National Aeronautics and Space Administration

NASA HQ Overview
ExoPAG 10
Boston, MA

June 6, 2014

Astrophysics

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Exoplanet Exploration Program Scientist

www.nasa.gov

FY14 (this year) Budget Appropriation

- Final FY14 Appropriation is $668M for Astrophysics and $658M for JWST.
  - **Appropriation includes new projects** for TESS, NICER, Euclid; augmentation for future Explorer AOs; core funding for research and suborbital projects; planning budget wedge for strategic mission starting NET FY17.
  - **JWST plan for 2018 launch is fully funded**.
  - **Budget is $26M higher for Astrophysics than requested**, including $56M directed funding for WFIRST/AFTA studies (compared with $13M planned).
  - Remainder of Astrophysics (other than JWST and WFIRST/AFTA) must be adjusted to accommodate the ~$20M difference; accommodated without impact by rephasing Explorers funding.
  - Appropriation includes no funding in Astrophysics for education; SMD to continue conducting education activities in FY14 and to consider consolidation at the Division level; **Astrophysics reprogrammed some funds for education activities in FY14**.
- FY15 President's budget request was released on March 4 (top level only) and March 10 (full details)

FY15 (next year) Budget Request

Outyears are notional

($M)	2013	2014	2015	2016	2017	2018	2019
Astrophysics	$617	$668	$607	$634	$651	$697	$993
JWST	$627	$658	$645	$620	$569	$535	$305

- **Supports pre-formulation of WFIRST/AFTA**, including technology development for detectors and coronagraph.
- Supports a growing Astrophysics Explorer program with continued development of ASTRO-H, NICER, and TESS, and initiation of the next Small Explorer mission.
- Supports operating missions: Hubble, Chandra, and other missions rated highly by the 2014 Senior Review.
- Continues a competed astrophysics research program and support of the balloon program.
- Seeks to work with current partner Germany and potential partners to identify a path forward for SOFIA with greatly reduced NASA funding. Unless partners are able to support the U.S. portion of SOFIA costs, **NASA will place the aircraft into storage by FY 2015**.
- **Supports the commitment to an October 2018 launch date for JWST**. Continues manufacturing of the flight sunshield structure and membranes. Completes and delivers the flight cryogenic cooler tower assembly. Delivers the Optical Telescope Element flight structure. Initiates integration of the 18 flight primary mirror segments. Conducts the final Integrated Science Instrument Module level cryo-vacuum test.

FY15 (next year) Budget Appropriation

- Administration request is $607M for Astrophysics and $645M for JWST.
- Progress to date: markup by House subcommittee and committee; considered on House floor on May 28-29. House drafted appropriations bill and report includes:
  - Recommendation is $680M for Astrophysics and $645M for JWST
  - Restores $5M reduction in Hubble operations
  - Rejects SOFIA termination; appropriates $70M (an increase of $58M) to "support the aircraft's fixed costs (flight crews, required maintenance, etc.) as well as a base level of scientific observations. NASA shall continue seeking third-party partners whose additional funding support would restore SOFIA's budget to its full operational level."
  - Provides $30M (an increase of $15M) to "proportionally reallocate these funds among the SMD divisions, resulting in a dedicated budget line for each division's own EPO activities."
- Next steps:
  - Markup by Senate appropriations subcommittee and committee scheduled for this week; draft appropriations bill and report to be reconciled with House version.
  - Votes by House and Senate then signed into law by the President

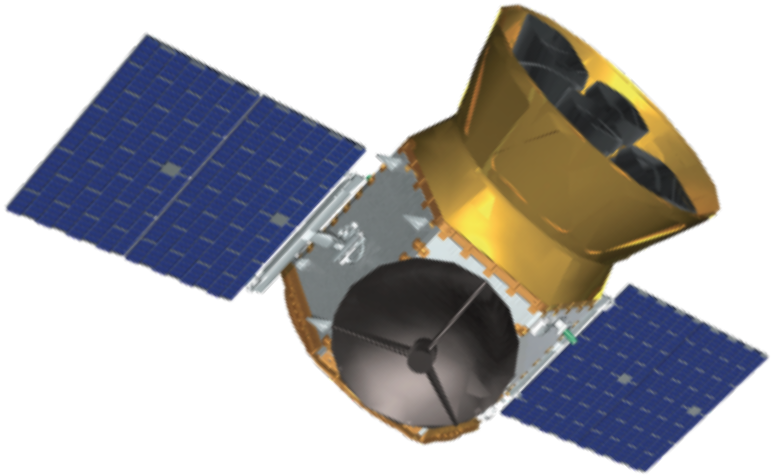
Kepler
Kepler Space Telescope

- **NASA's first space mission dedicated to the search for extrasolar planets, or exoplanets**
- **PI:** W. Borucki, NASA Ames Research Center
- **Launch Date:** March 6, 2009
- **Payload:** 0.95-meter diameter telescope designed to measure the tiny dimming that occurs when an orbiting planet passes in front of ('transits') a star
- **Scientific objectives:**
  - conduct census of exoplanet systems
  - explore the structure and diversity of extrasolar planetary systems
  - determine the frequency of habitable, Earth-sized planets in our galaxy

CURRENT STATUS:

- Kepler "K2" mission concept approved for operations through Fiscal Year 2016 after completion of 2014 Senior Review.
  - Kepler will conduct observations along the ecliptic, changing its orientation four times per year.
  - First 75-day Campaign to begin in June.
  - Targets selected via proposals from community.
  - GO Solicitation in preparation; will solicit proposals for Campaigns 4 and 5. Additional solicitations planned to support subsequent campaigns
  - Proposals for analysis of observations from Campaigns 0-3 eligible for funding under ADAP.
- Analysis of first 3 years of Kepler primary mission data has revealed:
  - 3845 exoplanet candidates orbiting 2658 unique stars
  - 962 candidates validated as planets to date
  - More than 100 "habitable zone" planets, two dozen of which have radii < 2 R_{Earth}.
- Analysis of the full (4+ year) Kepler data set ongoing.

TESS
Transiting Exoplanet Survey Satellite



Standard Explorer (EX) Mission

PI: G. Ricker (MIT)

Mission: All-Sky photometric exoplanet mapping mission.

Science goal: All-sky survey for transiting exoplanets around the closest and brightest stars in the sky.

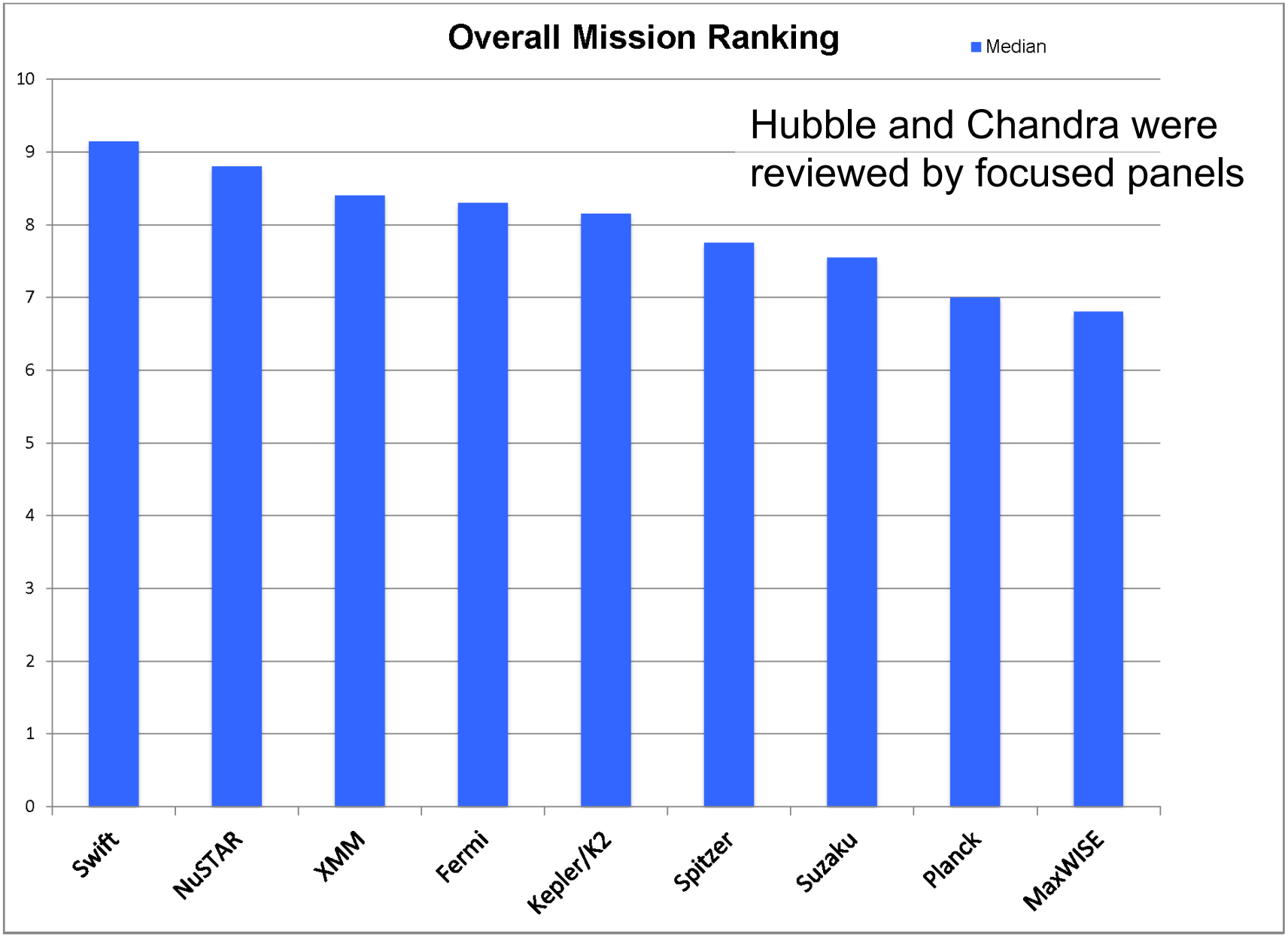
Instruments: Four wide field of view (24°x24°) CCD cameras with overlapping field of view–operating in the Visible-IR spectrum (0.6-1 micron).

Operations: 2017 launch with a 2-year prime mission

CURRENT STATUS:

- Downselected April 2013.
- Major partners:
  - PI and science lead: MIT
  - Project management: NASA GSFC
  - Instrument: Lincoln Labs
  - Spacecraft: Orbital Science Corp
- Current launch readiness date: August 2017.
- High-Earth elliptical orbit (17 x 58.7 Earth radii).
- Development progressing on plan.
  - Systems Requirement Review successfully completed on February 12-13, 2014.
  - Preliminary Design Review (PDR) scheduled for Sept. 2014
  - Confirmation Review, for approval to enter implementation phase, planned for Oct./Nov. 2014.

Astrophysics 2014 Senior Review



Astrophysics 2014 Senior Review

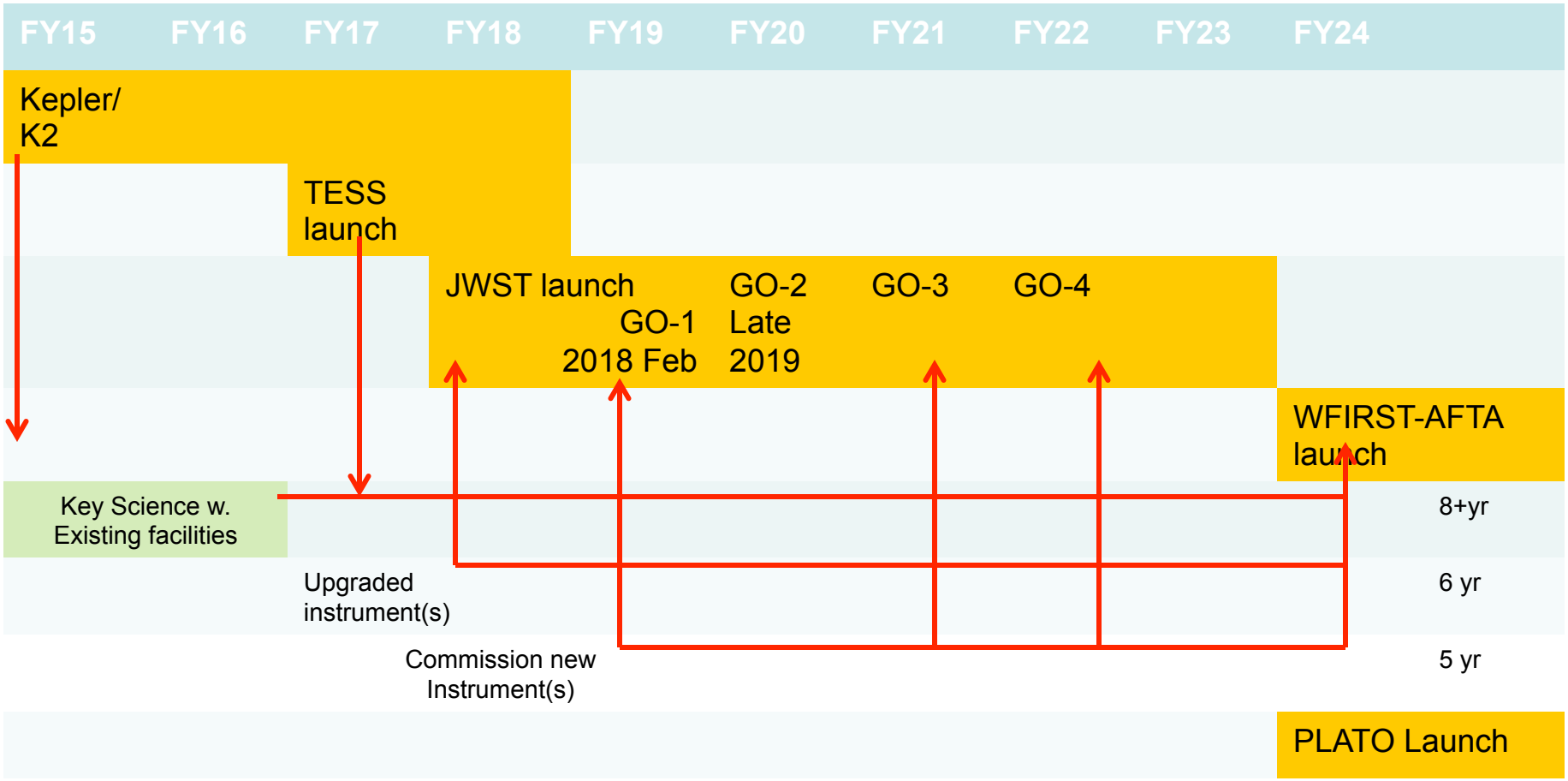
- Hubble Space Telescope: extension approved
- Chandra X-ray Observatory: extension approved
- Swift Gamma-ray Burst Explorer: extension approved
- Nuclear Spectroscopic Telescope Array (NuSTAR): extension approved and new GO program
- X-ray Multi-Mirror Mission-Newton (XMM-Newton) (ESA mission): extension approved and augmented GO program
- Fermi Gamma-ray Space telescope: extension approved
- Kepler Space Telescope: K2 extension approved
- Spitzer Space Telescope: mission not extended
- Suzaku (JAXA mission): extension approved
- Planck (ESA mission): augmentation approved
- Widefield Infrared Survey Explorer (NEOWISE-R): data analysis proposal not approved

http://science.nasa.gov/astrophysics/2014-senior-review-operating-missions/

WFIRST Preparatory Science

- New ROSES Element, announced April 21.
- Proposals due July 11.
- Purpose: bridge from basic theory to observational modeling for WFIRST/AFTA.
- Proposals must be both:
  - Relevant to WFIRST's primary astrophysics goals.
  - Predominantly WFIRST-specific development of detailed simulations and models.
- Anticipate selecting ~12 proposals, total $1.8M in first year.
- Intend to select a range of scales (smaller and larger) and periods of performance (1,2,3 yr).
- Investigators selected will coordinate efforts with WFIRST Study Office and WFIRST/AFTA Science Definition Team.
  - Annual summary white paper on progress.

Precision RV Timeline



Criticality and need-date for expanded PRV defined by mission needs, especially obtaining best TESS targets for JWST

2014 Astrophysics Explorer AO (1 of 2)

- Community Announcement released on November 12, 2013, indicating NASA will solicit proposals for SMEX missions and Missions of Opportunity.
- Draft AO targeted for spring 2014, with Explorer Workshop ~ 2 weeks later.
- Final AO targeted for late summer/early fall 2014, with Pre-Proposal Conference ~ 3 weeks after final AO release. Proposals due 90 days after AO release.
- Missions of Opportunity allowed in all three categories: Partner Mission of Opportunity, New Missions using Existing Spacecraft, or Small Complete Mission, including those requiring flight on the ISS.
- PI-managed cost cap $35M for sub-orbital class MOs, which include ultra-long duration balloons, suborbital reusable launch vehicles, and CubeSats. Other MOs (not suborbital-class) have a $65M PI-managed cost cap.
- Two-step process. Step 1 selects 2-3 SMEX missions and 1-3 MOs for 1-year Phase A concept studies, Step 2 down-selects 1 SMEX and 1 MO for Phase B and subsequent phases.

2014 Astrophysics Explorer AO (2 of 2)

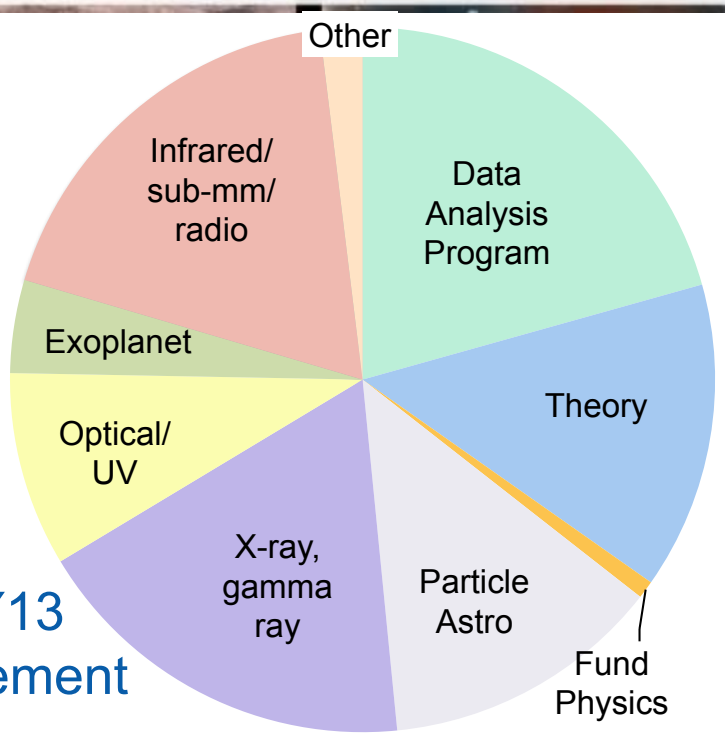
- Although NASA-provided launch services are offered and may be proposed, proposers may also propose alternative access to space, including contributed launch services.
- The PI-Managed Mission Cost for proposed SMEX missions will be $175M, including the launch services.
- NASA-provided launch services may be proposed at a charge of $50M in FY 2015 dollars against the PI-Managed Mission Cost.
- For alternative access to space, which must be arranged by the proposer and funded within the $175M PI-Managed Mission Cost, a charge to the PI-Managed Mission Cost of $2M will be levied for the expected NASA launch vehicle monitoring functions and advisory services.

Backup Slides

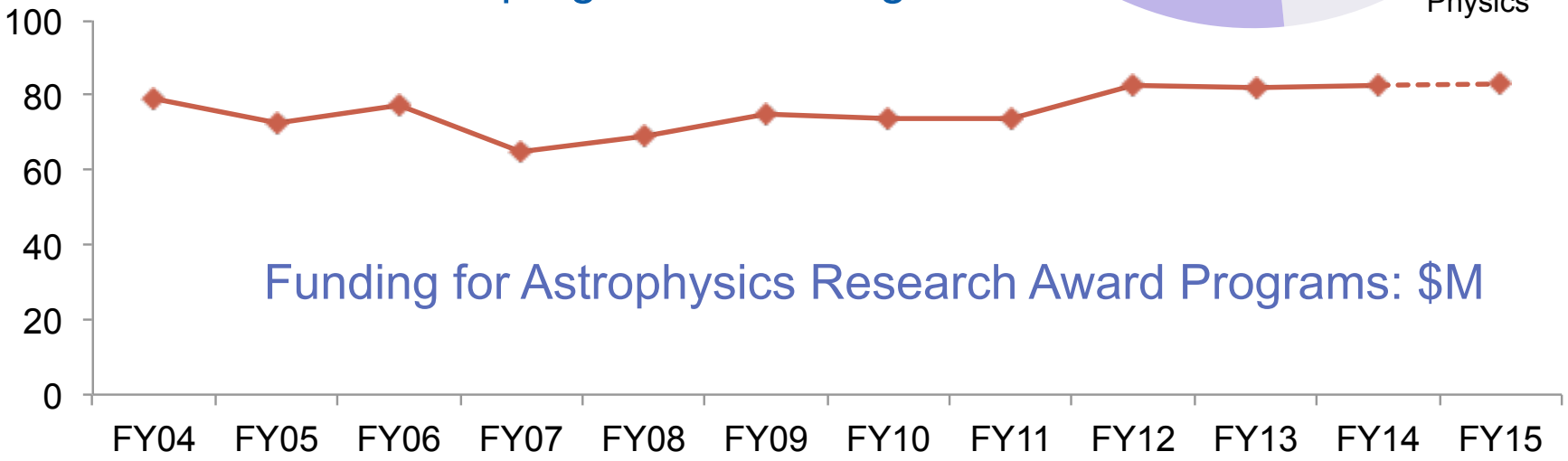
Astrophysics Research Program Funding

Most recent year:

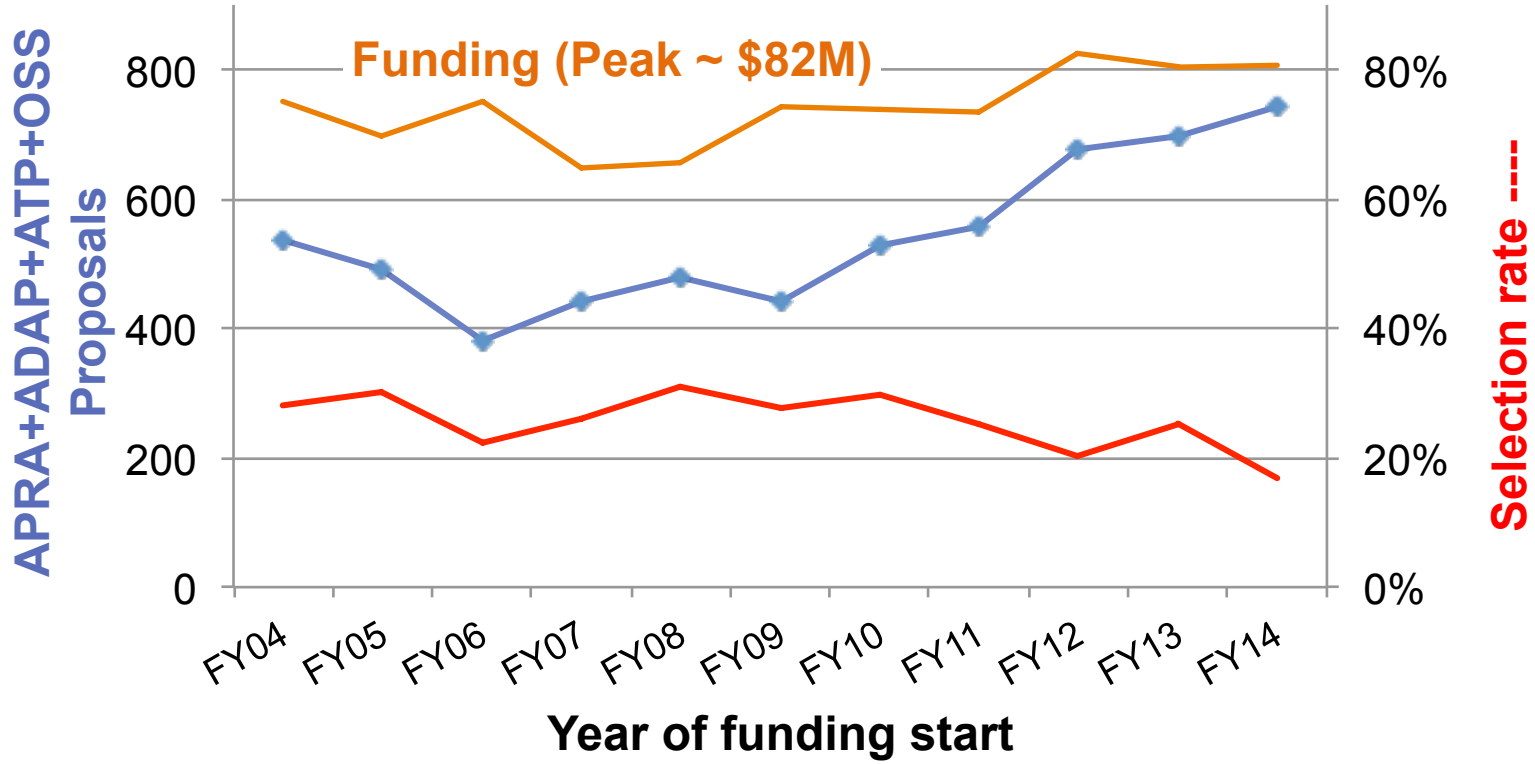
	Proposals Rec'd	Year-1 $M	selected	Success Rate
RTF-12	12	0.6	2	17%
APRA-12	178	13.6	37	21%
SAT-12	38	5.2	9	24%
ADAP-13	276	4.4	41	15%
OSS-13	39	0.9	7	18%
ATP-13	181	3.9	27	15%



Split of $81.967M spent in FY13
PI award programs + management



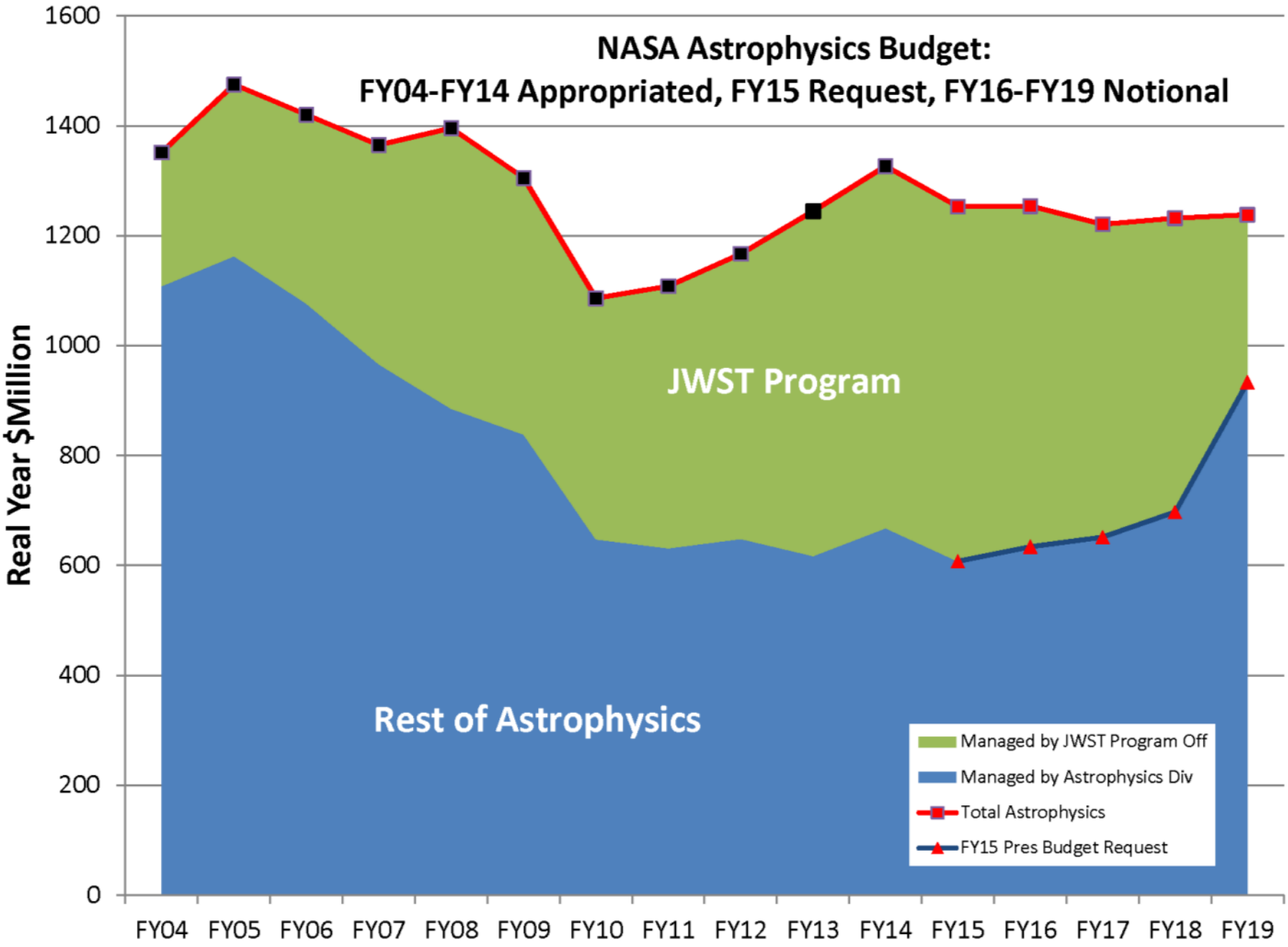
Astrophysics ROSES selection rates



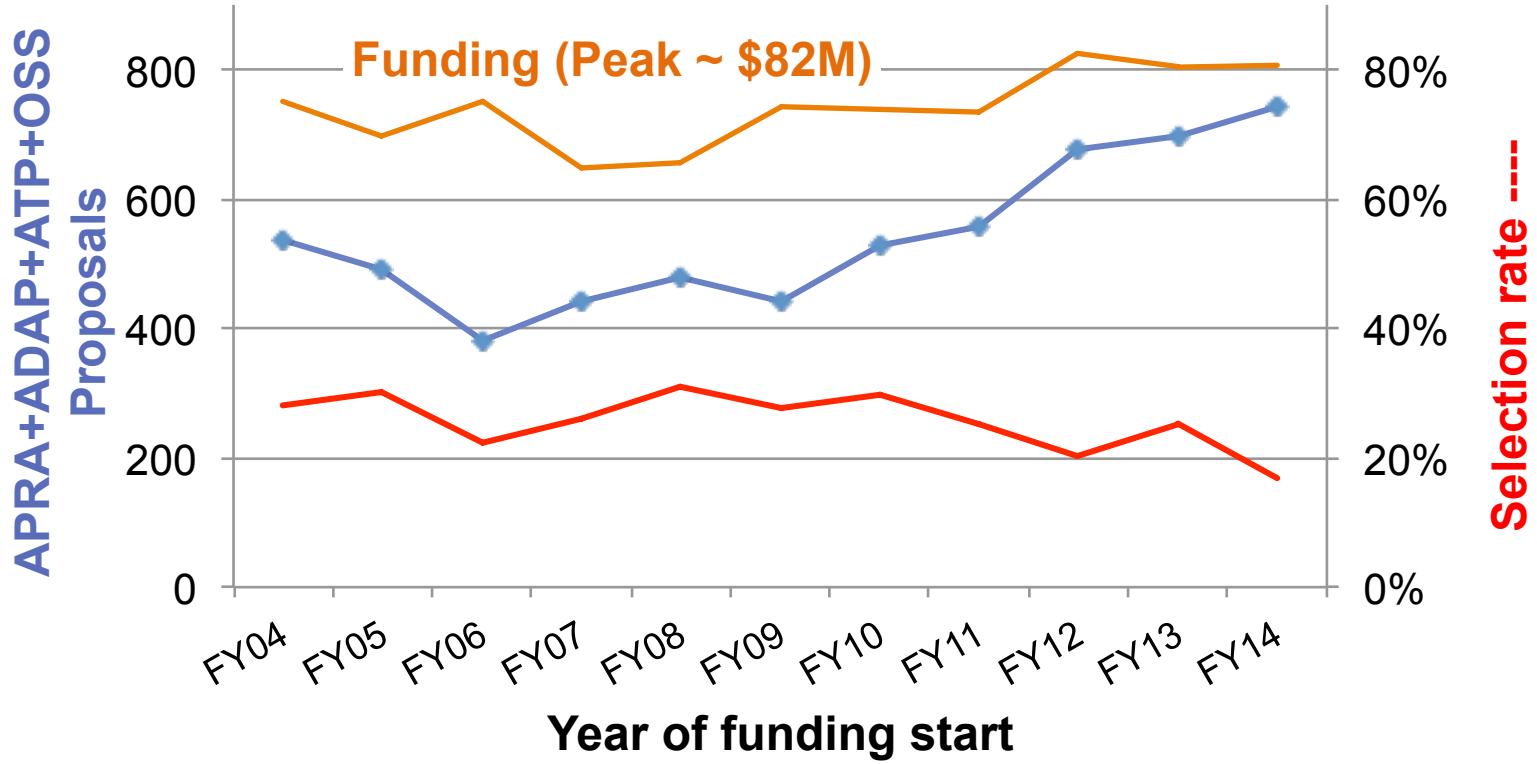
Last year, the Astrophysics Research Program received twice as many proposals as in 2006.

Funding for the program has risen 25% since 2006, but it has not doubled; so the success rate has fallen.

Total funding per successful proposal has been steady at $500k-$600k – this is an average over theory investigations, flight payloads, etc.


NASA Astrophysics Budget:
FY04-FY14 Appropriated, FY15 Request, FY16-FY19 Notional
Real Year $Million
1600
1400
1200
1000
800
600
400
200
0
JWST Program
Rest of Astrophysics
Managed by JWST Program Off
Managed by Astrophysics Div
Total Astrophysics
FY15 Pres Budget Request
FY04
FY05
FY06
FY07
FY08
FY09
FY10
FY11
FY12
FY13
FY14
FY15
FY16
FY17
FY18
FY19

Astrophysics ROSES selection rates



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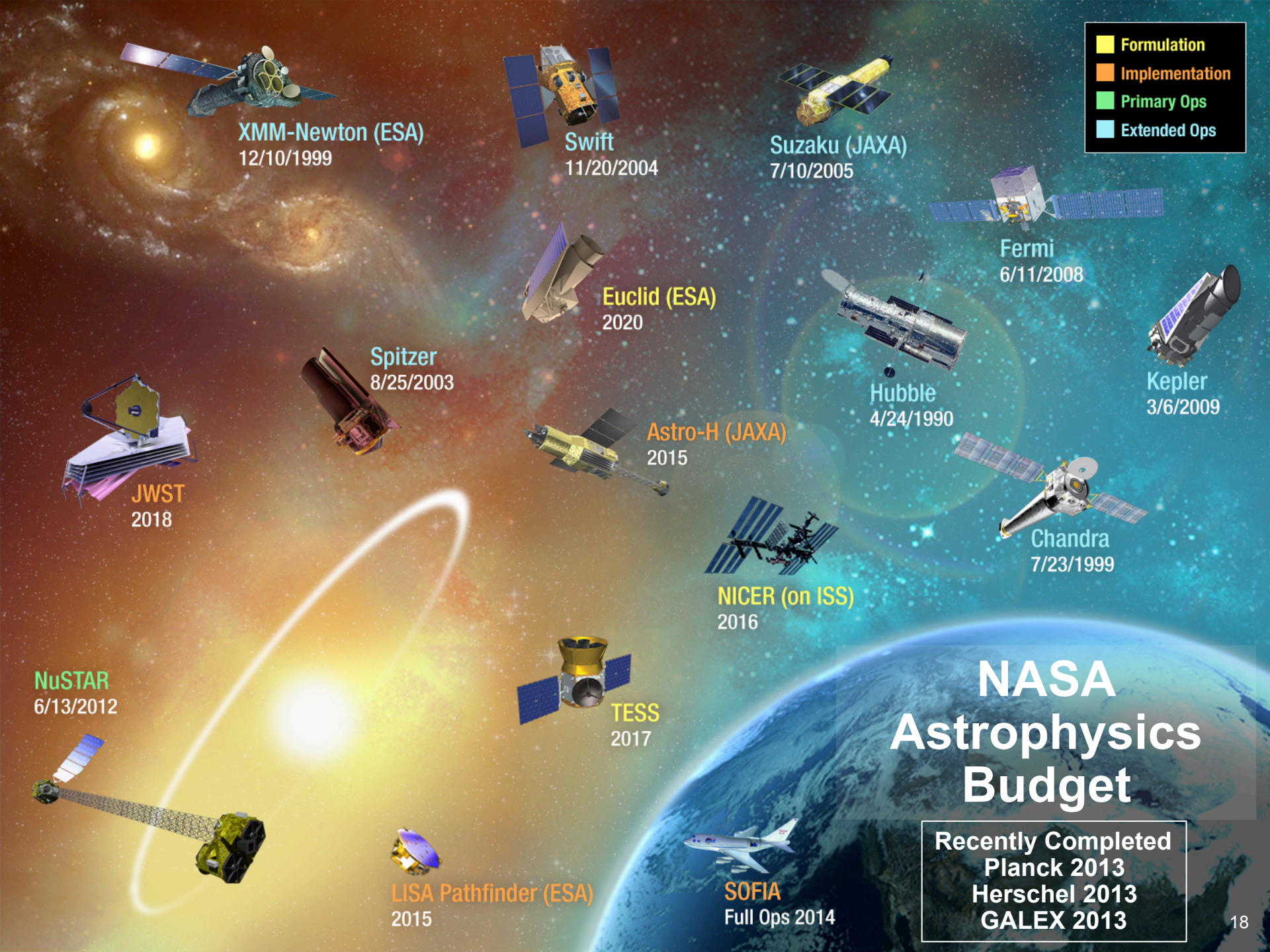
Formulation
Implementation
Primary Ops
Extended Ops
XMM-Newton (ESA)
12/10/1999
Swift
11/20/2004
Suzaku (JAXA)
7/10/2005
Fermi
6/11/2008
Euclid (ESA)
2020
Spitzer
8/25/2003
Hubble
4/24/1990
Kepler
3/6/2009
JWST
2018
Astro-H (JAXA)
2015
Chandra
7/23/1999
NICER (on ISS)
2016
NuSTAR
6/13/2012
TESS
2017
LISA Pathfinder (ESA)
2015
SOFIA
Full Ops 2014
NASA Astrophysics Budget
Recently Completed
Planck 2013
Herschel 2013
GALEX 2013

Astrophysics Division - Science Mission Directorate

May 22, 2014

Resource Management
Omana Cawthon +
Clemencia Gallegos-Kelly +

Director
Paul Hertz
Deputy Director
Andrea Razzaghi

Lead Secretary: Kelly Johnson
Secretary: Leslie Allen
Program Support Specialist: Jackie Mackall

Cross Cutting

Technology Lead: William (Billy) Lightsey *
Division E/PO POC: Hashima Hasan (Lead Comm Team)
Division Public Affairs POC: Lisa Wainio *
Information Manager: Lisa Wainio *

Astrophysics Research

Program Manager: Linda Sparke
Program Support: Janet Larson *
Astrophysics Data Analysis: Debra Wallace *
Astrophysics Theory: Keith MacGregor *
Origins of Solar Systems: Larry Petro *
APRA lead: Michael Garcia *
Cosmic Rays, Fundamental Physics: Vernon Jones, Keith MacGregor *
Gamma Ray/X-ray: Michael Garcia*, Stefan Immler* Lou Kaluzienski, Rita Sambruna, Wilt Sanders*
Optical/Ultraviolet: Michael Garcia *, Hashima Hasan, Mario Perez *
IR/Submillimeter/Radio: Dominic Benford *, Doug Hudgins, Larry Petro *, Eric Tollestrup *, Glenn Wahlgren*
Lab Astro: Glenn Wahlgren*
Data Archives: Hashima Hasan
Astrophysics POC for Sounding Rockets: Wilt Sanders *
Balloons Program: Vernon Jones (PS), Mark Sistilli (PE)

Programs / Missions

Exoplanet Exploration (EXEP)

Program	Program Scientist: Doug Hudgins	Program Executive: John Gagosian
Keck	Hashima Hasan	Mario Perez *
Kepler	Doug Hudgins	Jeff Hayes
LBTI	Hashima Hasan	Mario Perez *
NExScI	Hashima Hasan	Mario Perez *

Cosmic Origins (COR)

Program	Program Scientist: Mario Perez *	Program Executive: Lia Lapiana
Herschel	Glenn Wahlgren *	Jeff Hayes
Hubble	Michael Garcia *	John Gagosian
JWST	Hashima Hasan	N/A
SOFIA	Glenn Wahlgren *	John Gagosian
Spitzer	Glenn Wahlgren *	Jeff Hayes

Physics of the Cosmos (PCOS)

Program	Program Scientist: Rita Sambruna	Program Executive: Lia LaPiana
Chandra	Wilt Sanders *	Jeff Hayes
Euclid	Linda Sparke	Jeff Hayes
Fermi	Keith MacGregor *	Jeff Hayes
L2/X-ray	Michael Garcia *	Lia LaPiana
Planck	Rita Sambruna	Jeff Hayes
ST-7/LPF	Wilt Sanders *	Jeff Hayes
XMM-Newton	Lou Kaluzienski	Jeff Hayes

Astrophysics Explorers (APEX)

Program	Program Scientist: Wilt Sanders *	Program Executive: Mark Sistilli
ASTRO-H	Lou Kaluzienski	Jeanne Davis
NICER	Rita Sambruna	Jeanne Davis
NuSTAR	Lou Kaluzienski	Jeff Hayes
Suzaku	Lou Kaluzienski	Jeff Hayes
Swift	Michael Garcia *	Jeff Hayes
TESS	Doug Hudgins	Mark Sistilli
WFIRST/AFTA	Dominic Benford *	Lia LaPiana

\+ *Member of the Resources Mgmt Division*
* *Detailee, IPA, or contractor*
JWST now part of the JWST Program Office.

Anne-Marie Novo-Gradac on detail to the SMD Front Office.