National Aeronautics and Space Administration

Charge from HQ

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AFTA Science Definition Team

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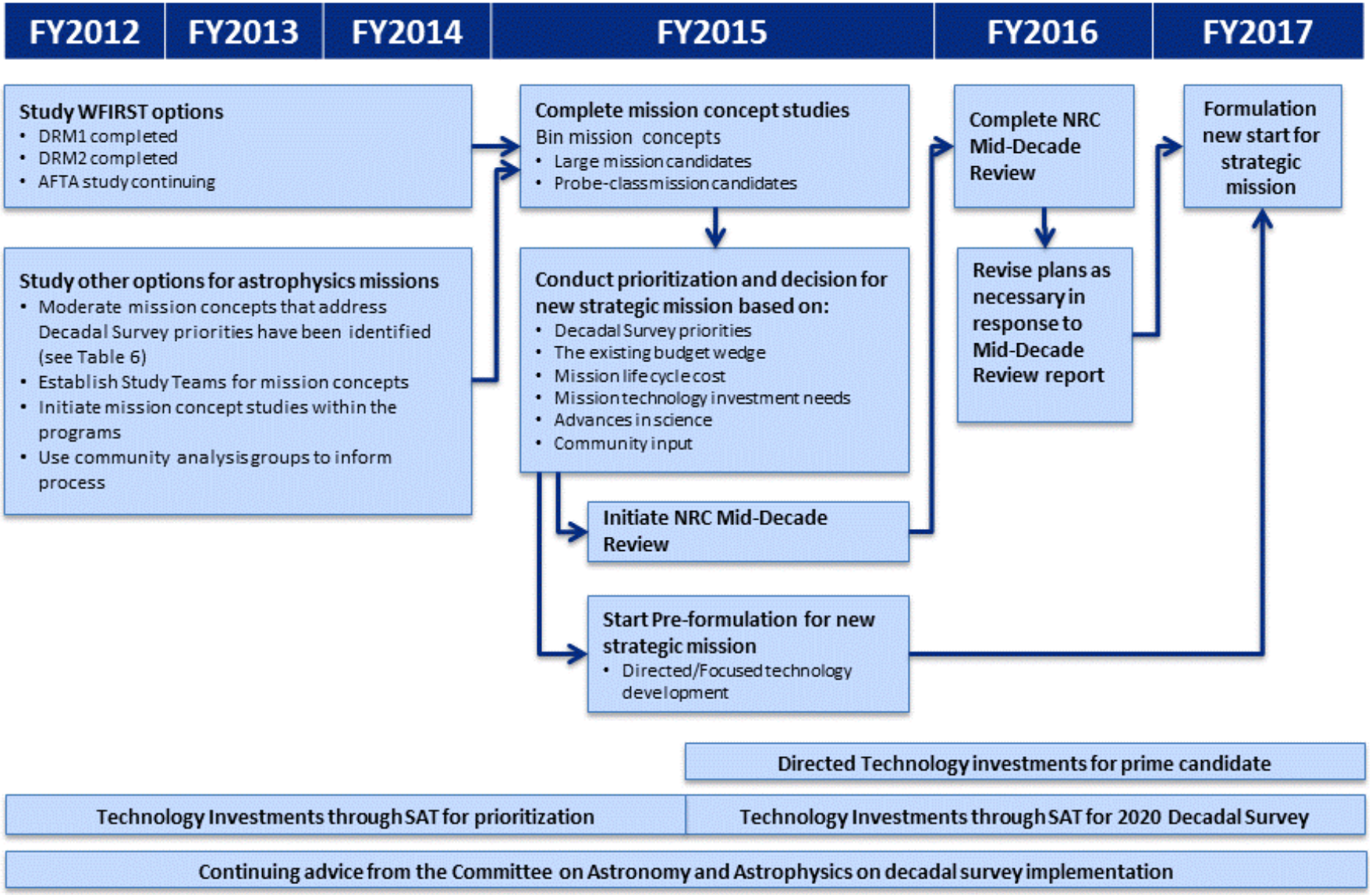
Astrophysics Near-term Strategy



Preparing for the Next Strategic Mission

Strategic Mission Concepts	Derived from Recommendation	Status of Studies	Plan for Future
WFIRST: Large Strategic Mission (DRM1)	Large 1st : WFIRST	Completed in 2012	Candidate large mission for mid-decade
WFIRST: Probe-size Strategic Mission (DRM2)	Large 1st : WFIRST	Completed in 2012	Candidate probe for mid-decade
Use of the 2.4m telescope assets to advance the science of WFIRST (study includes an optional second instrument to advance exoplanet science)	Large 1st : WFIRST (Medium 1: New Worlds Technology)	Started in 2012	Candidate large mission for mid-decade
Gravitational Wave missions to advance the science of LISA	Large 3rd : LISA Technology	Completed in 2012	Candidate large mission for next decade; candidate for international partnership
X-ray missions to advance the science of IXO	Large 4th : IXO Technology	Completed in 2012; under consideration for study in 2014	Candidate probe for mid-decade; candidate large mission for next decade; candidate for international partnership
Exoplanet probes to advance the science of a planet characterization and imaging mission	Medium 1st : New Worlds Technology	Planned for 2013	Candidate probe for mid-decade; candidate large mission for next decade
Cosmic Microwave Background Polarization Probe	Medium 2nd : Inflation Probe Technology	Study under consideration for study in 2015	Candidate probe or large mission for next decade
Science and technology drivers for a UV/Visible mission	Small: (Definition of) a future UV-optical space capability	Started in 2012	Candidate probe or large mission for next decade

What will we do with the AFTA study?

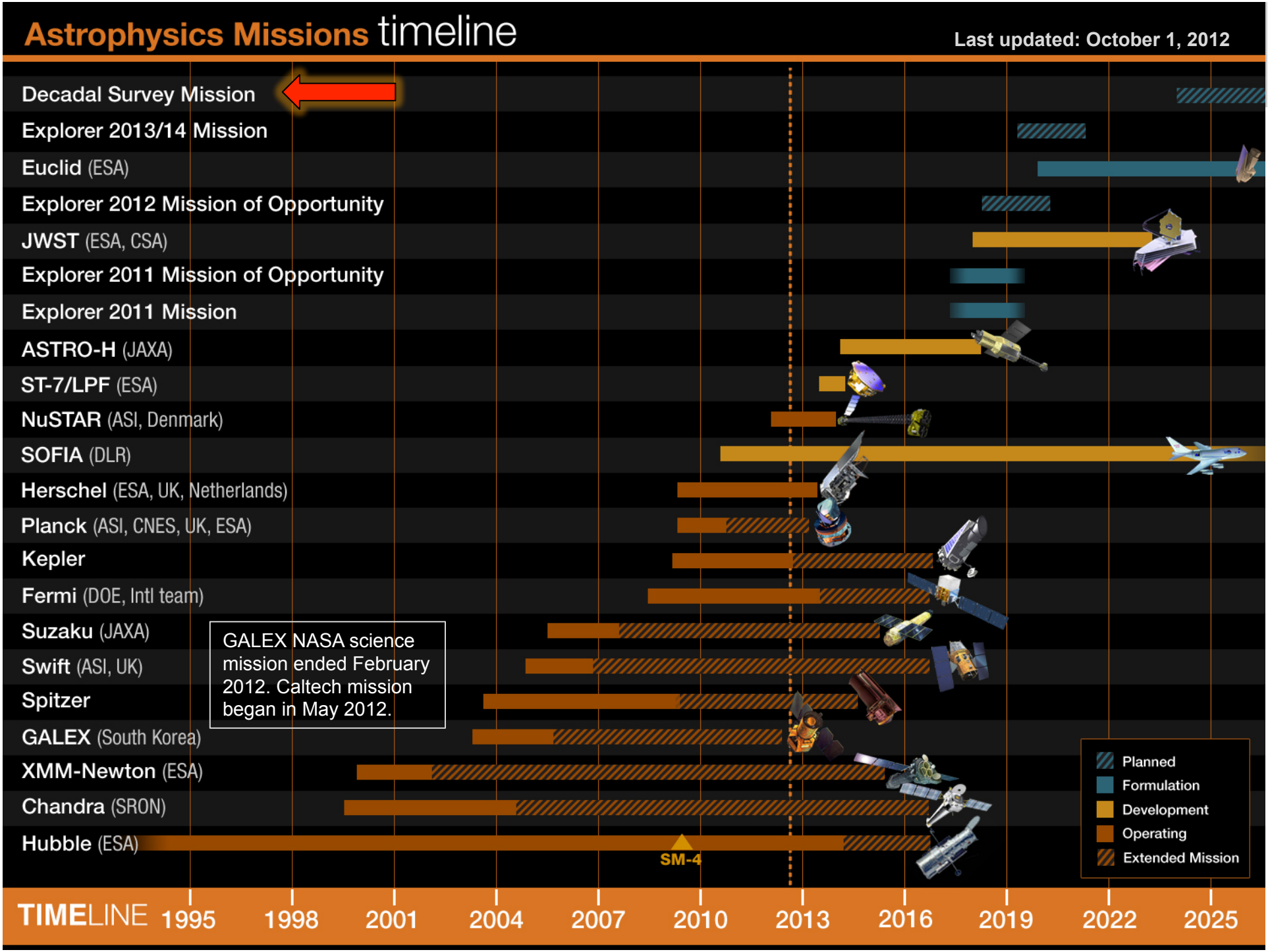
- Decide whether or not to keep the 2.4m telescope assets
  - Administrator wants to ensure there is strategic value to them since NASA resources must be spent to curate and then use them
  - Parallel effort ongoing to identify non-WFIRST applications
  - NASA Strategy Integration and Planning (SIP) Board meeting planned for April 2013
- Decide whether or not to base WFIRST on the 2.4m telescope assets
  - Does it yield a WFIRST DRM that is either more capable or less expensive?
  - Capability is measured against Decadal Survey science objectives
- If both answers are affirmative
  - Direct efforts of WFIRST study office (Kevin Grady et al) toward this concept including further study
  - Identify tall poles that need to be resolved and apply some funding to them
  - Work with the CAA to determine whether this concept is responsive to the Decadal Survey (capability, schedule)
  - Extend the SDT?

Cost Guidance

- NASA is looking for the lowest credible cost for this DRM
  - **"Overall mission cost is to be kept as low as possible while still achieving all or part of the science priorities for a wide field infrared survey telescope."**
  - Not looking for a "buy in" number; assume that we might be stuck with this number and will be cancelled if we exceed it before confirmation
  - Must be scientifically compelling as WFIRST
  - Need to know what savings can be had by using a sub-optimal orbit and/or by eliminating serviceability
- Not looking for lowest possible cost
- Not looking for a fully loaded concept (bells and whistles)
- The trade between "best value" and "lowest credible cost" is completely subjective
  - Can usually increase science with additional spending
  - SDT must apply science judgment in this area

Guidelines worth Discussing

- Develop a single configuration and a single Design Reference Mission which incorporates the following
  - Mechanisms to allow on-orbit replacement of hardware modules.
  - Will optimize the design configuration for the orbit selected by the SDT. The project will attempt to design a configuration that works in both HEO/GEO and L2, however this may not be possible.
  - The CATE would be done for this configuration.
- In the baseline DRM and CATEd
  - Design for I&V testing at the modular component level.
  - Modularity to facilitate on-orbit servicing [n.b. this means commercially available robotic servicing; if no such commercial capability appears likely this is descopable].
  - SDT selected orbit.
- Impacts and delta costs estimated but not in baseline DRM or CATE
  - Coronagraph as a prototypical second instrument.
  - Operations from high Earth orbit (GEO) if not in baseline.
  - Optical comm if not in baseline.
  - No modularity to facilitate on-orbit servicing.
- Not part of study
  - Use of SLS.
  - Costs to servicing the mission after launch and the infrastructure to support servicing before and after launch.


Astrophysics Missions timeline
Last updated: October 1, 2012
Decadal Survey Mission
Explorer 2013/14 Mission
Euclid (ESA)
Explorer 2012 Mission of Opportunity
JWST (ESA, CSA)
Explorer 2011 Mission of Opportunity
Explorer 2011 Mission
ASTRO-H (JAXA)
ST-7/LPF (ESA)
NuSTAR (ASI, Denmark)
SOFIA (DLR)
Herschel (ESA, UK, Netherlands)
Planck (ASI, CNES, UK, ESA)
Kepler
Fermi (DOE, Intl team)
Suzaku (JAXA)
Swift (ASI, UK)
Spitzer
GALEX (South Korea)
XMM-Newton (ESA)
Chandra (SRON)
Hubble (ESA)
GALEX NASA science mission ended February 2012. Caltech mission began in May 2012.
SM-4
Planned
Formulation
Development
Operating
Extended Mission
TIMELINE
1995
1998
2001
2004
2007
2010
2013
2016
2019
2022
2025

Additional Policy Guidelines for Developing the Astrophysics Focused Telescope Assets (AFTA) Design Reference Mission (DRM)

- **A baseline (DRM) is to be developed which uses one of the telescope assets "as is" and is technically viable for a launch by calendar year 2022 if funding starts for implementation in fall of 2016 (beginning of government fiscal year 2017). Overall mission cost is to be kept as low as possible while still achieving all or part of the science priorities for a wide field infrared survey telescope.**
- The combination of servicing or no servicing, GEO/HEO orbit or L2, coronagraph in or not, will lead to an excessive number of unique configurations for assessment if treated as separate point designs.
- The funding and time available is small fraction of what was available for the WFIRST SDT completed this year, making an assessment of even one of these configurations a very top level effort compared to the DRMs 1 and 2 from the WFIRST SDT report.
- Given the above, the following approach is to be followed for the AFTA SDT study:
- Develop a single configuration and a single Design Reference Mission which incorporates the following
  - Mechanisms to allow on-orbit replacement of hardware modules.
  - Will optimize the design configuration for the orbit selected by the SDT. The project will attempt to design a configuration that works in both HEO/GEO and L2, however this may not be possible.
  - The CATE would be done for this configuration.
- **The SDT will identify the science return for the AFTA mission, and make a comparison of that to the science return of DRM1 and DRM2, along with the requirements in NWNH. This information, together with the LCC of AFTA DRM, will allow a comparison of the science yield vs. cost for each of the three DRMs. This information will be critical in the decision process going forward for WFIRST development.**
- Approach to addressing the options identified in the chart titled "Long Term Vision" presented by SMD to SIP in August 2012: Category 1 = to be included in the DRM and CATEd; Category 2 = option required to be studied but not to be included in the DRM and will not be CATEd but will be costed by the project at a high level. Category 3 = content that will not be studied or costed by this study
  - Adding a coronagraph instrument : Category 2. SDT report to include science that could be done and impacts to proposed operations in a separate chapter of their report.
  - **Modularity to facilitate on-orbit servicing (including servicing mechanisms and I&V testing at the modular component level): Category 1. In addition, the benefits and costs of modularity will be assessed. differential of a modular spacecraft design compared to a non-modular spacecraft design will be separately identified by the project (not CATEd).**
  - Operations from high earth orbits (GEO and HEO): Category 2 but the SDT has the option to make this a Category 1 based upon science drivers. Request a statement in the SDT report if this is a science driver or not. If it is in the DRM, as a requirement from the SDT, then it will be included in the CATE. If this is not a science driver and not included in the DRM, the project will do a top level analysis on the spacecraft design stating if the mission can be done in high earth orbit or not and why and a ROM cost impact for including this capability.
  - Optical communication : Category 2 but the SDT has the option to make this a Category 1 based upon science drivers. Request a statement in the SDT report if this is a science driver or not. If it is in the DRM, as a requirement from the SDT, then it will be included in the CATE. If this is not a science driver and not included in the DRM, the project will do a top level analysis on the spacecraft design and a ROM cost impact for including it.
  - Opportunity to utilize the Space Launch System (SLS) for launching the telescope into any orbit: Category **3**. The costs for a EELV will be included in the DRM. The cost savings by using a SLS (this assumes Astrophysics Division is not paying for the launch) will be identified by the project and equal the cost for the EELV launch in the DRM.
  - Costs to servicing the mission after launch and the infrastructure to support servicing before and after launch. Category 3. Only the cost of the servicing mechanisms to remove hardware on-orbit is included in DRM, and this is a small fraction of the cost of servicing.

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Paul Hertz date

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