



# NASA Research Announcement: Technology Development for Exoplanet Missions (TDEM)

## Introduction and Overview

January 25, 2011

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# Background and Scope



- **Background**

- Astro2010 Recommendations:
  - The ultimate goal for exoplanet exploration is a flagship “New Worlds Mission” to conduct imaging and spectroscopy of rocky planets in the habitable zones of stars in the Solar neighborhood;
  - “New Worlds Technology Development Program” to facilitate this mission in the next decade was top medium-class priority.
  - Implementation:
    - *Maintain support for the development of technologies that feed into any of the candidate architectures for a future direct-detection mission (i.e. internal coronagraphs, starshades, interferometers) through the middle of the coming decade.*
    - *If, by that time, the scientific groundwork and design requirements for a direct-detection mission are sufficiently clear, a technology down-select should be made, and subsequent technology investments focused on that mission architecture.*
- It is the goal of the SAT/TDEM program to bring the field to that mid-decade decision point, and the programmatic relevance of proposed programs will be prioritized based on the degree to which they support that goal.



# Background and Scope



- **Scope of the TDEM Program**

- Program addresses the important technology development gap between “Blue Skies” investigations and mission-specific development articulated in Astro2010 Decadal Survey.
- Supports focused development of key technologies that feed into exoplanet exploration measurement techniques for a future New Worlds direct detection mission.
- Program designed to address maturation of mid-TRL technologies ( $3 < \text{TRL} \leq 6$ )
  - *Technologies whose feasibility has been demonstrated in the lab, but are...*
  - *Insufficiently mature to incorporate into flight hardware without unacceptable risk.*
- Not intended to support ‘basic’ research into new technologies and initial demonstration of their feasibility (TRL 1-3).
- Not intended to support development of flight hardware (TRL 7-9)
- Excluded technologies from the TDEM2010 solicitation include (1) detector technology; (2) mirror technology (with the exception of adaptive systems); (3) telescope assembly technology; (4) sunshields and isothermal control; (5) propulsion systems; (6) vibration isolation systems; (7) spacecraft pointing control; and (8) formation flying technology.



# Scope of Program



## ExoPlanet Exploration Program

- Architecture upon which a future New Worlds mission will likely be based include:
  - Internal coronagraphs
  - External occulters (starshades)
  - Interferometers
- Areas of technology development of particular interest to the TDEM program include (but not limited to):
  - Starlight suppression
    - *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 ( $10^7$  contrast ratio at infrared wavelengths;  $10^{10}$  contrast ratio at visible wavelengths).*
  - Wavefront sensing and control
    - *Development of control algorithms, sensing technology, and deformable mirror technology that will permit the light paths within both coronagraphic and interferometric systems to be controlled to sub-nanometer precision.*
  - System performance assessment
    - *Development of high-fidelity, very high density models that capture the physics properly, and seamlessly integrate thermal, mechanical, and optical models, to infer expected picometer-level on-orbit performance of starlight suppression systems based on nanometer-level ground measurements.*



# Programmatic Information



- **Proposals must:**

- Demonstrate that candidate technology is at a TRL  $\geq 3$ .
- Establish that candidate technology is specifically targeted at exoplanet-related measurements, i.e. requirements are driven specifically by demands of anticipated exoplanet measurements.
- Must clearly articulate the expected technology advancement
  - *Identify state of technological readiness at beginning*
  - *Identify one or more quantitative milestones that will be achieved over course of proposed development project.*
  - *Identify success criteria for evaluating project performance at end of 2 yr project.*
  - *Must provide a detailed schedule for achieving milestones*

Note: The goal of TDEM program is advancement of key technologies for exoplanet exploration flight missions to TRL 6-7; however, it is neither required nor expected that this process will be completed within the two-year horizon of the current solicitation; the horizon of the proposed work may extend beyond 2 years.



# Reporting Requirements



- Annual Progress Report
  - Both written report and presentation (in person, telecon) to ExEP Program Officer at end of first year.
- Final Report
  - Written report submitted at end of second year detailing project performance against proposed success criteria.
- Formal Documentation of Milestones
  - When work begins, success criteria of a technology demonstration is documented in a 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
    - *Also subject to review and verification by independent board.*



## 4. Summary of Key Information



- Total funding available for new awards: ca. \$5.2M over 2 yr (ca. \$2.6M in FY12; ca. \$2.6M in FY13)
- Expected number new awards: ca. 5–10
- Expected Period of Performance: 2 years
- NOIs due: January 28, 2011
- Proposal due date: March 25, 2011
- Start Date of new awards: October 1, 2011
- Website for proposal submission (NSPIRES):
  - <http://nspires.nasaprs.com/>
  - NSPIRES Helpdesk [nspires-help@nasaprs.com](mailto:nspires-help@nasaprs.com) or (202) 479-9376
- Detailed instructions for proposal preparation
  - NASA 2010 Guidebook for Proposers, <http://www.hq.nasa.gov/office/procurement/nraguidebook/>



# NASA Program Officer



ExoPlanet Exploration Program

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