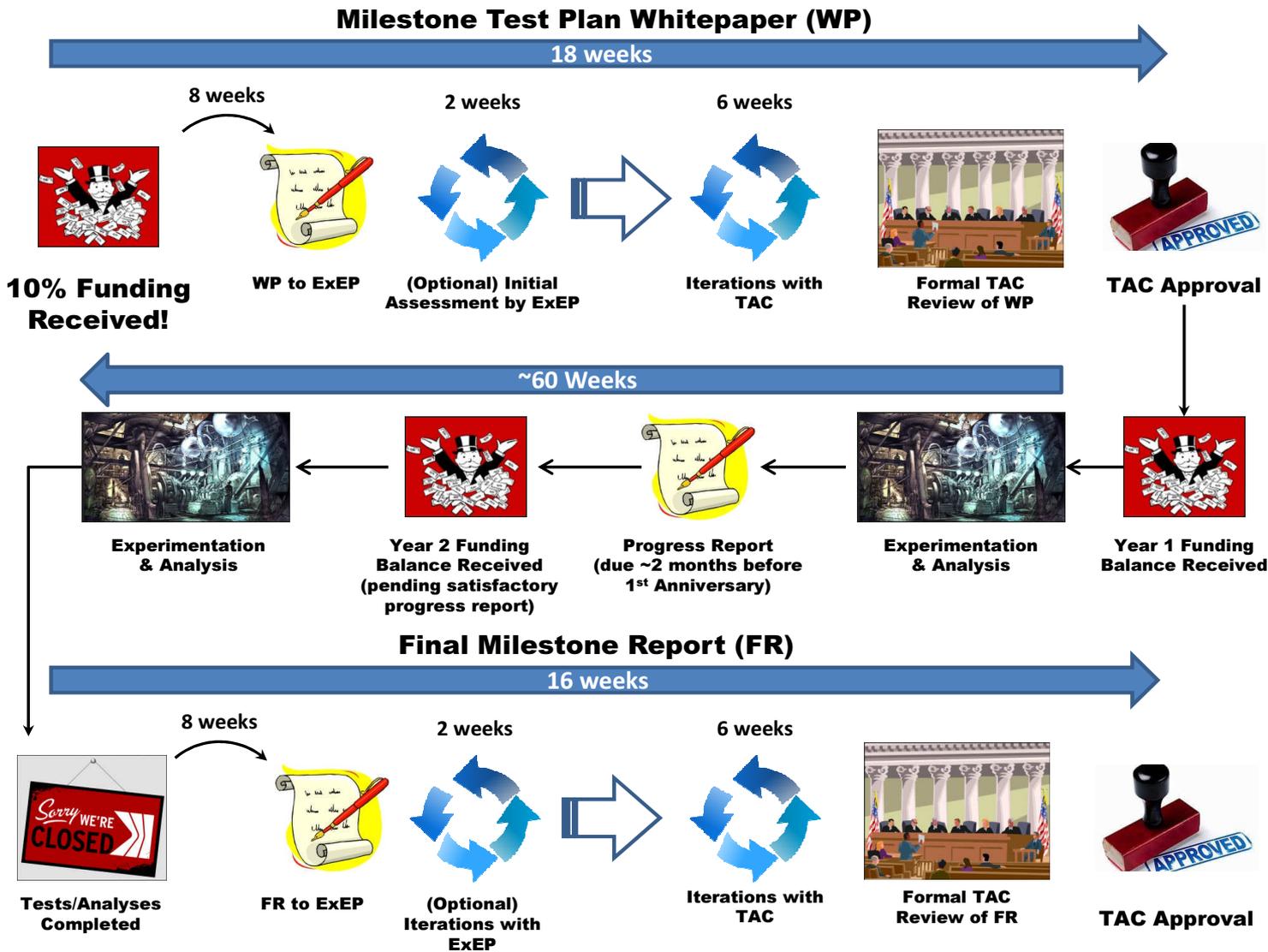


- SAT/TDEM investigators will be contacted periodically by a scheduler from the Exoplanet Exploration Program Office to track the progress of their investigation and ensure timely completion of milestones.
- Annual Progress Report (NASA requirement)
 - A written report, submitted to the SAT/TDEM program 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



- Expected Period of Performance: 2 or 3 years
- Notices of Intent due: January 20, 2017
- Proposal due date: March 17, 2017
- Planning Date for start of new awards: January 1, 2018
- 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 2016 Guidebook for Proposers,
<http://www.hq.nasa.gov/office/procurement/nraguidebook/>
- SAT/TDEM Program Officer: Douglas Hudgins, NASA Headquarters
Douglas.M.Hudgins@nasa.gov, (202) 358-0988