National Aeronautics and Space Administration

Astrophysics

Implementation of the Decadal Survey

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Astrophysics Subcommittee

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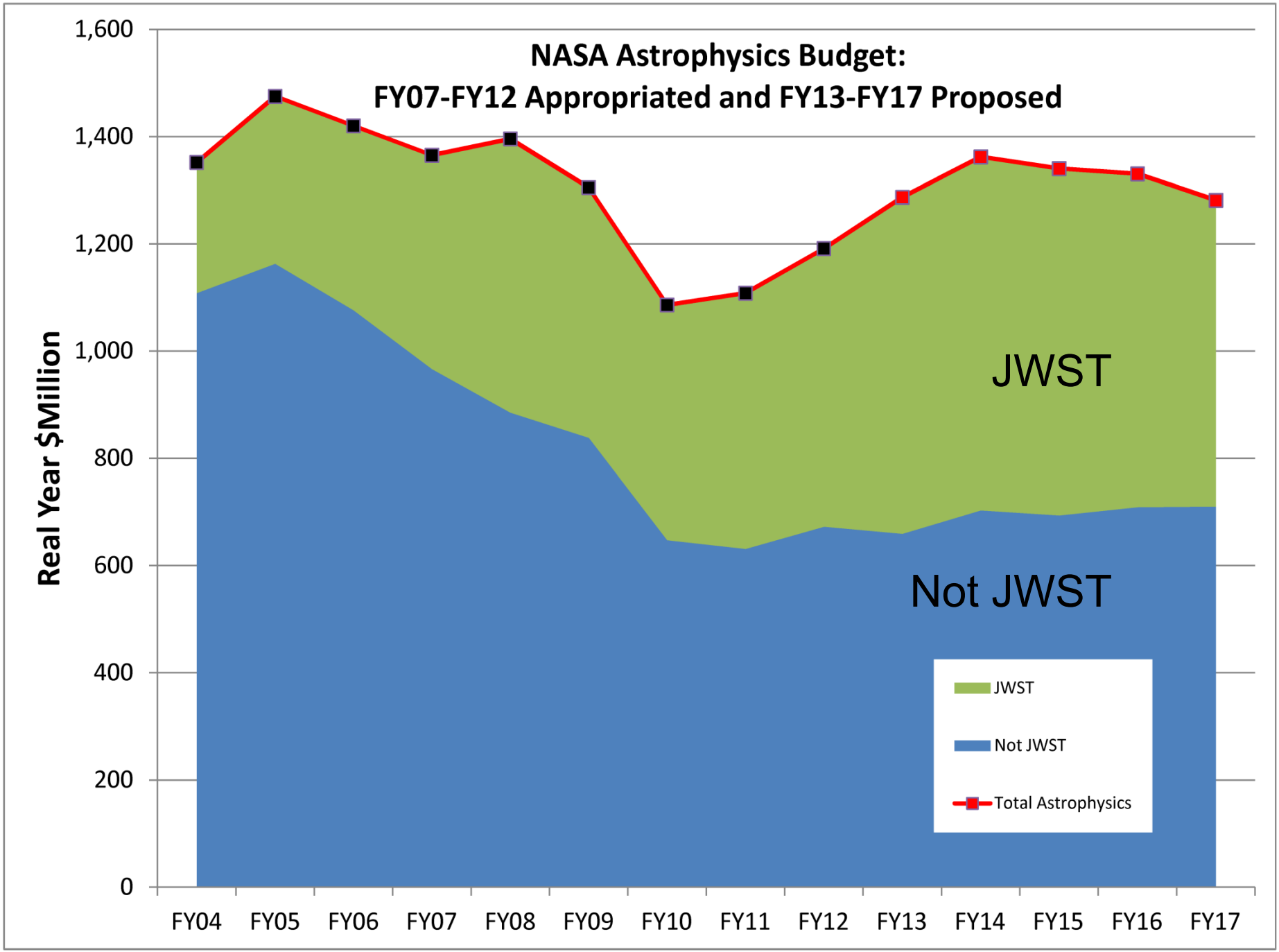
Astrophysics Division Responsibilities

- The Astrophysics Division is responsible for the stewardship of the Nation's capabilities in space astrophysics and for advancing the Nation's space astrophysics goals and objectives.
- The guiding principles used by the Division in implementing its strategy for meeting those responsibilities include:
  - Enable the science and priorities given by the Decadal Survey with new activities as well as through ongoing missions, including large missions, medium missions, and Explorers.
  - Invest in the Astrophysics Research Program for developing the science cases and technologies of new missions and for maximizing the scientific return from operating missions.
  - Receive community input and advice through the APS and its associated PAGs, the CAA, and the AAAC, and use this input and advice to inform decisions made by the Division.
  - Implement the program through choices made by the Astrophysics Division in the context of the science and priorities set by the Decadal Survey, and work with the Science Mission Directorate, NASA Administrators office, and White House Office of Management and Budget (OMB) to move those choices into budget realities.
  - Use processes that are as transparent as possible.
  - Preserve and nurture core capabilities at NASA Centers and throughout the Nation.
  - Maintain flexibility needed in an environment that is constantly changing.

Astrophysics Budget Reality

- There is inadequate available budget to implement the Astro2010 Decadal Survey recommendations as written; there is also changed external context.
  - JWST was rebaselined for a 2018 launch with an increased cost commitment LCC of $8,8B, an increase of $3.1B.
  - Neither the optimistic nor the constrained budget scenarios of the Astro2010 decadal Survey have been realized.
  - Due to budget constraints, no new astrophysics missions other than Explorers can enter formulation before FY17 (when JWST approaches launch).
  - NASA and ESA have ended the joint LISA and IXO studies.
  - NASA has committed to a partnership with ESA on Euclid.
  - NASA is considering whether the NRO 2.4m telescope assets can enable astrophysics priorities or other NASA objectives.
- Large strategic missions in the future are possible only with the Astrophysics budget that is freed up as JWST spending begins to decrease in FY17 and out.
  - A new strategic mission can be started as early as FY17 subject to available funding.


NASA Astrophysics Budget:
FY07-FY12 Appropriated and FY13-FY17 Proposed
Real Year $Million
1,600
1,400
1,200
1,000
800
600
400
200
0
FY04
FY05
FY06
FY07
FY08
FY09
FY10
FY11
FY12
FY13
FY14
FY15
FY16
FY17
JWST
Not JWST
JWST
Not JWST
Total Astrophysics

Astrophysics Near-term Goal

- The goal is to be prepared to start a new strategic Astrophysics mission to follow JWST as soon as funding becomes available while continuing to advance the science during the interim.
- The goal of the Astrophysics Division is to begin a new, strategic mission in 2017, subject to funding availability, which will follow JWST and be responsive to the recommendations of the Decadal Survey.
  - Since it cannot be assumed that the authority to start a new large mission will be granted by 2017, concepts for moderate cost missions that cost no more than approximately $1B must also be considered.
  - All mission concept studies being studied derive from the science objectives of the Decadal Survey's prioritized activities.
  - In addition, progress on Decadal Survey science and priorities is maintained through sustaining and enhancing the core research program, continued operation of existing missions and their Guest Observer (GO) programs, growing use of the suborbital programs, and more frequent Explorer opportunities. Funding for all of these programs is maintained in the President's FY 2013 budget request.

Astrophysics Near-term Strategy

- Use the science and prioritized activities of the Astro2010 Decadal Survey to guide strategy and inform choices.
- In the absence of new missions, progress against decadal priorities is maintained through the core research program, through continued operation of existing missions and their GO programs, through the suborbital programs, and through frequent Explorer opportunities.
  - Support for all of these is maintained in the President's FY13 budget request.
- In order to prepare for a new mission, a near term program of mission concept studies and technology development will be undertaken, with the goal of informing a mid-decade decision on which mission(s) will begin formulation starting as early as FY17.
  - Currently there are no new starts for large missions. Moderate missions ("probes") will be studied, in addition to a large mission (e.g., WFIRST), to be prepared for a mid-decade decision.
  - Mission concepts studied must derive from the science of the missions and recommendations prioritized in the Decadal Survey.

Astrophysics Near-term Program

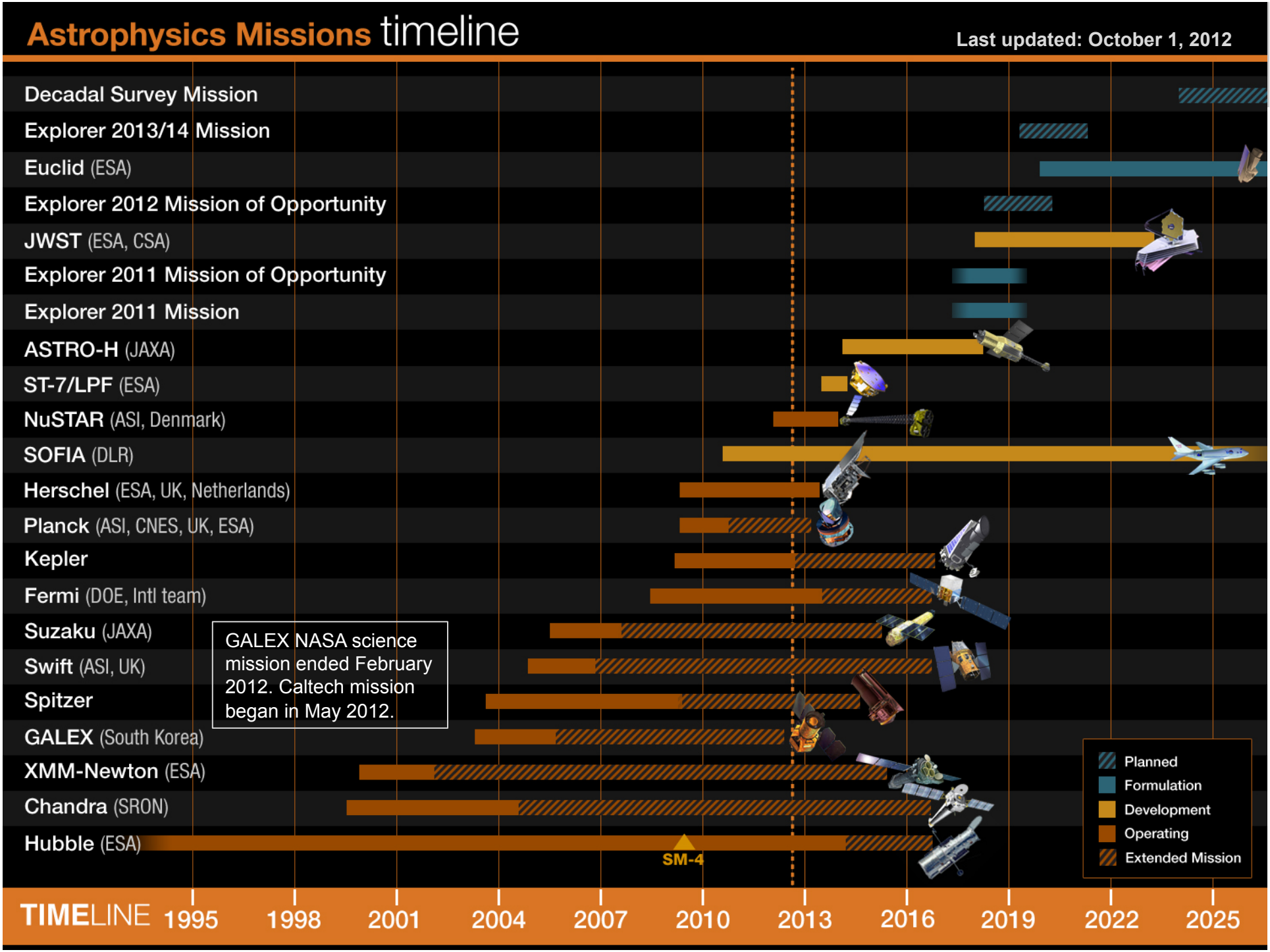
- The President's FY 2013 budget request for the Astrophysics Division includes:
  - An Astrophysics Explorer Program that can support four mission selections and four Missions of Opportunity (MO) selections over a decade (depending on the cost caps chosen and launch vehicle availability).
  - Extensions of astrophysics operating missions and their associated GO programs.
  - Continued development and operation of the SOFIA airborne observatory.
  - A new program for mid-TRL level technology development.
  - An augmented competitive Astrophysics Research Program that maintains growth realized in FY 2012.
  - New research opportunities: Theory and Computation Networks (in partnership with NSF), laboratory astrophysics consortia, and the Nancy Grace Roman Technology Fellowships for early career researchers.
- Following the formulation of the Presidents FY 2013 budget request and an NRC, NASA has undertaken a partnership with ESA to provide a contribution of detector subsystems for the NISP instrument on the Euclid mission in exchange for appointing NASA-selected members in the Euclid Consortium and the Euclid Science Team.

Response to Decadal Survey

Scale	Decadal Survey Recommendation	Response included in the FY 2013 President's Budget Request
Large	WFIRST	SDT and DRMs in FY 2011 and FY 2012; AFTA study in FY 2013; technology investments in detectors through SAT program; participation in Euclid
Large	Explorer Augmentation	Augment budget to support selection of 2 EX missions, 2 SMEX missions, and 4 Missions of Opportunity over a decade; MO AO in 2012, SMEX AO in 2013/2014, and EX AO in 2015
Large	LISA Technology	Complete ST-7/LISA Pathfinder mission; technology investments through SAT program; Community Science Team (CST) study in 2012
Large	IXO Technology	Technology investments through SAT program; CST study in 2012; potential probe study
Medium	New Worlds Technology	Technology investments through technology testbeds and SAT program; probe studies in FY 2013 and FY 2014
Medium	Inflation Probe Technology	Technology investments through APRA program including three suborbital balloon payloads; complete Planck mission and data analysis; potential probe study after Planck results

Response to Decadal Survey

Scale	Decadal Survey Recommendation	Response included in the FY 2013 President's Budget Request
Small	Astrophysics Theory Program Augmentation	Small augmentation starting in FY 2012 and maintained
Small	(Definition of) a future UV-optical space capability	Technology investments through SAT program; science driver studies in FY 2012 and responsive mission studies in FY 2013 leading toward next decadal survey
Small	Intermediate Technology Development Augmentation	Initiated SAT program in FY 2010
Small	Laboratory Astrophysics Augmentation	Augmentation to select laboratory consortia
Small	SPICA (U.S. contributions to JAXA-led)	Not supported as a strategic contribution; candidate for Explorer Mission of Opportunity
Small	Suborbital Program Augmentation	Small augmentation for payloads; augmentation to support development of ULDB platforms and WASP
Small	Theory and Computation Networks (NASA, NSF, DOE)	Solicitation for proposals in FY 2013 (with NSF)
N/A	Additional core program augmentations	Initiated Nancy Grace Roman Technology Fellows program; small augmentation for ADAP program; small augmentation for APRA program


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

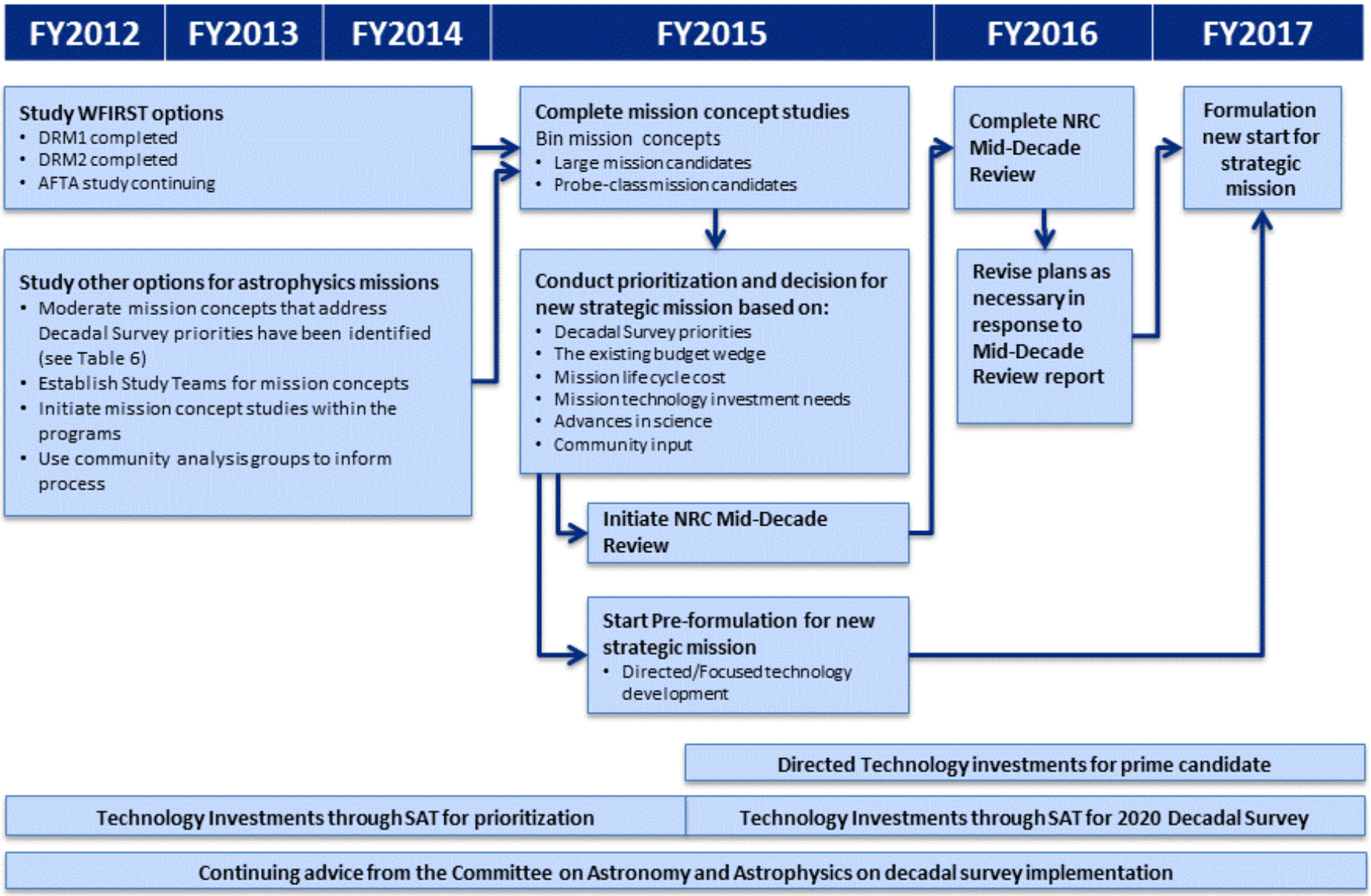
Preparing for the Next Strategic Mission

- To prepare for a new mission, the Astrophysics Division is undertaking a near-term program of mission concept studies and technology development, with the goal of informing a mid-decade decision on a mission which could begin formulation starting as early as FY 2017.
  - These include studies of a large strategic mission, WFIRST.
  - Since funding availability for a large mission cannot be guaranteed, moderate missions ("probes") are also being studied for formulation as early as mid-decade.
- Note that all mission concept studies must derive from the science objectives of the prioritized activities in the Decadal Survey.

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

Astrophysics Near-term Strategy



Identifying the Next Strategic Mission

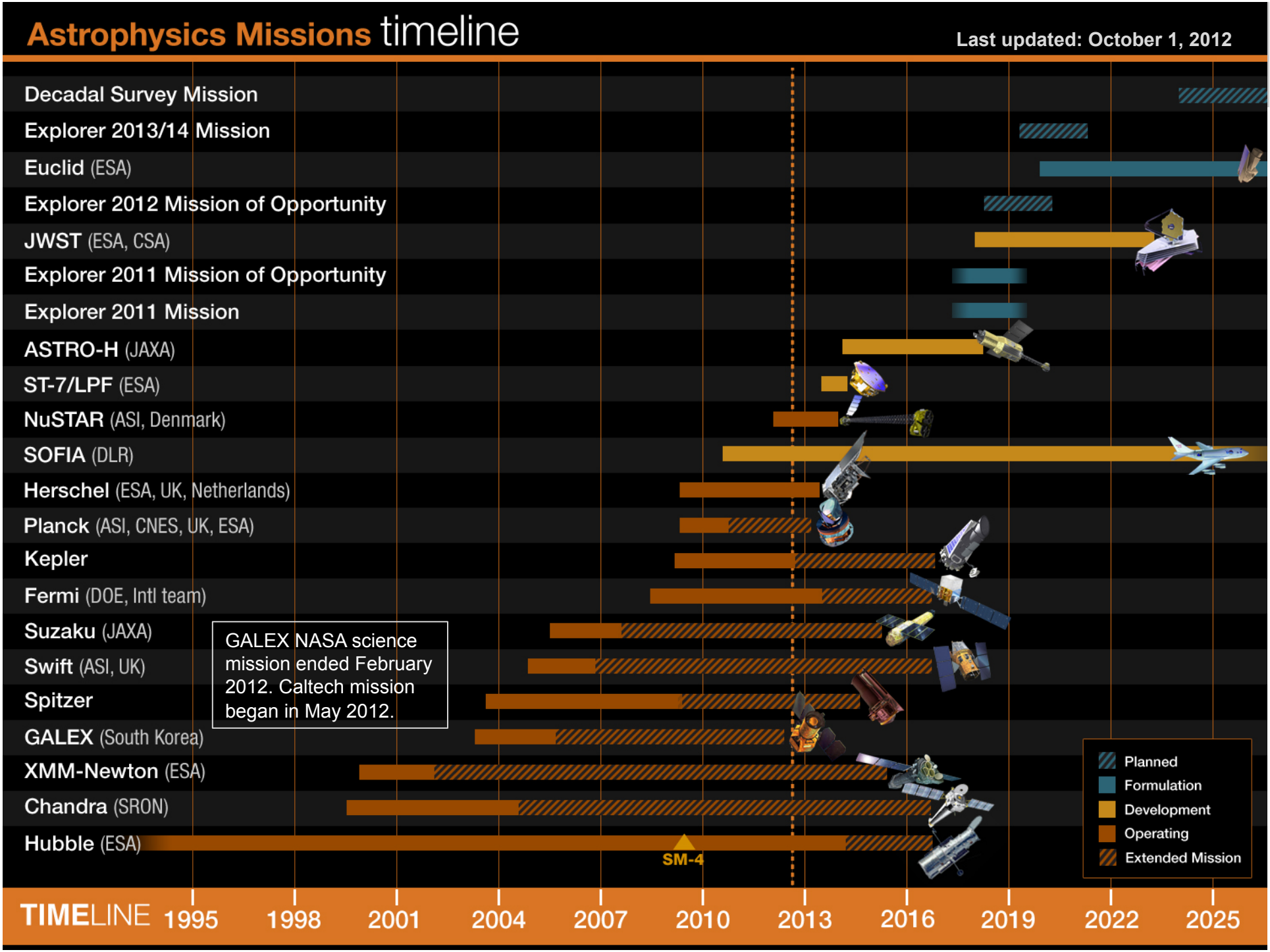
- Although not fully developed, the decision criteria for determining the next strategic mission are expected to include the following key elements:
  - If a large strategic astrophysics mission is approved to follow JWST, a mission that addresses the Decadal Survey science objectives of WFIRST remains the highest priority.
  - Any approved mission must be responsive to the stated intent of the Decadal Survey taking into account the budgetary and other constraints governing the Astrophysics Division and its programs. Simply stated, the selected mission must logically derive from the science objectives addressed by the prioritized activity recommendations of the Decadal Survey.
  - The required funding profile, including technology developments, must be compatible with the Astrophysics Division's planning budget for technology and mission development; this planning budget is given in the President's FY 2013 budget request and will evolve annually. Any technology development funding required to bring the necessary technology to TRL 6 before the mission PDR must be affordable within the planning budget.
  - The risk posture of the selected mission must be well understood, including programmatic, technical, and institutional risks. High confidence is required that the mission life cycle cost is within the budgetary constraints mentioned above.

Role of the Mid-Decade Review

- The 2006 Mid-Decade Review of Astrophysics was charged to address:
  - How well NASA's program addresses the strategies, goals, and priorities outlined in the Decadal Survey and other NRC reports;
  - Progress toward realizing these strategies, goals and priorities; and
  - Any actions that could be taken to optimize the scientific value of the program in the context of current and forecasted resources available to it.
- That Committee was not charged to revisit nor to alter the scientific priorities or mission recommendations provided in the Decadal Survey or other reports, but rather to provide guidance about implementing the recommended mission portfolio leading toward the next decadal survey.
- The Astrophysics Division, in partnership with the NSF's Division of Astronomical Sciences, currently intends to request a Mid-Decade Review beginning in 2015 and concluding in 2016.
- A key aspect of the Mid-Decade Review will be an assessment by the review committee on whether NASA's astrophysics program, including the decision regarding the strategic mission to follow JWST, aligns with the Decadal Survey science and priorities in the context of current and forecasted resources available to the Astrophysics Division.

Astrophysics Budget Strategy

- A white paper describing the Astrophysics Division strategy in response to the Decadal Survey recommendations, consistent with current budget guidance, is under development.
  - Is under review by the Committee on Astronomy and Astrophysics and the Astrophysics Subcommittee.
  - Will release to the community before Long Beach AAS meeting; target release date is December 14, 2012.
  - Will be discussed at the NASA Town Hall.
- This presentation is an abbreviated version of the white paper.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