

A vibrant, multi-colored image of a nebula, likely the支柱星云 (Pillars of Creation), set against a dark background of space. The nebula features intricate, pillar-like structures of gas and dust in shades of blue, green, yellow, and red, with numerous small stars visible throughout the field.

NASA Report to CAA: SDT Interim Reports

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Astrophysics

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Astrophysics Strategy

- A goal is to be prepared to start a new strategic NASA Astrophysics mission to follow JWST as soon as funding becomes available, while continuing to advance Decadal Survey science during the interim.
 - Implementation of this strategy described in Astrophysics Implementation Plan (2012), available at <http://science.nasa.gov/astrophysics/documents/>)
- The following studies are underway, and interim reports will be presented to CAA today:
 - WFIRST-AFTA (WFIRST using existing 2.4 m telescopes)
 - Moderate missions (“probes”) derived from the science objectives of the prioritized missions and recommendations in the 2010 Decadal Survey are being studied, in addition to a large mission (WFIRST), to be prepared for a mid-decade decision.
- A probe-class mission has an LCC of ~\$1B (FY15\$) including formulation, development, launch, and prime mission operations.



Charters support Astrophysics Implementation Plan

Charter for the Science and Technology Definition Teams (STDTs) for Probe-Class Exoplanet Direct Imaging Mission Concepts

Purpose

The Astrophysics Division, through its Exoplanet Exploration (ExEP) Program Office, is initiating mission concept studies of probe-class missions to advance the science of an exoplanet characterization and imaging mission as prioritized in the Astronomy and Astrophysics 2010 Decadal Survey¹. In this context, the designation as “probe-class” is taken to mean missions with a total life cycle cost (LCC) not to exceed \$1B. The highest priority Decadal Survey medium scale recommendation is a New Worlds Technology Development Program in preparation for an exoplanet imaging mission beyond 2020, including precursor science activities. The Decadal Survey’s proposed program is designed to allow a habitable Exoplanet imaging mission to be well formulated in time for consideration by the 2020 Decadal Survey.

Two Science and Technology Definition Teams (STDTs) for probe-class exoplanet direct imaging mission concepts are chartered to define reference mission concepts of high scientific, technical, and programmatic merit that would both advance the compelling scientific priorities articulated in the Decadal Survey and which could be started within the current decade and within the Astrophysics Division’s current budget profile. As described in the NASA Astrophysics Strategic Implementation Plan², if a large mission like WFIRST cannot be started this decade, then an Exoplanet probe which is technologically ready would be a candidate for a probe to start this decade as early as FY2017. An FY 2017 new start, followed by efficient development for the selected mission, requires mature technology by the end of this decade. The mission concept studies will identify technology requirements, and these will be used to guide technology investments during this decade.

Leading toward the NRC Mid-Decade Review, the results of the concept studies will be considered by the NASA Astrophysics Division and jointly evaluated along with studies from other Astrophysics programs. The probe-scale mission concepts developed by the STDTS are intended to be representative of concepts that are fully responsive to the constraints described above. They are not intended to be the only possible probe-scale exoplanet mission concepts for consideration by the Astrophysics Division in its strategic planning.

- ◀ Responsive to 2010 Decadal Survey
- ◀ Consideration by 2020 Decadal Survey
- ◀ Backup to WFIRST/AFTA
- ◀ Guide technology investments



Implementing the Decadal Survey

FY2012

FY2013

FY2014

FY2015

FY2016

FY2017

Spring 2013: Begin AFTA studies following Administrator's decision

Identified SDT studies:
Versions of WFIRST (2012)
Exoplanet probe(s) (2013)
X-ray probe (2013) (halted)

Spring 2014: NRC study of AFTA SDT report

Astrophysics Implementation Plan (CY2012)

Astrophysics Roadmap (CY2013)

Winter 2015: Final SDT reports to NASA and CAA; CATE on each

Spring 2015: NRC study of all SDT reports resulting in a NRC letter report

Initiate NRC Mid-Decade Review

Start Pre-formulation for new strategic mission
• Directed/Focused technology development

Complete NRC Mid-Decade Review

Revise plans as necessary in response to Mid-Decade Review report

Formulation new start for strategic mission

Agency Decision Point

Agency Decision Point

ESA's L2/L3 process

Directed Technology investments for prime candidate

Technology Investments through SAT for prioritization

Technology Investments through SAT for 2020 Decadal Survey

Continuing advice from the Committee on Astronomy and Astrophysics on decadal survey implementation



Astrophysics Strategy

- WFIRST
 - Science Definition Team (SDT) co-chaired by Paul Schechter and Jim Green studied two design reference missions (DRMs) (2010-2012)
 - Interim DRM / DRM1: WFIRST as described in New Worlds, New Horizons (July 2011)
 - DRM2: Assume JWST, Euclid, LSST and eliminate any duplication + reduce costs (August 2012)
 - Second SDT co-chaired by David Spergel and Neil Gehrels studied WFIRST using 2.4m telescope assets (2012-2015)
 - AFTA: Assume use of existing 2.4m telescopes, include optional coronagraph (May 2013)
 - NRC ad hoc study chaired by Fiona Harrison addresses responsiveness of this concept (2014)
 - **Interim report today**
 - All WFIRST SDT reports at <http://wfirst.gsfc.nasa.gov/science/>



Astrophysics Strategy

- LISA
 - Community Science Team (CST) co-chaired by Rainer Weiss and Ned Wright (2011-2012)
 - Charter: Are there probe-class mission concepts that address decadal survey recommendations for a gravitational wave observatory?
 - CST report concluded no (August 2012)
 - CST report at
<http://pcos.gsfc.nasa.gov/studies/gravitational-wave-mission.php>
 - No probe-class gravitational wave mission study has been undertaken



Astrophysics Strategy

- IXO
 - Community Science Team (CST) chaired by Joel Bregman (2011-2012)
 - Charter: Are there probe-class mission concepts that address decadal survey recommendations for an X-ray observatory?
 - CST report concluded yes; the most IXO science can be addressed with a single-instrument calorimeter mission (August 2012)
 - CST report at <http://pcos.gsfc.nasa.gov/studies/x-ray-mission.php>
 - Probe-class X-ray calorimeter mission study was begun by a SDT co-chaired by Jay Bookbinder and Ann Hornschemeier (2013)
 - X-ray probe study terminated when ESA selected an X-ray observatory as L2
 - NASA discussing partnership with ESA on L2
 - Delivers more science for less US funding on approximately same timescale as a potential X-ray probe
 - X-ray probe charter at

<http://pcos.gsfc.nasa.gov/studies/x-ray-probe-2013-2014.php>



Astrophysics Strategy

- New Worlds
 - Study to determine: Can a coronagraph on WFIRST/AFTA address decadal survey recommendations for New Worlds technology development and demonstration?
 - Incorporated into WFIRST/AFTA study
 - NRC ad hoc study chaired by Fiona Harrison addresses responsiveness of this concept (2014); Report in March 2014
 - Studies to determine: Are there probe-class mission concepts that address decadal survey recommendations for a New Worlds observatory?
 - Science & Technology Definition Teams (STDTs) established in 2013
 - Charters at <http://exep.jpl.nasa.gov/stdt/>
 - Exoplanet Coronagraph Probe (Exo-C) STDT chaired by Karl Stapelfeldt (2013-2015)
 - **Interim report today**
 - Exoplanet Starshade Probe (Exo-S) STDT chaired by Sara Seager (2013-2015)
 - **Interim report today**



Astrophysics Strategy

- Inflation Probe
 - Decadal Survey recommends
 - Pursuing CMB technology development program as lower priority than other recommendations when budget is constrained (p. 237-238)
 - Probing CMB polarization through ground based and suborbital investigations prior to embarking on mission studies and mission-enabling technology development (p. 217)
 - NASA has not, at this time, undertaken mission concept studies for an Inflation Probe



Progress Toward Decadal Survey Priorities

The NASA FY14 Appropriation and the notional out years in the President's Budget Request for FY14 support

L1. WFIRST	Preformulation and focused technology development for AFTA (a 2.4m version of WFIRST) are underway to enable a new start NET FY17
L2. Augmentation to Explorer Program	Increased from ~\$90M in FY07 and ~\$115M/yr in FY10 to ~\$140M/yr in FY16 and beyond; supports AOs in 2014, ~2016/2017, ...
L3. LISA	Strategic technology investments including LISA Pathfinder plus discussing partnership in ESA's L3 gravitational wave observatory
L4. IXO	Strategic technology investments plus discussing partnership in ESA's L2 X-ray observatory
M1. New Worlds Technology Development Program	Focused technology development for a coronagraph on WFIRST; mission concept studies and strategic technology investments
M2. Inflation Probe Technology Development Program	Three balloon-borne investigations plus strategic technology investments
Small. Research Program Augmentations	Increased from \$65M (FY07) to \$74M (FY10) to \$82M (FY12 and beyond)



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