National Aeronautics and Space Administration

NASA Budget Update

Astronomy and Astrophysics Advisory Committee

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Astrophysics

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NASA Anticipated Accomplishments in FY16

SLS/Orion: Complete structural build of major components and begin testing

ISS: Increase utilization with science and technology payload hardware to 70 percent; Complete the One-year crew increment

Launch 13 science and cargo missions and one commercial crew test

Commercial Crew Program: Conduct Commercial Crew transportation system test flight and other milestones

Asteroid Redirect Mission: Complete definition of the ARM robotic mission segment

JWST: Integrate the JWST mirror with science instruments (cameras and spectrographs)

Aeronautics: Complete Capstone UAS flight demo to deliver 5 years of results; enable FAA regulations on integration

Space Tech: Transform technology with six major in-space demos

FY16 President's Budget Request

Outyears are notional planning from FY16 President's budget request

($M)	2014	2015	2016	2017	2018	2019	2020
Astrophysics*	$678	$685	$689	$707	$750	$986	$1,118
JWST	$658	$645	$620	$569	$535	$305	$198

- Supports operating missions: Chandra, Fermi, Hubble, Kepler, NuSTAR, SOFIA, Spitzer, and Swift.
- Funds development of Explorer missions TESS and NICER. TESS will continue the search for exoplanets, scanning all of the sky for Exoplanets closer to Earth than those found by Kepler.
- Supports pre-formulation studies for WFIRST/AFTA.
- Maintains a competed astrophysics research program and support of the balloon program.
- Supports the commitment of an October 2018 launch date for JWST.
  - Will deliver the Integrated Science Instrument Module for integration;
  - Completes integration of flight primary mirror subassemblies onto the flight primary mirror backplane;
  - Completes acceptance testing of the cryocooler compressor assembly;
  - Completes spacecraft bus structure; and
  - Completes the sunshield structure manufacture and test.

* Excludes "SMD STEM Activities" in all years.

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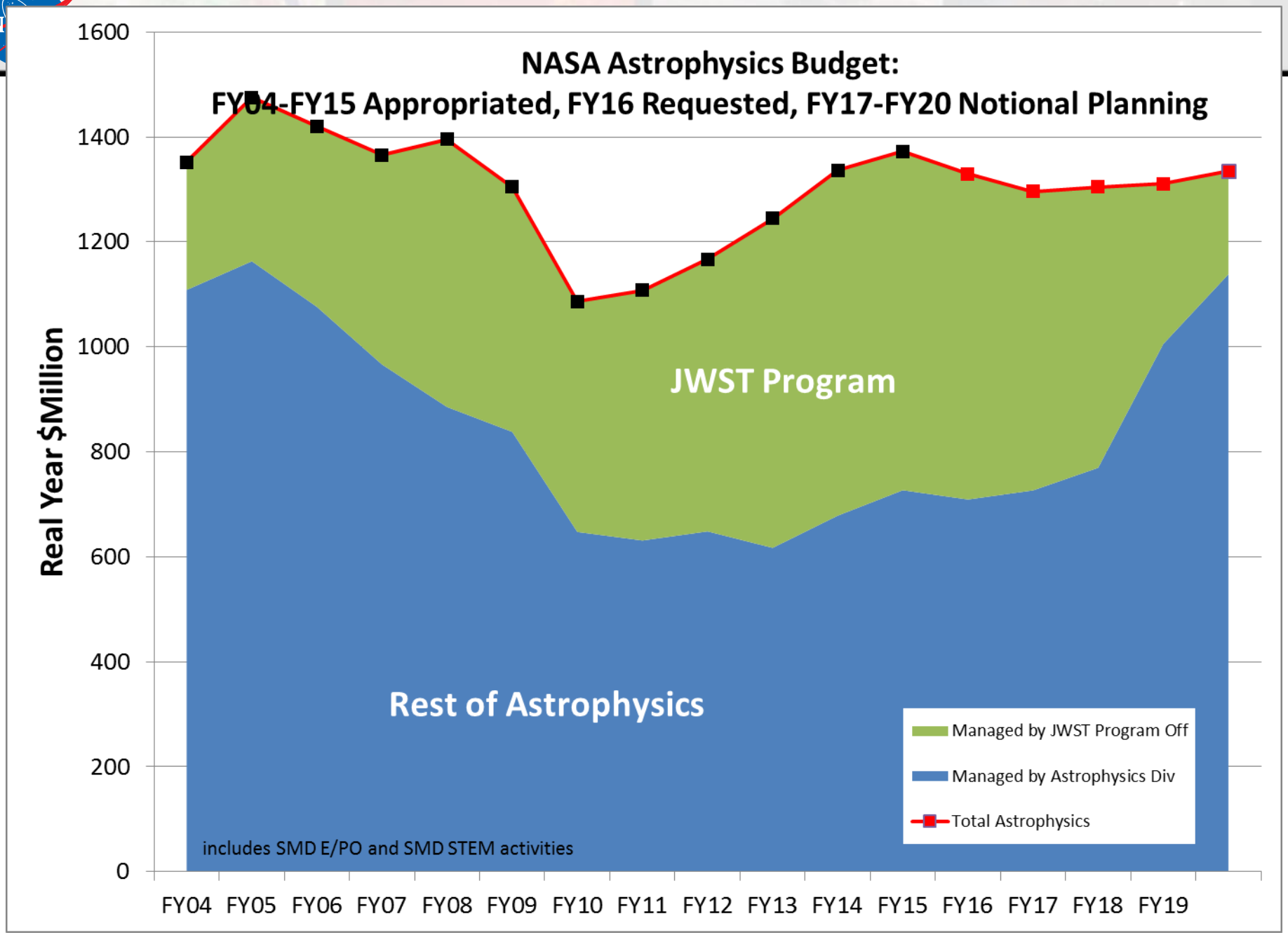
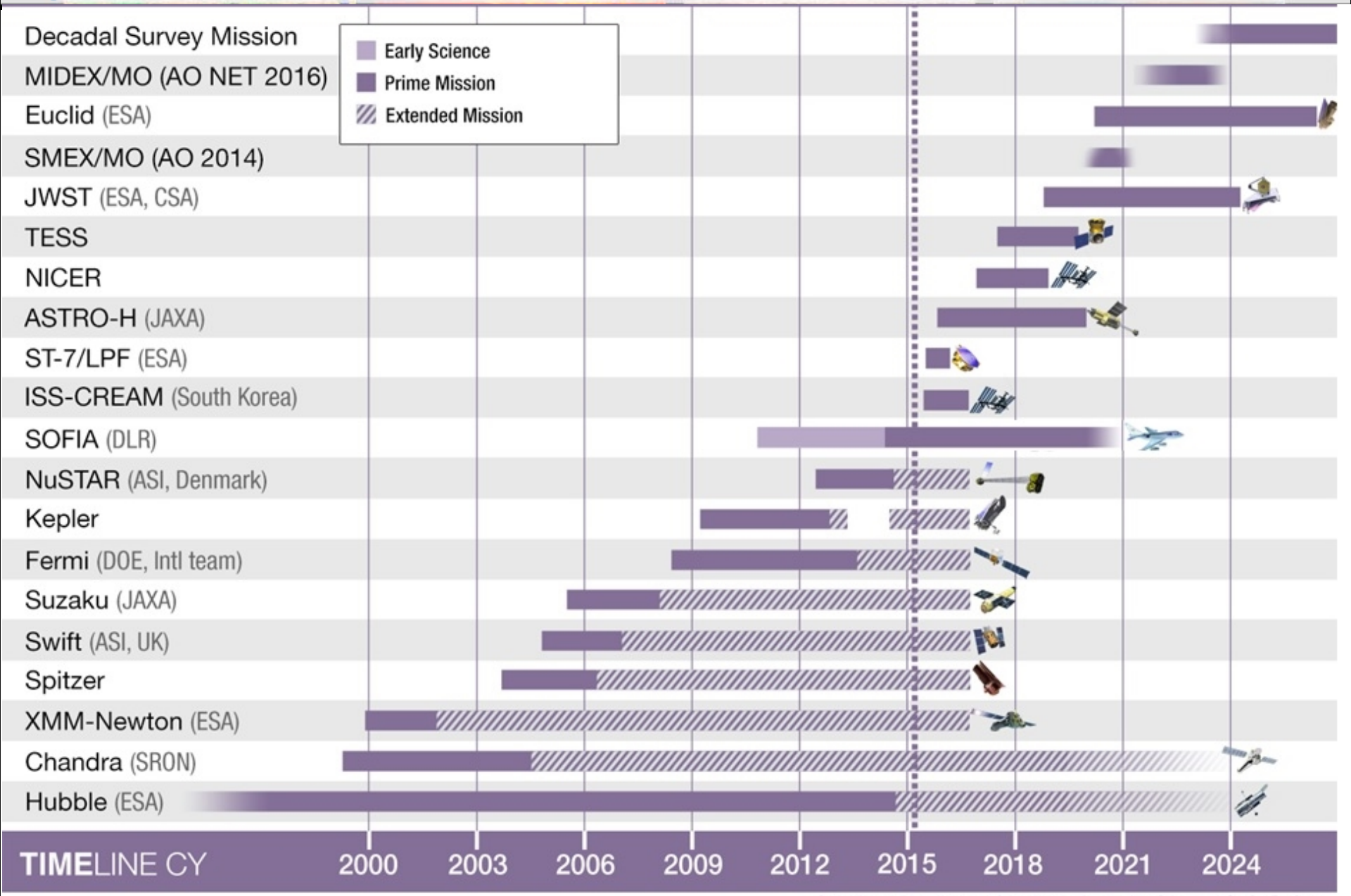
- Continues preformulation of WFIRST/AFTA as the "Astrophysics Decadal Strategic Mission."
- Grows Astrophysics Research and Analysis (including Astrophysics Data Analysis Program) to ~$90M/yr in FY16.
- Supports completion of missions under development, including LPF/ST7, ASTRO-H, NICER, TESS, and Euclid.
- Enables selection of a SMEX mission and an Explorer Mission of Opportunity from the 2014 AO, and notional release of a MIDEX AO in late CY16/early FY17.
- Provides full funding for SOFIA operations and places SOFIA into the 2016 Astrophysics Senior Review.
- Plans for the 2016 Astrophysics Senior Review.
- Plans for continued Hubble operations through FY20 providing overlap with JWST.
- Plans for mission concept studies and technology development (within the three Program SR&T budgets) leading up to the 2020 Decadal Survey.

* Excludes "SMD STEM Activities" in all years.


NASA Astrophysics Budget:
FY04-FY15 Appropriated, FY16 Requested, FY17-FY20 Notional Planning
Real Year $Million
1600
1400
1200
1000
800
600
400
200
0
JWST Program
Rest of Astrophysics
includes SMD E/PO and SMD STEM activities
Managed by JWST Program Off
Managed by Astrophysics Div
Total Astrophysics
FY04 FY05 FY06 FY07 FY08 FY09 FY10 FY11 FY12 FY13 FY14 FY15 FY16 FY17 FY18 FY19

Astrophysics Timeline



Dates beyond 2016 are contingent upon the results of the 2016 Senior Review

Backups

Big Picture

- The FY15 appropriation and FY16 budget request provide funding for NASA astrophysics to continue its programs, missions, and projects as planned
  - The total funding (Astrophysics including JWST) is flat at ~$1.3B through FY20
  - Fully fund JWST to remain on plan for an October 2018 launch
  - Fund continued pre-formulation and technology work leading toward WFIRST
  - Restores SOFIA to the budget with a reduction in FY15 and full funding beyond
  - Provides funding for SMD's education programs
- The operating missions continue to generate important and compelling science results, and new missions are under development for the future
  - Chandra, Fermi, Hubble, Kepler/K2, NuSTAR, Spitzer, Suzaku, Swift, XMM-Newton continued following the 2014 Senior Review
  - SOFIA is in prime operations as of May 2014
  - Missions on track for launch include ISS-CREAM (2015), LISA Pathfinder (2015), ASTRO-H (2015), NICER (2016), TESS (2017), JWST (2018), Euclid (2020)
  - New Explorers being selected (SMEX in 2015, MIDEX in 2017), WFIRST being studied, NASA joining ESA's Athena and ESA's L3 gravitational wave observatory
- Update to the Astrophysics Implementation Plan has been released
- Progress being made against recommendations of the 2010 Decadal Survey
  - NRC Mid Decade Review (with NSF, DOE) to begin in early 2015
  - NASA initiating concepts studies for 2020 Decadal Survey

FY15 Appropriation

($M)	2013	2014	2015	2016	2017	2018	2019
Astrophysics			$685				
JWST			$645				

- Provides $77M more than the President's Budget Request for FY15
- Supports the commitment to an October 2018 launch date for JWST
- Includes $50M for continued preformulation of WFIRST, an increase of $36M over the Administration request and comparable to FY14
- Includes $70M for continued SOFIA operations, a reduction of $14M (17%) from FY14
  - Directs NASA to (a) seek partners to restore SOFIA to its full level, and (b) not terminate missions without a Senior Review
- Includes $98M for Hubble operations, the same as FY14
- Includes $38M for scientific ballooning, an increase of $5M (15%) from FY14
- Includes $42M for Education SMD-wide as a separate budget line (so E/PO is no longer budgeted as 1% of every mission)
- Does not specify the distribution of funding for the rest of Astrophysics, but the funding is adequate for Astrophysics to execute its program as planned in FY15.
  - Includes support as planned in FY15 for missions under development, operating missions, SMEX AO, R&A, etc.
  - Final budget numbers available when NASA operating plan approved

Progress Toward Decadal Survey Priorities

The NASA FY15 Appropriation, the President's FY16 Budget Request, and the notional out year budget planning guidance in the President's FY16 Budget Request, support:	
Large-scale 1. WFIRST	Preformulation and focused technology development for WFIRST/AFTA (a 2.4m version of WFIRST with a coronagraph) are underway to enable a new start NET FY2017. Budget line established for an Astrophysics Decadal Strategic Mission.
Large-scale 2. Augmentation to Explorer Program	Astrophysics Explorers planned budget increased to support decadal cadence of AOs including SMEX AO in Fall 2014 and MIDEX AO in late 2016/early 2017.
Large-scale 3. LISA	Discussing partnership on ESA's L3 gravitational wave observatory and participating in ESA-led assessments in 2014-2015. Strategic astrophysics technology (SAT) investments plus support of LISA Pathfinder.
Large-scale 4. IXO	NASA is pursuing a partnership on ESA's L2 Athena X-ray observatory; the Athena study phase, with U.S. participation, is underway. Strategic astrophysics technology (SAT) investments.
Medium-scale 1. New Worlds Technology Development Program	Focused technology development for a coronagraph on WFIRST, strategic astrophysics technology (SAT) investments, and exoplanet probe mission concept studies. Established partnership with NSF to develop extreme precision Doppler spectrometer as facility instrument. Exozodi survey using LBTI.

Progress Toward Decadal Survey Priorities

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Medium-scale 2. Inflation Probe Technology Development Program	Balloon-borne investigations plus strategic astrophysics technology (SAT) investments.
Small-scale. Research Program Augmentations	Increased annual R&A budget by 10% from FY10 to FY12 and another 10% from FY14 to FY16. Within R&A: established Theoretical and Computational Astrophysics Networks (TCAN) program with NSF; funding available for astrophysics theory; funding available for lab astrophysics; funding available for suborbital payloads.
Small-scale. Intermediate Technology development Augmentation	Established competed Strategic Astrophysics Technology (SAT) program element; directed technology funding for WFIRST and other large-scale decadal priorities.
Small-scale. Future Ultraviolet-Visible Space Capability	Strategic Astrophysics Technology (SAT) investments.
Small-scale. SPICA (U.S. contribution to JAXA-led)	Not supported as a strategic contribution; candidate for Explorer Mission of Opportunity.