

Exoplanet Standard Definitions and Evaluation Team (ExSDET) – Charter

Date: 11-22-2016

A. Background:

To prepare for the 2020 Astrophysics Decadal Survey, the Astrophysics Division (APD) has chartered the study of four large mission concepts for prioritization by the decadal survey committee. Each study will be completed by a Science and Technology Definition Team with support from a NASA Center Study Office. The science and engineering cases for these missions will be developed and delivered to the decadal survey committee by 2019. APD coordinates all four large concept studies through the Decadal Survey Management Team (DSMT). The charter, deliverables, membership, and management plan for these studies is described at the Astrophysics Division website ¹.

Exoplanet direct imaging and spectroscopy will be performed by more than one of the large mission concept studies. A consistent assessment of the scientific figures of merit for each mission, along with a transparent process for computing these figures of merit, will be essential to enable APD and the Decadal Survey committee to quantitatively compare the scientific potential of these missions. The science metrics may include, but are not limited to: planet detection yields, signal-to-noise of the spectra that will be obtained for the detected planets, and precision to which the mission concepts can measure the orbital elements of the detected planets. Because of the potential for differences in input assumptions, modeling methods, and definitions of figures of merit, the Astrophysics Division charters the Exoplanet Standard Definition and Evaluation Team (ExSDET) for these two purposes:

1. To provide science yield analyses based on unbiased exoplanet science metrics, which are consistent and common to multiple large mission concept studies, as well as for any exoplanet direct-imaging mission concept studies that may be later chartered by APD, and;
2. To document in a transparent manner: the common inputs, assumptions, and analysis methods used to quantify the science output metrics.

The ExSDET is chartered by the NASA APD and coordinated and funded through the Exoplanet Exploration Program (ExEP) for APD. The ExSDET is accountable to the DSMT, and will work with the study STDTs to accomplish the work product. The goal with the common science figures of merit is agreement between the study STDTs, with facilitation by the ExSDET and ExSDET liaisons to the STDTs, and the ExEP Chief Scientist reconciling consensus challenges. The ExSDET will adopt the common science metrics, evaluate these metrics for comparison of the exoplanet direct imaging studies, and promote common definitions. However, the mission study STDTs remain responsible for performing yield modeling needed for work specific to their study and mission concept, including but not limited to evaluating intermediate trades and quantifying additional science metrics not common to both STDTs. The STDTs may (but are not required to) make use of any tools produced by the ExSDET to accomplish these additional tasks that are expressly *not* the responsibility of the ExSDET. The Exoplanet Technical Assessment Committee (ExoTAC) ² will perform an independent review of the ExSDET deliverables.

¹ <http://science.nasa.gov/astrophysics/2020-decadal-survey-planning/>

² <https://exoplanets.jpl.nasa.gov/exep/technology/enabling-technologies/>

B. Deliverables:

The ExSDET is directed by the NASA Astrophysics Division to:

1. Maintain and document transparent and consistent definitions of input parameters and analysis assumptions, which are common to exoplanet direct imaging and characterization missions. These can include but are not limited to: planet and star properties, survey strategies, target star lists, assumed planet population characteristics, instrument parameters, and detection thresholds;
2. Develop and provide transparent and unbiased analysis tools that will allow quantification of the science metrics for the mission studies, including:
 - a. A primary program analysis tool, based on module additions to Dmitry Savransky's open-source tool, currently funded under the WFIRST Preparatory Science program^{3,4}
 - b. Complementary independent analysis tools (e.g. the Altruistic Yield Optimization tools developed by Chris Stark, or tools developed by others at the ExSDET discretion), which can be used to validate the results of the primary program analysis tool.
3. Incorporate physics-based instrument models to robustly evaluate the capabilities of specific internal coronagraph and external occulter designs;
4. Provide simple test cases to validate these models, with analytic or semi-analytic corroboration or modeled cross-validation of the results of these test cases if possible;
5. Provide two separate, full, end-to-end evaluations of the common exoplanet direct imaging science metrics of the mission concepts for each STDT: one intermediate and one final mission concept, as specified by the interim and final STDT deliverables defined in the Management Plan for Large Concept Studies (M4 and M7);

C. Period of Performance:

The period of performance will be 10/1/2016 through the concept study delivery the Decadal Survey committee (currently March 2019 per the Management Plan)

D. Membership

The ExSDET is a small team composed of analysis experts from the general science community. The following individuals will participate as ExSDET members. The large mission concept study STDT chairs will appoint a liaison to the ExSDET.

Dr. Rhonda Morgan	Lead, NASA Exoplanet Exploration Program, JPL
Dr. Bruce Macintosh	Stanford University
Dr. Dmitry Savransky	Cornell University
Dr. Chris Stark	Space Telescope Science Institute
Dr. Avi Mandell	NASA Goddard Space Flight Center
Dr. Ruslan Belikov	NASA Ames Research Center
Dr. John Krist	NASA Jet Propulsion Laboratory
Dr. Eric Nielson	SETI, IR Direct Imaging Expert

³ http://wfirst.gsfc.nasa.gov/science/sdt/wps/WPS_Investigations.pdf

⁴ <https://github.com/dsavransky/EXOSIMS>

STDT Liaisons:

Courtney Dressing	Caltech	(LUVOIR)
Karl Stapelfeldt	ExEP	(HabEx)
Klaus Pontoppidan	Space Telescope Science Institute (OST)	

The ExSDET may seek subject matter expert advice from the large concept study STDTs, and may adjust membership over time depending on the work requirements that follow from the STDT large concept study designs and science cases.

Approved:

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