

National Aeronautics and Space Administration



Hubble Space Telescope Users Committee (STUC)

April 16, 2015

Astrophysics

Michael Garcia

HST Program Scientist

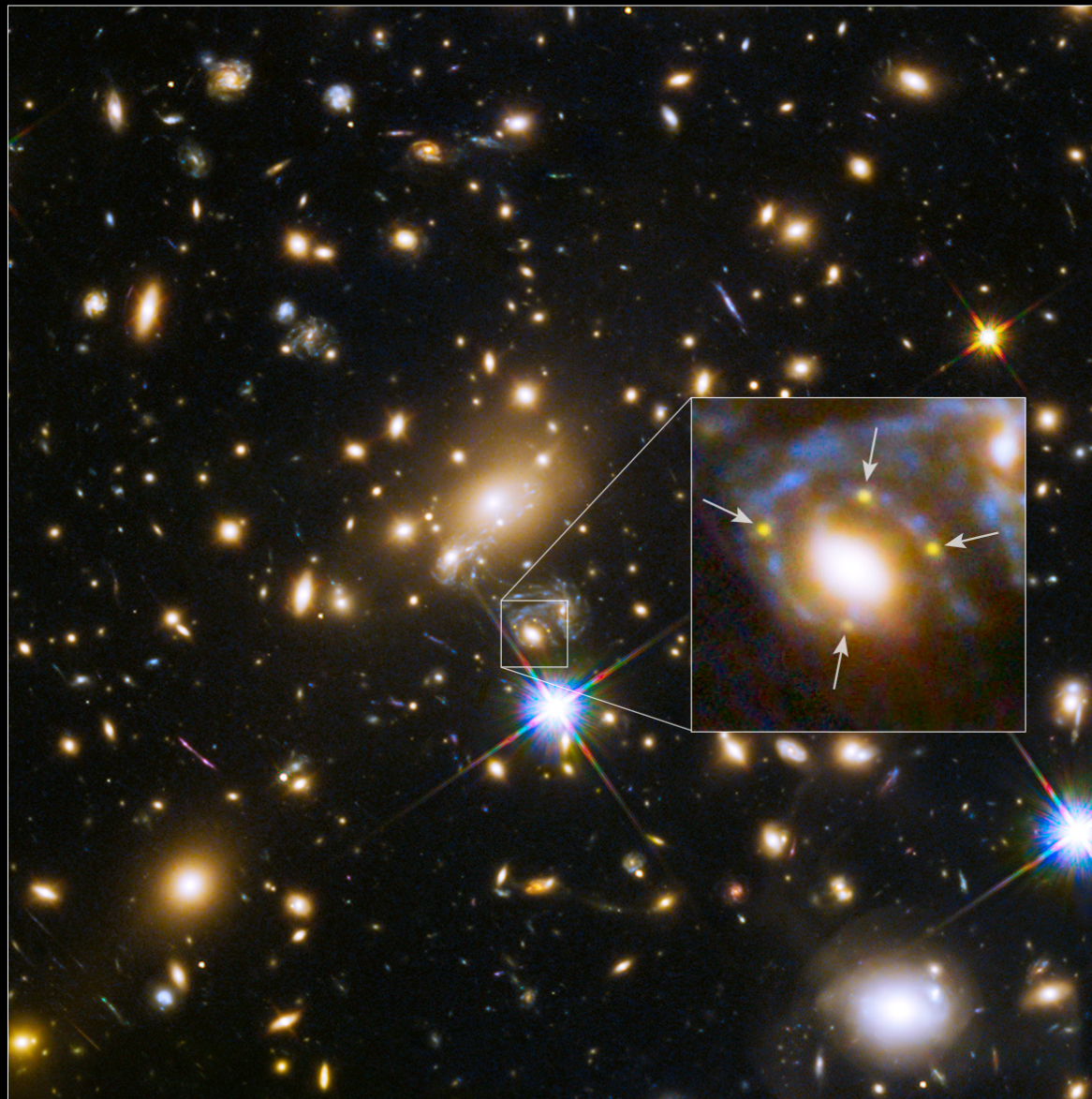
Michael.R.Garcia@NASA.GOV



Hubble Sees Supernova Split into Four Images by Cosmic Lens

Supernova Refsdal
Galaxy Cluster MACS J1149.6+2223

Hubble Space Telescope
ACS/WFC ■ WFC3/IR



NASA and ESA

STScI-PRC15-08a



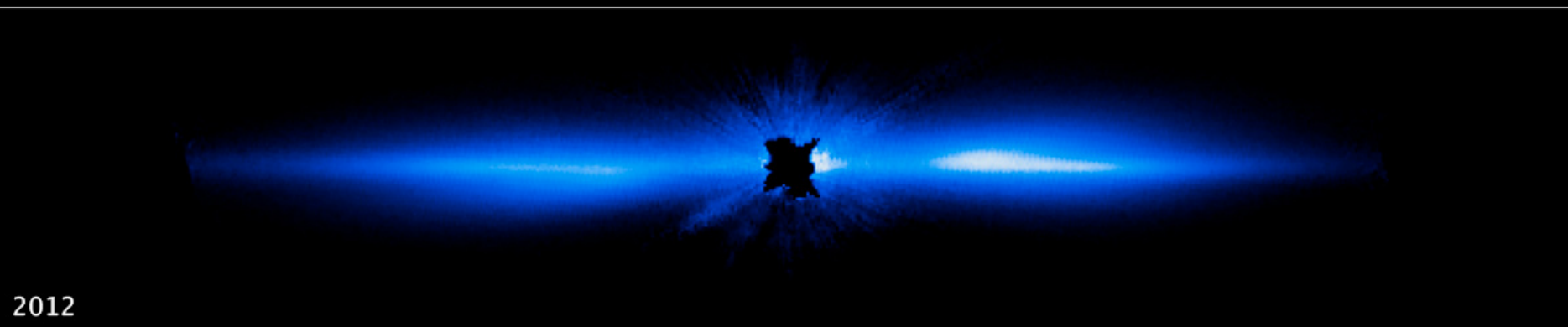
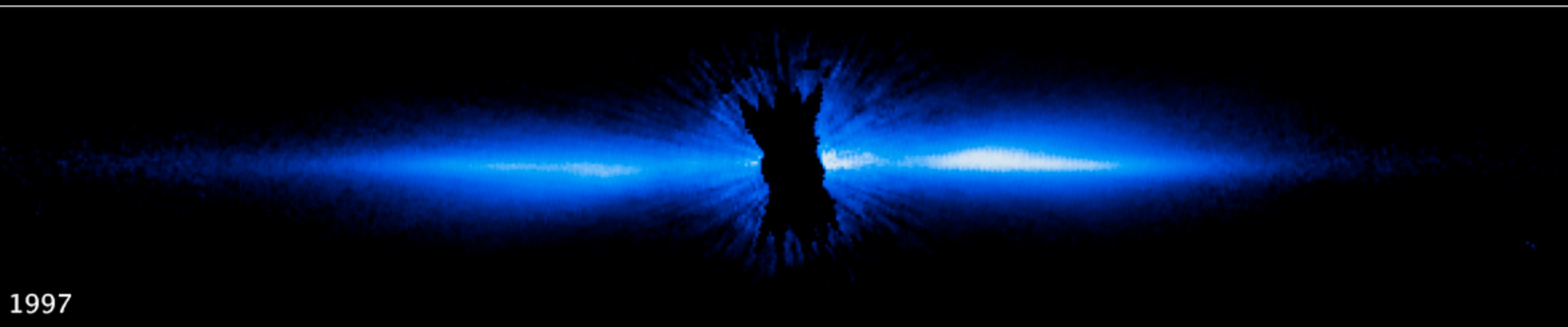
NASA's Hubble Observations suggest Underground Ocean on Jupiter's Largest Moon Ganymede





NASA's Hubble detects Distortion of Circumstellar Disk by a Planet

Beta Pictoris ■ *Hubble Space Telescope* ■ STIS

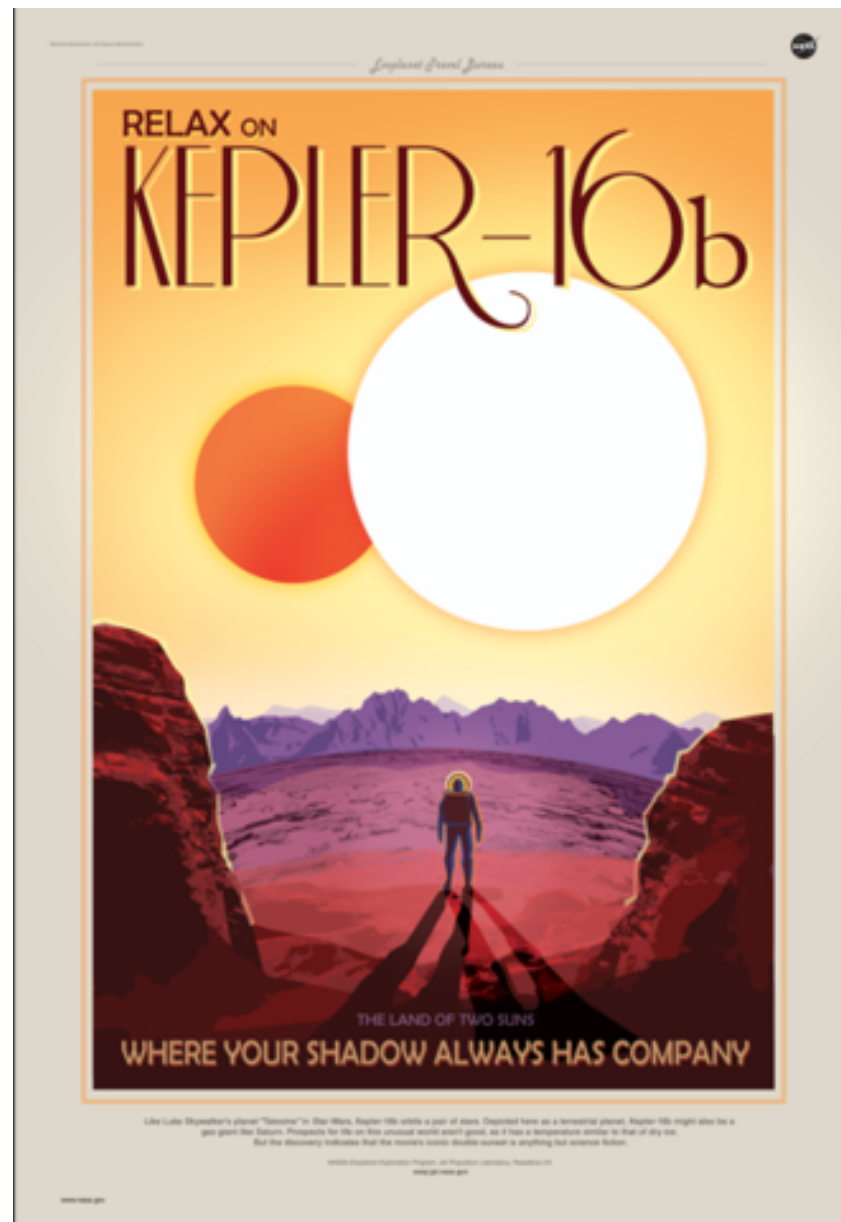


NASA and ESA

STScI-PRC15-06a



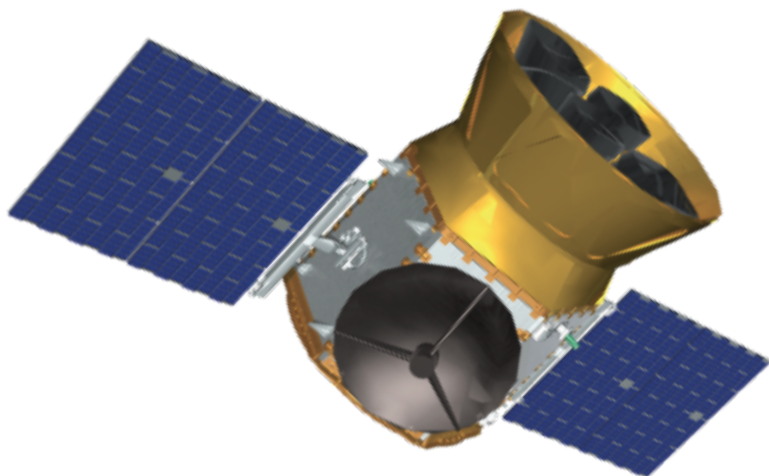
The Exoplanet Travel Bureau





TESS

Transiting Exoplanet Survey Satellite



Standard Explorer (EX) Mission

PI: G. Ricker (MIT)

Mission: All-Sky photometric exoplanet mapping mission.

Science goal: Search for transiting exoplanets around the nearby, bright stars.

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

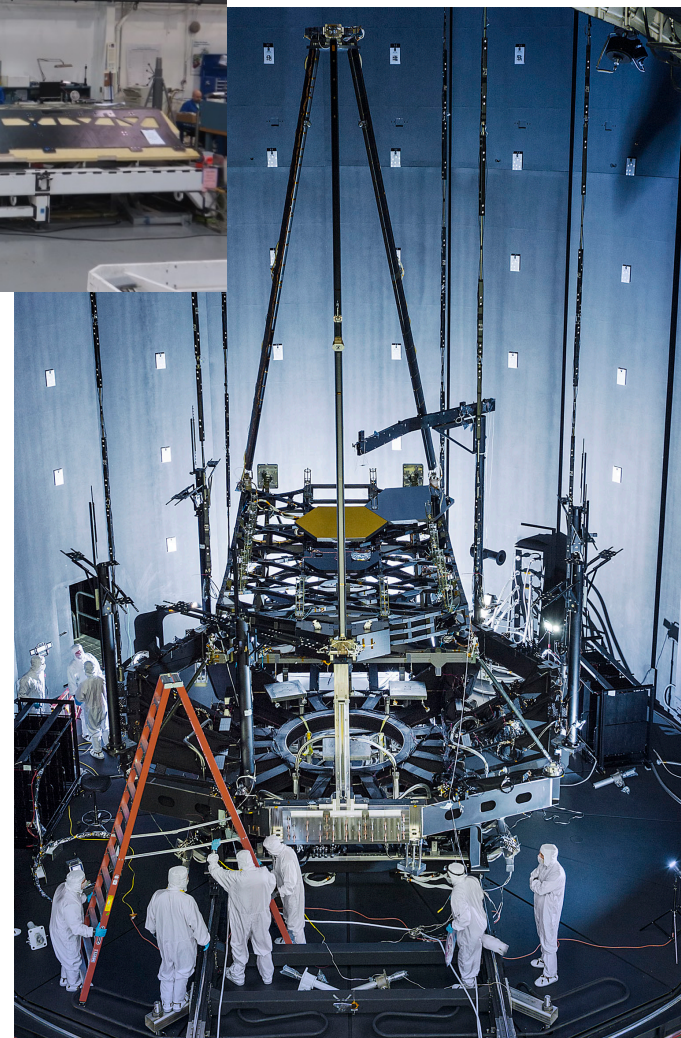
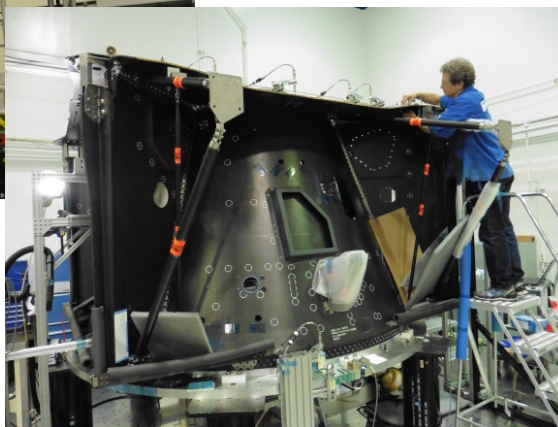
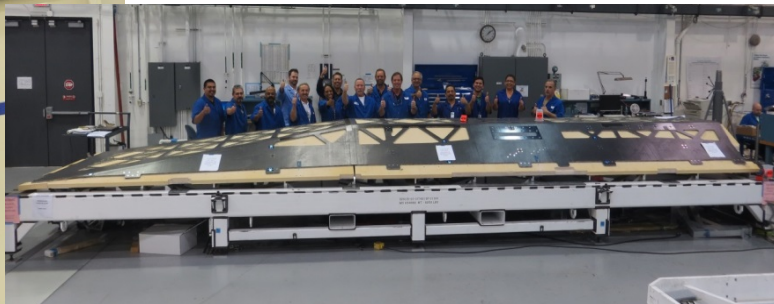
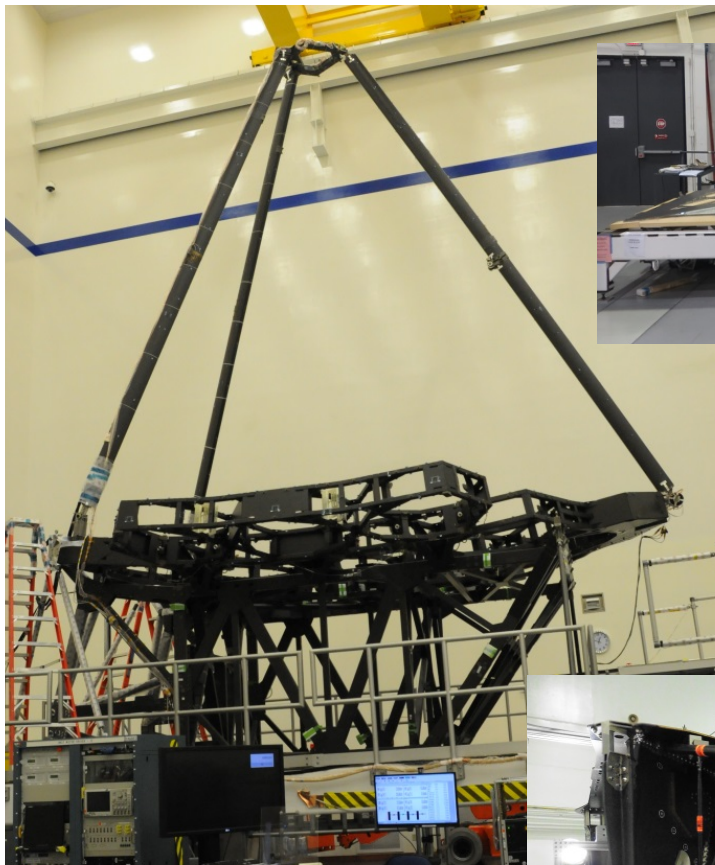
Operations: 3-year science mission after launch.

CURRENT STATUS:

- Downselected April 2013.
- Major partners:
 - PI and science lead: MIT
 - Project management: NASA GSFC
 - Instrument: Lincoln Laboratory
 - Spacecraft: Orbital Science Corp
- Agency launch readiness date NLT June 2018 (working launch date August 2017).
- High-Earth elliptical orbit (17 x 58.7 Earth radii).
- Development progressing on plan.
 - Systems Requirement Review (SRR) successfully completed on February 12-13, 2014.
 - Preliminary Design Review (PDR) successfully completed Sept 9-12, 2014.
 - Confirmation Review, for approval to enter implementation phase, successfully completed October 31, 2014.
 - Mission CDR on track for August 2015



JWST Hardware Progress



JWST remains on track for an October 2018 launch within its replan budget guidelines



WFIRST / AFTA

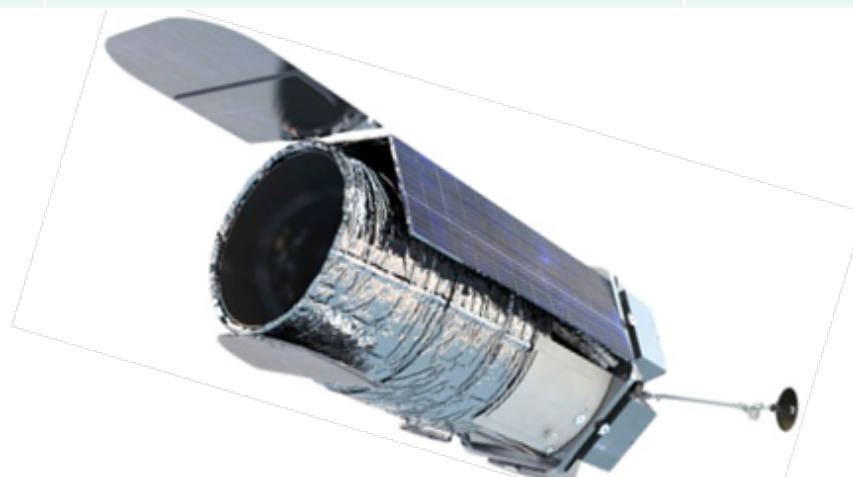
Widefield Infrared Survey Telescope with Astrophysics Focused Telescope Assets

Coronagraph Technology Milestones

1	Shaped Pupil mask fabricated with reflectivity of 10^{-4} and 20 μm pixel size.	7/21/14 ✓
2	Shaped Pupil Coronagraph demos 10^{-8} raw contrast with narrowband light.	9/30/14 ✓
3	PIAACMC mask fabricated with 10^{-8} raw contrast with 10% broadband light.	12/15/14 ✓
4	Hybrid Lyot Coronagraph demos 10^{-8} raw contrast with narrowband light..	2/28/15 ✓
5	Occulting Mask Coronagraph demos 10^{-8} raw contrast with 10% broadband light.	9/15/15
6	Low Order Wavefront Sensing provides jitter sensing better than 0.4 mas rms.	9/30/15
7	Spectrograph read-out demo to have low dark current and read noise.	8/25/16
8	PIAACMC coronagraph demos 10^{-8} raw contrast with 10% broadband light.	9/30/16
9	Occulting Mask Coronagraph demos 10^{-8} raw contrast with 10% broadband light.	9/30/16

Widefield Detector Technology Milestones

1	Produce, test, and analyze 2 candidate passivation techniques in banded arrays.	7/31/14 ✓
2	Produce, test, and analyze 1 additional candidate passivation techniques in banded arrays.	12/30/14 ✓
3	Produce, test, and analyze full arrays with operability > 95%.	9/15/15
4	Produce, test, and analyze final selected recipe in full arrays demonstrating a yield > 20% with operability > 95%.	9/15/16
5	Complete environmental testing of one sensor chip assembly, as per NASA test standards.	12/1/16





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
 - Restore SOFIA to the budget with a reduction in FY15 and full funding beyond
 - Provide 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 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 large mission concept 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 \$98.6M for Hubble operations, ~the same as FY14
- Includes \$38M for scientific ballooning, an increase of \$5M (15%) from FY14
- 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



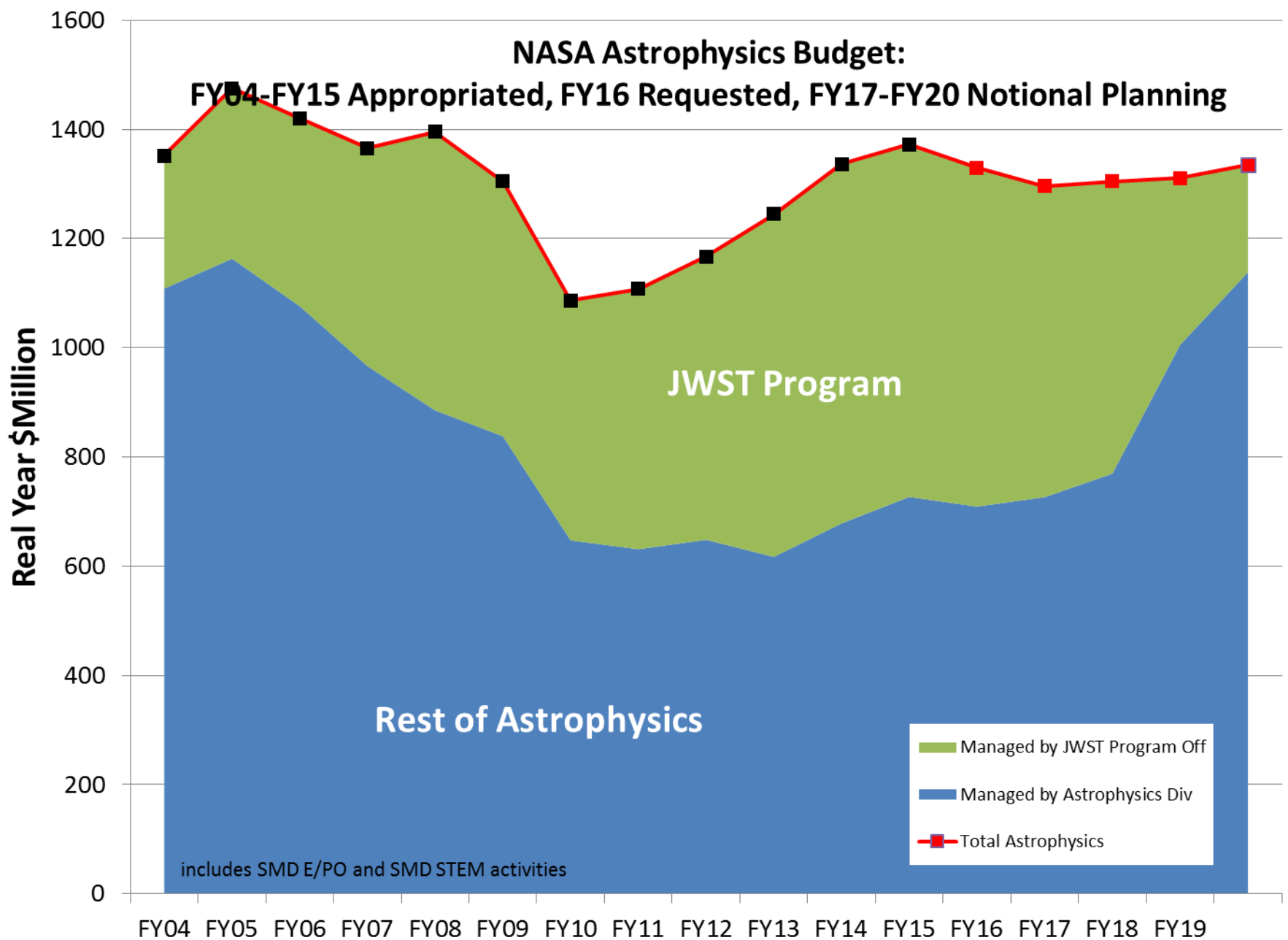
FY16 President's Budget Request

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

- Continues preformulation of WFIRST/AFTA as the “Astrophysics Decadal Strategic Mission.”
- [Grows Astrophysics Research and Analysis \(including Astrophysics Data Analysis Program\) from ~\\$80M/yr 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.



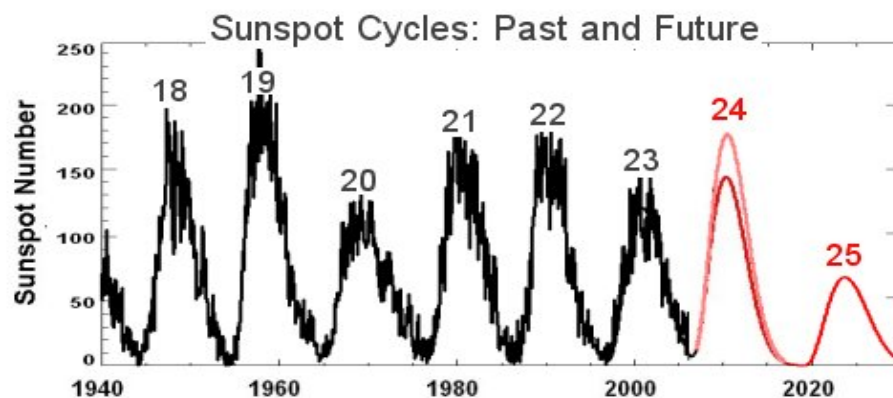
Astrophysics Program Content

	Op Plan FY14	Enacted FY15		Notional			
			FY16	FY17	FY18	FY19	FY20
Astrophysics	678.3	726.8	709.1	726.5	769.5	1005.5	1138.256
<u>Astrophysics Research (including STEM Activities)</u>	<u>145.2</u>		<u>187.7</u>	<u>228.1</u>	<u>226.9</u>	<u>229.1</u>	<u>253.2</u>
Astrophysics Research and Analysis	63.3		72.3	73.7	73.0	73.0	73.0
Balloon Project	32.9	38.0	34.2	34.3	37.3	37.4	37.4
<u>Other Missions and Data Analysis</u>	<u>49.1</u>		<u>81.1</u>	<u>120.1</u>	<u>116.6</u>	<u>118.7</u>	<u>142.8</u>
SMD STEM Activities	0.9	42.0	20.0	20.0	20.0	20.0	20.0
Astrophysics Data Curation and Archival	18.2		18.7	18.8	18.8	18.9	18.9
Astrophysics Data Program	17.0		17.6	17.6	17.6	17.6	17.6
Astrophysics Senior Review			0.2	37.7	33.2	36.2	34.3
Astrophysics Directed R&T			8.6	10.0	10.9	9.9	35.9
Contract Administration, Audit & QA Svcs	13.0		16.0	16.0	16.1	16.1	16.1
<u>Cosmic Origins</u>	<u>224.2</u>		<u>199.3</u>	<u>200.4</u>	<u>199.1</u>	<u>207.9</u>	<u>244.5</u>
Hubble Space Telescope	98.3	98.6	97.1	93.5	97.7	89.3	89.3
SOFIA	84.4	70.0	85.2	85.1	86.2	89.1	91.0
<u>Other Missions and Data Analysis</u>	<u>41.5</u>		<u>17.0</u>	<u>21.7</u>	<u>15.3</u>	<u>29.5</u>	<u>64.2</u>
Spitzer	17.3		7.2	7.5			
Herschel	11.6		2.4	1.0			
Cosmic Origins SR&T	10.0		3.5	9.3	10.9	25.1	58.7
Cosmic Origins Future Missions	0.1		1.0	0.9	1.3	1.3	2.4
Cosmic Origins Program Management	2.6		2.9	3.0	3.1	3.1	3.1



HST Going Forward

- 2014 Senior Review was not a budget review for HST
 - HST will be “operated as a Great Observatory as long as it is scientifically productive”
- Will be reviewed in 2016 ensure bullet 1
- NASA investigating ways to make HST SR more efficient
- Engineering and Safety Center ‘HST Observatory System Reliability Review’
 - Used to guide long-term investments
- Solar Cycle 24
 - Two sigma earliest is ~2025, else 2036





SMD Science Education

- Education is funded in the FY15 NASA Appropriation Act at \$42M SMD-wide as a separate budget line (so E/PO is no longer budgeted as 1% of every mission).
- SMD will compete and consolidate education activities for FY16.
- SMD has released a Cooperative Agreement Notice (CAN) soliciting team-based proposals for science education.
- The goal of the NASA SMD Science Education CAN is to meet the following objectives: Enabling STEM education; Improving U.S. science literacy; Advancing National education goals; and Leveraging science education through partnership.
- The schedule is as follows:

CAN Release Date	February 4, 2015
Preproposal Conference	February 27, 2015
Notice of Intent to Propose Deadline	March 9, 2015
Electronic Proposal Submittal Deadline	May 4, 2015
Selections Announced (target)	≤ 120 days after receipt of proposals, with initial awards distributed in FY 2015



Hubble Space Telescope 25th Anniversary

Sample of Events & Programs:

- Webcast event at National Air & Space Museum April 24
- Coordinated events worldwide April 24
- Family Day at Udvar-Hazy April 25
- Hubble 2020 STScI symposium
- Exhibits at museums around the world
- Exhibits at multiple airports
- Nationwide University lecture series
- Education programs in all 50 states
- Comprehensive traditional & social media outreach plans
- 'Ode to Hubble' video contest
- New Planetaria clips
- Re-release of IMAX 'Hubble 3D'



Find out more: hubble25th.org

Join the celebration: #Hubble25



Hubble Week

- **Monday April 20:**
 - Lunch and Learn on Capital Hill
 - STScI Science Writer's Workshop
 - Lecture at Cosmos Club
- **Wednesday April 22:**
 - Hubble Night at Nationals Stadium
 - Bachall Lecture at NASM
- **Thursday April 23**
 - Hubble 25th Anniversary Image Release, Newseum, ESA
 - Parallel HST25 Panels at HST 2020
 - Bachall Lecture at STScI
 - Anniversary Banquet in Baltimore
- **Friday April 24**
 - Hubble 25 'Teach in' Google+ hangout, 600 schools, 200 museums, 100 libraries
 - Bachall Lecture at GSFC
 - NASM event on Mall
- **Saturday April 25**
 - Udvar-Hazy Family Day with Hubble Astronauts
 - Newseum Taschen Book event

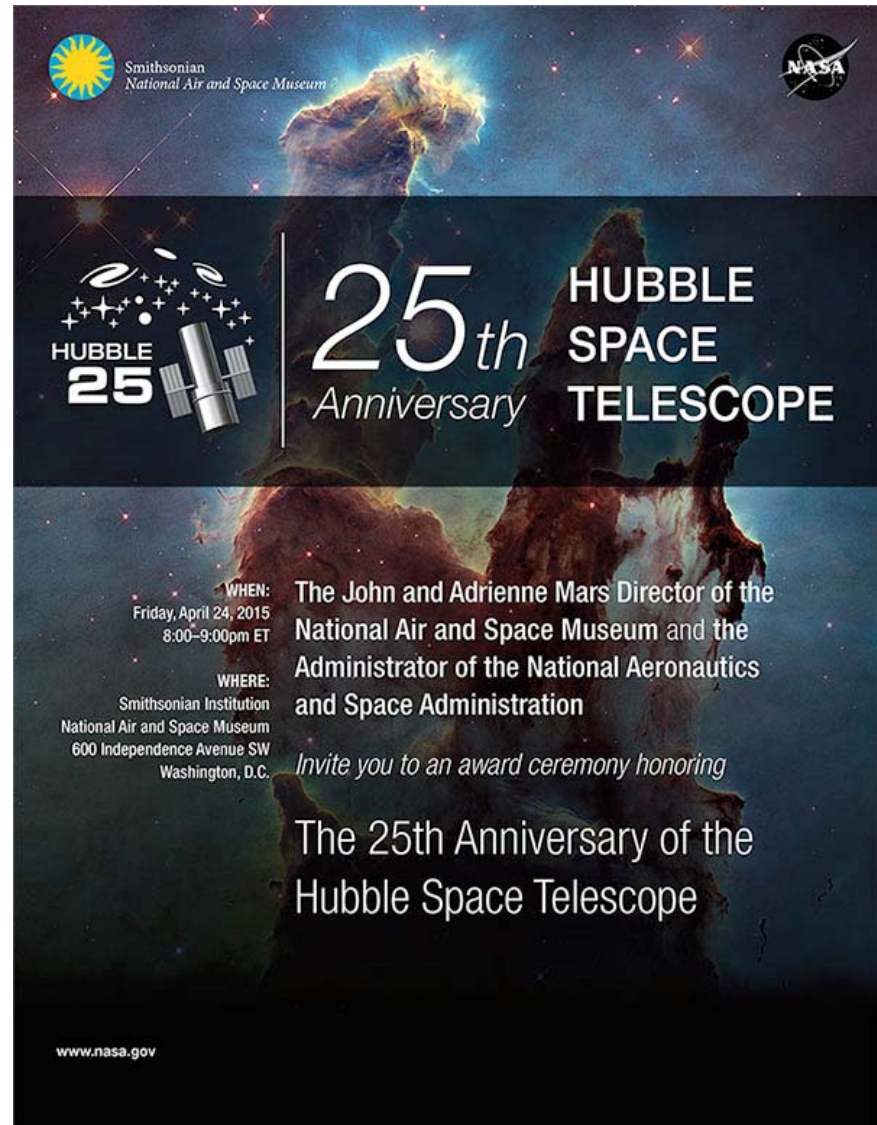


Capstone Event at NASM, April 24

Expecting 1500 attendees,
ESA, Congressional, White
House VIPs

Out of 31 Hubble Astronauts
available, 24 will attend.

Administrator will confer
Commendations to the
Hubble Team



Master of Ceremonies, Miles O'Brien

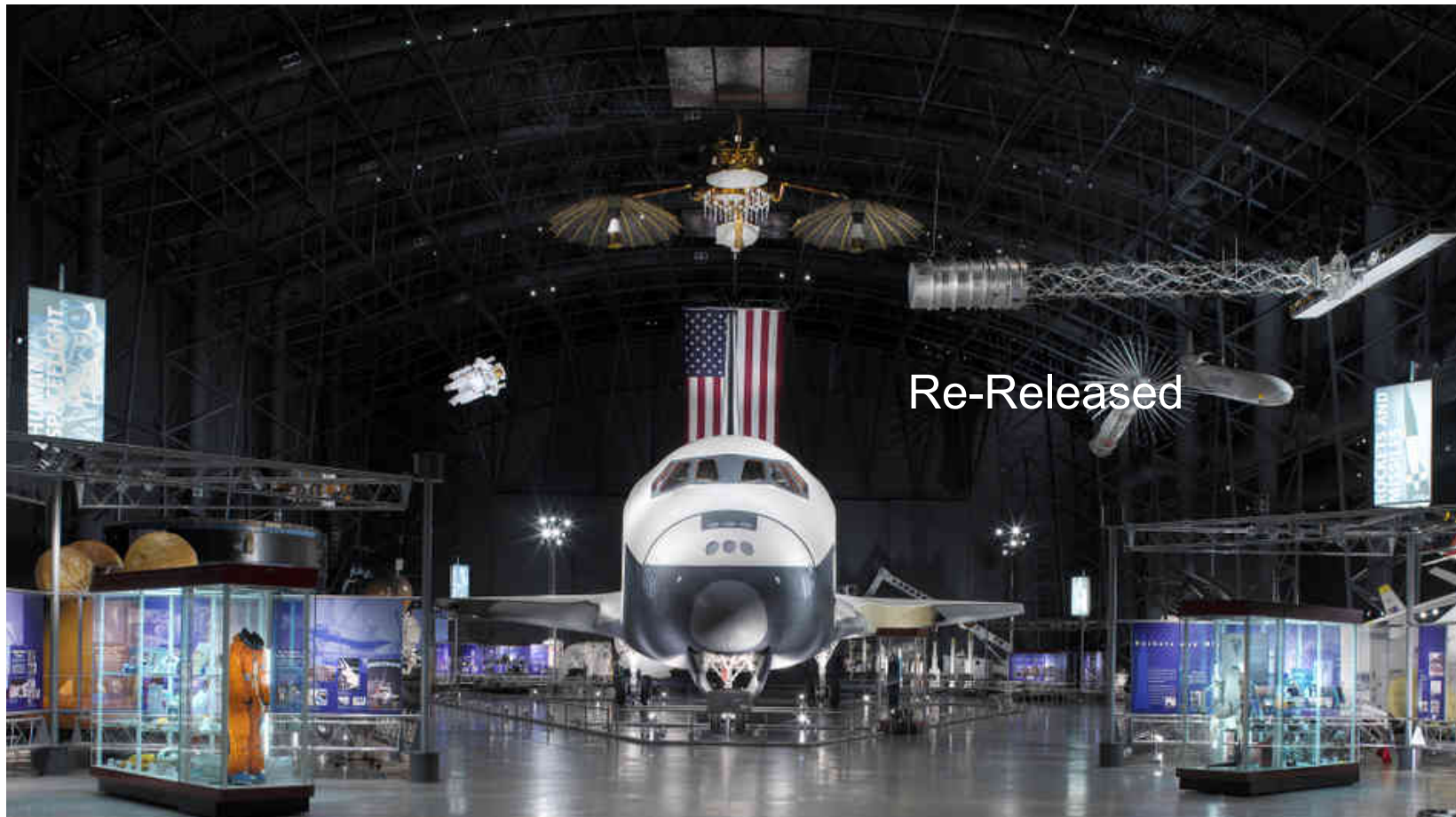
Confirmed speakers include NASA Administrator Charles Bolden,
Dr. John Grunsfeld, Dr. Adam Riess, Dr. Meg Urry, and Mr. James Crocker.

Doors open at 7 p.m. Dress is business attire.

Capstone Event at NASM/Udvar-Hazy, April 25

NASM 'Family Day' Event, expect 10,000+ visitors

Hubble Astronauts will participate in panel discussions



NASA/HQ 'Great Hall' Exhibit



Hubble 25th Anniversary Event in Times Square





Backups



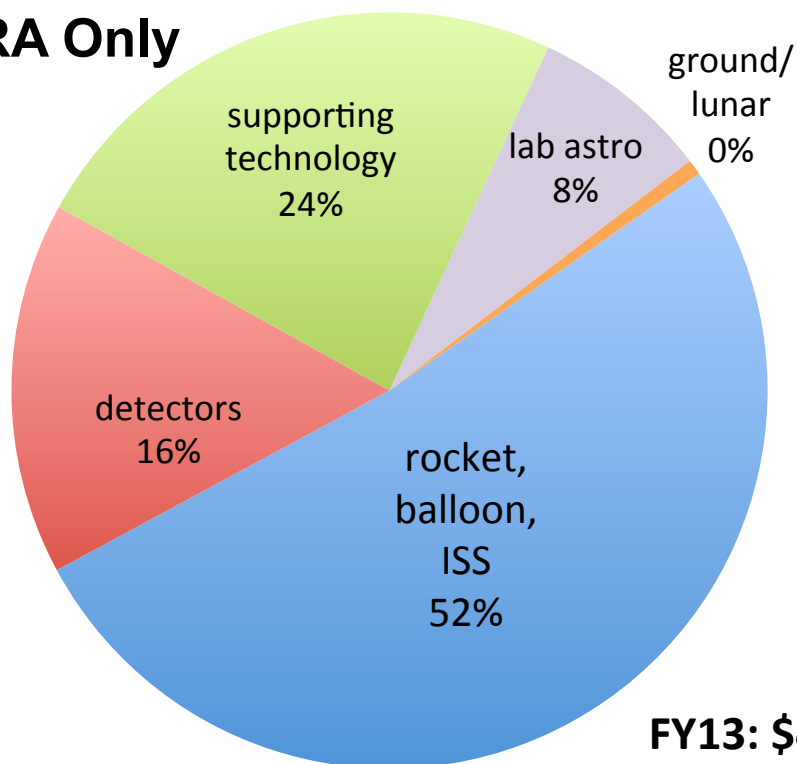
Astrophysics Research Program Funding

Snapshot: Most Recent Year

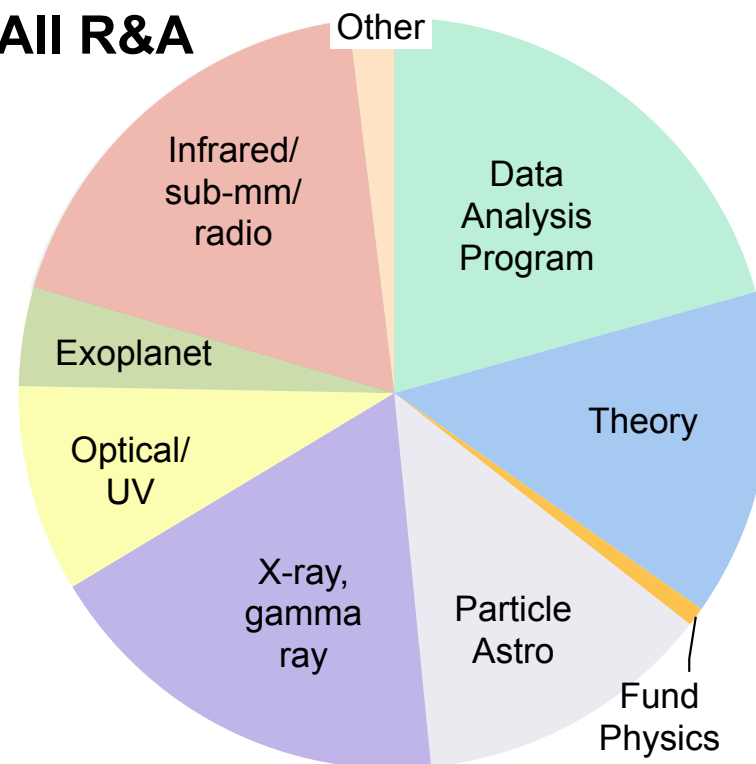
	Proposals Rec'd	Year-1 \$M	Proposals selected	Success Rate	Proposals Rec'd 2015
APRA-13	179	10.0	43	24%	151
SAT-13	18	5.4	10	56%	28
ADAP-14	300	7.5	62	21%	
XRP-14	62	1.3	11	18%	
ATP-14	214	4.7	31	14%	
TOTAL	773	28.9	157	20%	

Does not include
RTF, TCAN, WPS,
GO programs

APRA Only

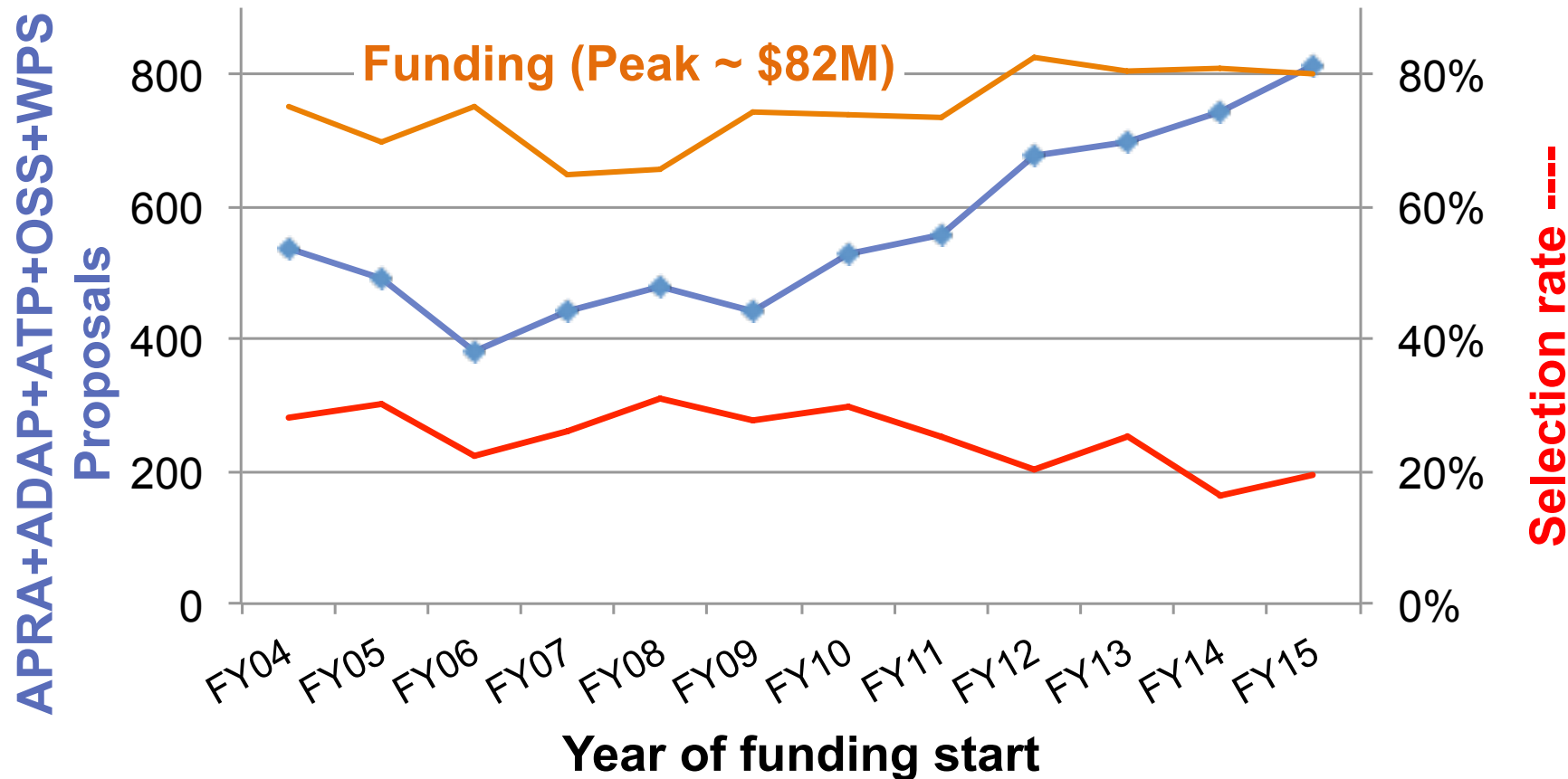


All R&A





Astrophysics ROSES selection rates



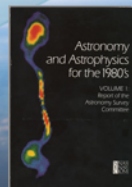
AAAC task force on R&A and demographics being led by Prisca Cushman (U. Minn)

ASTROPHYSICS

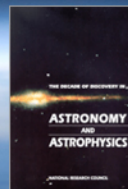
Decadal Survey Missions



1972
Decadal Survey
Hubble



1982
Decadal Survey
Chandra



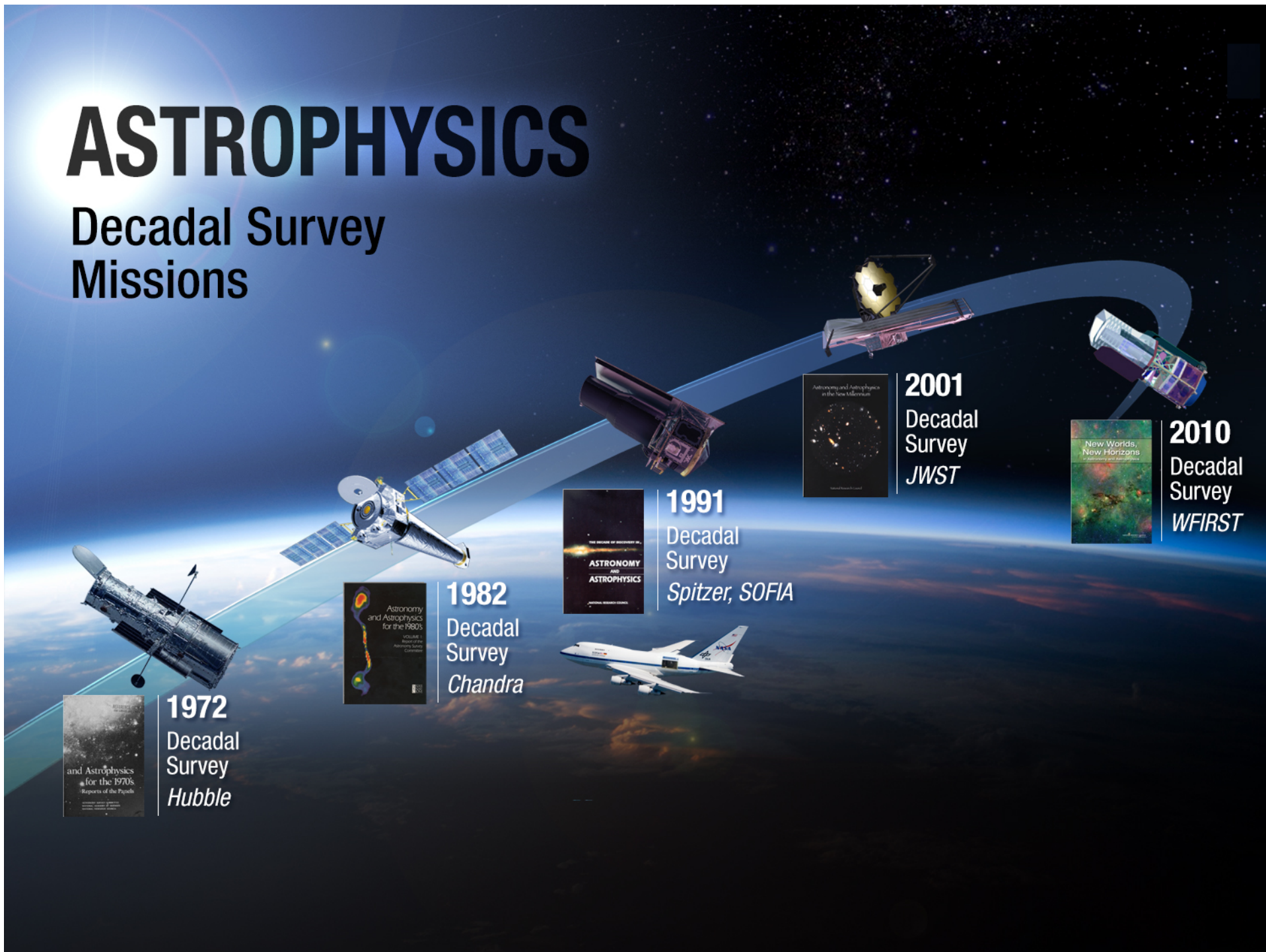
1991
Decadal Survey
Spitzer, SOFIA



2001
Decadal Survey
JWST



2010
Decadal Survey
WFIRST



Astrophysics Program Content (cont'd)

	Op Plan	Enacted	Notional				
	FY14	FY15	FY16	FY17	FY18	FY19	FY20
<u>Physics of the Cosmos</u>	<u>112.6</u>		<u>107.6</u>	<u>81.9</u>	<u>86.9</u>	<u>96.0</u>	<u>106.6</u>
Euclid	17.1		14.6	6.6	6.5	7.7	9.9
Chandra X-Ray Observatory	55.5		55.4	55.6	55.6	55.6	57.0
Fermi Gamma-ray Space Telescope	14.3		15.9				
XMM	1.9		2.9				
Planck	6.2		2.2				
PCOS SR&T	15.1		12.5	16.3	19.7	27.6	34.2
PCOS Future Missions			1.3	0.5	2.1	2.1	2.5
PCOS Program Management	2.7		2.8	2.9	3.0	3.0	3.0
<u>Exoplanet Exploration</u>	<u>106.7</u>		<u>64.2</u>	<u>67.8</u>	<u>148.4</u>	<u>302.2</u>	<u>365.7</u>
Astrophysics Decadal Strategic Mission	56.0	50.0	14.0	21.1	108.2	267.7	331.8
Kepler	18.7		16.5	5.3			
Keck Operations	5.7		6.1	6.1	6.2		
Large Binocular Telescope Interferometer	2.6		1.6	1.3			
Exoplanet Exploration SR&T	18.1		19.4	27.6	26.9	26.6	26.0
Exoplanet Exploration Future Missions	0.8		1.1	0.5	1.1	2.0	2.0
Exoplanet Exploration Program Management	4.9		5.5	5.8	6.0	5.9	5.9

Astrophysics Program Content (cont'd)

	Op Plan	Enacted	Notional				
	FY14	FY15	FY16	FY17	FY18	FY19	FY20
<u>Astrophysics Explorer</u>	<u>89.6</u>		<u>150.3</u>	<u>148.2</u>	<u>108.1</u>	<u>170.4</u>	<u>168.3</u>
Transiting Exoplanet Survey Satellite (TESS)	35.9		88.0	82.6	17.8	9.1	2.5
<u>Other Missions and Data Analysis</u>	<u>53.7</u>		<u>62.4</u>	<u>65.6</u>	<u>90.3</u>	<u>161.3</u>	<u>165.8</u>
ASTRO-H (SXS)	13.4		14.7	12.0	11.4	9.5	
Neutron Star Interior Composition Explor	25.6		11.0	3.5	1.3		
Nuclear Spectroscopic Telescope Array	2.5		6.9				
SWIFT	4.8		5.1				
Suzaku (ASTRO-E II)	0.3		0.6				
Wide-Field Infrared Survey Explorer	0.2						
GALEX	0.0						
Astrophysics Explorer Future Missions			14.4	40.8	70.2	147.2	161.3
Astrophysics Explorer Program Management	6.9		9.7	9.4	7.4	4.6	4.5
James Webb Space Telescope	658.2	645.4	620.0	569.4	534.9	305.0	197.5
Astrophysics + JWST Total	1336.5	1372.2	1329.1	1295.9	1304.4	1310.5	1335.8



FY15 and FY16 Planned Accomplishments

- The **TESS** Explorer Mission was confirmed to begin implementation (KDP-C) in Oct 2014
- SOFIA completed its Heavy Maintenance Visit in Dec 2014
- The **WFIRST/AFTA** science definition team final report completed Jan 30.
- JAXA's **ASTRO-H** mission to begin spacecraft system level test (KDP-D) in FY15 [~April 2015]
- The Astrophysics **Data Archives Senior Review** will be held in FY15 [spring 2015]
- The NRC **Mid-Decade Review** will begin in FY15 [spring 2015]
- A Critical Design Review (CDR) for NASA's contribution to ESA's **Euclid** will be held in FY15 [~Mar 2015]
- **Hubble** has achieved 25 years of operation in FY15 [Apr 2015]
- **TESS** will complete its Critical Design Review (CDR) in FY15
- The **ISS-CREAM** experiment will be launched to the International Space Station (KDP-E) in FY15/FY16 [LRD under review]
- **SOFIA** program management will transition from Armstrong Flight Research Center (AFRC) to Ames Research Center (ARC) in FY15 [NLT summer 2015]
- The Step 1 selection (KDP-A) will be made for the next Small Astrophysics **Explorer** and Explorer Mission of Opportunity in FY15 [summer 2015]
- ESA's **LISA Pathfinder** with NASA's ST-7 experiment will launch (KDP-E) in FY15/FY16 [NET Jul 2015]
- **NICER** will begin system level test (KDP-D) in FY15/FY16 [~Sep 2015]
- JAXA's **ASTRO-H** mission will launch (KDP-E) in FY16 [NET Nov 2015]
- NASA will select its contribution to ESA's L2 **Athena** mission study in FY16 [ESA AO in spring 2016]
- The Astrophysics **Operating Missions Senior Review** will be held in FY16 [spring 2016]
- Four **Balloon** campaigns are planned in FY15, and four campaigns are planned in FY16
- Five Astrophysics **Sounding Rocket** payloads are planned in FY15, and several are planned in FY16



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

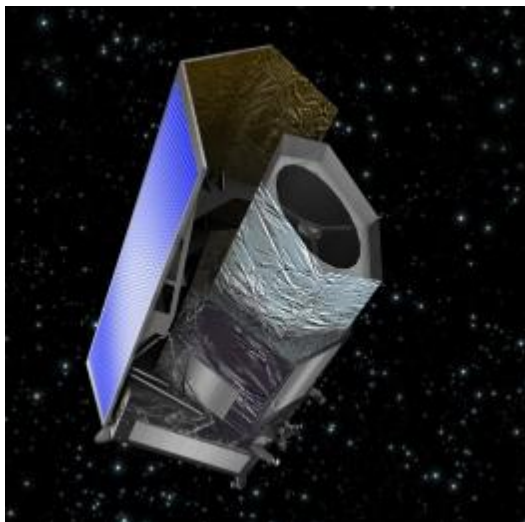
CURRENT STATUS:

- Kepler "K2" observation method was approved for operations through FY2016 after completion of the 2014 Senior Review.
 - Kepler is conducting observations along the ecliptic, changing its orientation four times per year.
 - The fourth 75-day Campaign commenced in February 2015 and runs until April 2015.
 - Targets are selected via proposals from the community. Cycle 2 proposals (covering Campaigns 6-7) were due February 27, 2015
 - December 18, 2014: First confirmed planet discovery using K2 observation method
- From 2009-13, Kepler continuously monitored 100 sq. deg. field in constellations of Cygnus and Lyra for 4+ years.
 - These observations ended after failure of 2nd reaction wheel.
- Analysis of first 4 years of Kepler data has revealed:
 - Approximately 4200 exoplanet candidates
 - Over 1000 candidates confirmed as planets to date
 - More than 100 planets discovered in their star's "habitable zone".
- Analysis of the full (4+ year) Kepler data set ongoing.



Euclid

A visible and near-infrared telescope to explore cosmic evolution



- **ESA Cosmic Vision 2015-2025 Mission,** M-Class with NASA participation.
- 1.2-m mirror, visible & near-IR images, spectra
- **Launch Date:** Mar 2020
- **Science Objectives:**
 - Euclid will look back 10 billion years into cosmic history.
 - Probe the history of cosmic expansion (influenced by dark energy and dark matter) and how gravity pulls galaxies together to form the largest structures.
 - The shapes of distant galaxies appear distorted because the gravity of dark matter bends their light (gravitational lensing). Measuring this distortion tells us how the largest structures were built up over cosmic time.
 - Measuring how strongly galaxies are clumped together tells us how gravity influences their motions, and how dark energy has affected the cosmic expansion.

CURRENT STATUS:

- Currently in implementation phase.
- ~50 U.S. scientists are members of the Euclid Science Team that will analyze the data, and make maps of the sky.
- NASA is providing the sensor assembly for the NISP instrument.
 - First experimental manufacturing run for the Euclid near-infrared detectors was completed in FY 2014 (ESA) and are currently being evaluated and characterized.
 - NASA has initiated the buy for the flight infrared detectors. First lot is complete with a better than expected yield, moving into hybridization phase and growing the second lot of layers. NASA will test and characterize the near-IR flight detectors.
 - Final proposal for detector contract received from Teledyne in February 2015.
- NASA is funding the ENSCI (Euclid NASA Science Center at IPAC). ENSCI will:
 - Support all segments of US community on Euclid to enhance science utilization
 - Integrate into Euclid Science Ground System provided by the Euclid consortium to gain/contribute expertise in pipelines



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

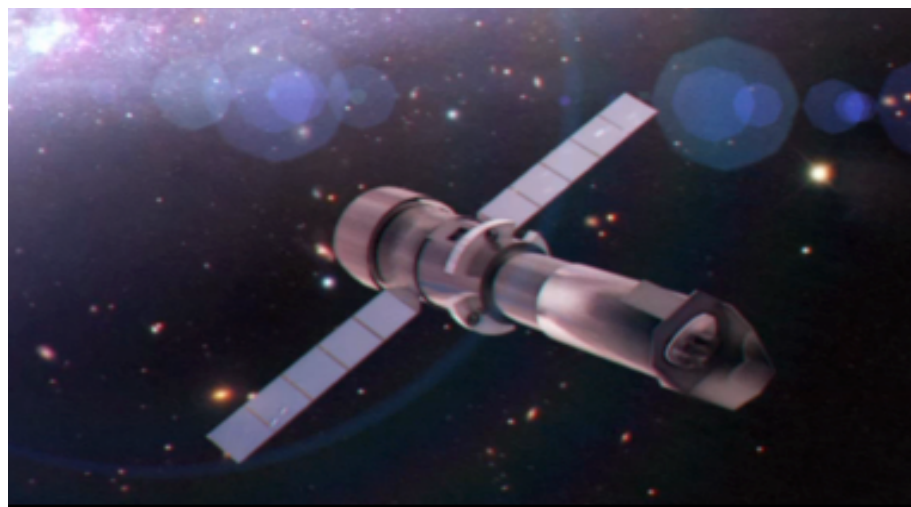
- Supports operating missions: Chandra, Fermi, Hubble, Kepler, NuSTAR, SOFIA, Spitzer, and Swift.
- Funds development of Explorer missions TESS and NICER. TESS will continue the search for exoplanets, scanning all of the sky for Exoplanets closer to Earth than those found by Kepler.
- Supports pre-formulation 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.



Athena

Advanced Telescope for High Energy Astrophysics



- **Second ESA Cosmic Vision Large mission**
 - L-class with NASA/JAXA participation
 - Decadal Survey recommendation
 - Large X-ray mirror, X-IFU and WFI instruments
- **Launch Date:** 2028
- **Breakthrough Technologies:**
 - High Throughput, Wide FOV, High spectral resolution X-ray Astronomy
 - 10x Chandra area, 100x improved non-dispersive spectral resolution, 5x FOV.
- **Science Objectives:** The Hot and Energetic Universe: How does ordinary matter assemble into the large scale structures that we see today? How do black holes grow and shape the Universe?

CURRENT STATUS:

- Selected as 2nd Large mission in ESA Cosmic Visions Program
- Currently in 2 year Study Phase
- NASA and US community involved in Study Phase via membership on ESA-chartered Athena Science Study Team and Science Working Groups
- NASA budgeting for a \$100M-\$150M hardware contribution, plus a US GO program and a U.S. data center
- NASA and ESA are discussing possible NASA contributions, such as:
 - Sensor array to the X-ray Integral Field Unit
 - Portions of the X-ray Mirror
 - Contribution to science data center (U.S. node)
- NASA continues to invest in Athena technologies via SAT and directed investigations.



NASA/NSF Partnership for Exoplanet Research



- New Worlds, New Horizons:
“NASA and NSF should support an aggressive program of ground-based high-precision radial velocity surveys of nearby stars to identify potential candidates ... for a future space imaging and spectroscopy mission”.
- NASA/NSF Partnership using NOAO share of WIYN telescope
 - Enable a community based exoplanet research program in support of NSF research interests and NASA mission goals (e.g., Kepler, K2, TESS, JWST, WFIRST, etc.).
 - Provide US astronomical community with open access to a world-class precision radial velocity facility instrument
- Anticipated timeline:
 - 2015-2018 – Exoplanet-targeted Guest Observer program with existing instrumentation on WIYN using NOAO share of WIYN time starting 2015B
 - 2015-2018 – NASA funded development of facility-class Extreme Precision Doppler Spectrometer (EPDS) for the WIYN telescope
 - January 2015 – EPDS solicitation as amendment to ROSES 2014 NRA
 - August 2015 – announcement of selection, initiation of project
 - 2017/2018 – commissioning of EPDS and beginning of operations
 - 2018-TBD – Exoplanet-targeted Guest Observer and guaranteed time program at WIYN with EPDS instrument and existing WIYN instruments



2014 Astrophysics Explorers AO

- AO released September 17, 2014.
 - Small Explorer (SMEX), cost cap \$125M + LV (or \$175M)
 - Mission(s) of Opportunity, cost cap \$65M for space, \$35M for suborbital-class
 - US Participating Investigators
- Notice of intent were due October 15, 2014.
 - NASA received ~30 NOIs
- Proposals received December 18, 2014.
 - NASA received ~25 proposals (total of all three categories)
- Step 1 Selections expected ~Summer 2015.
- Step 2 Downselections expected ~early 2017.
- Launch Readiness Date NLT end of 2020.

For additional info: <http://explorers.larc.nasa.gov/APSMEX/>

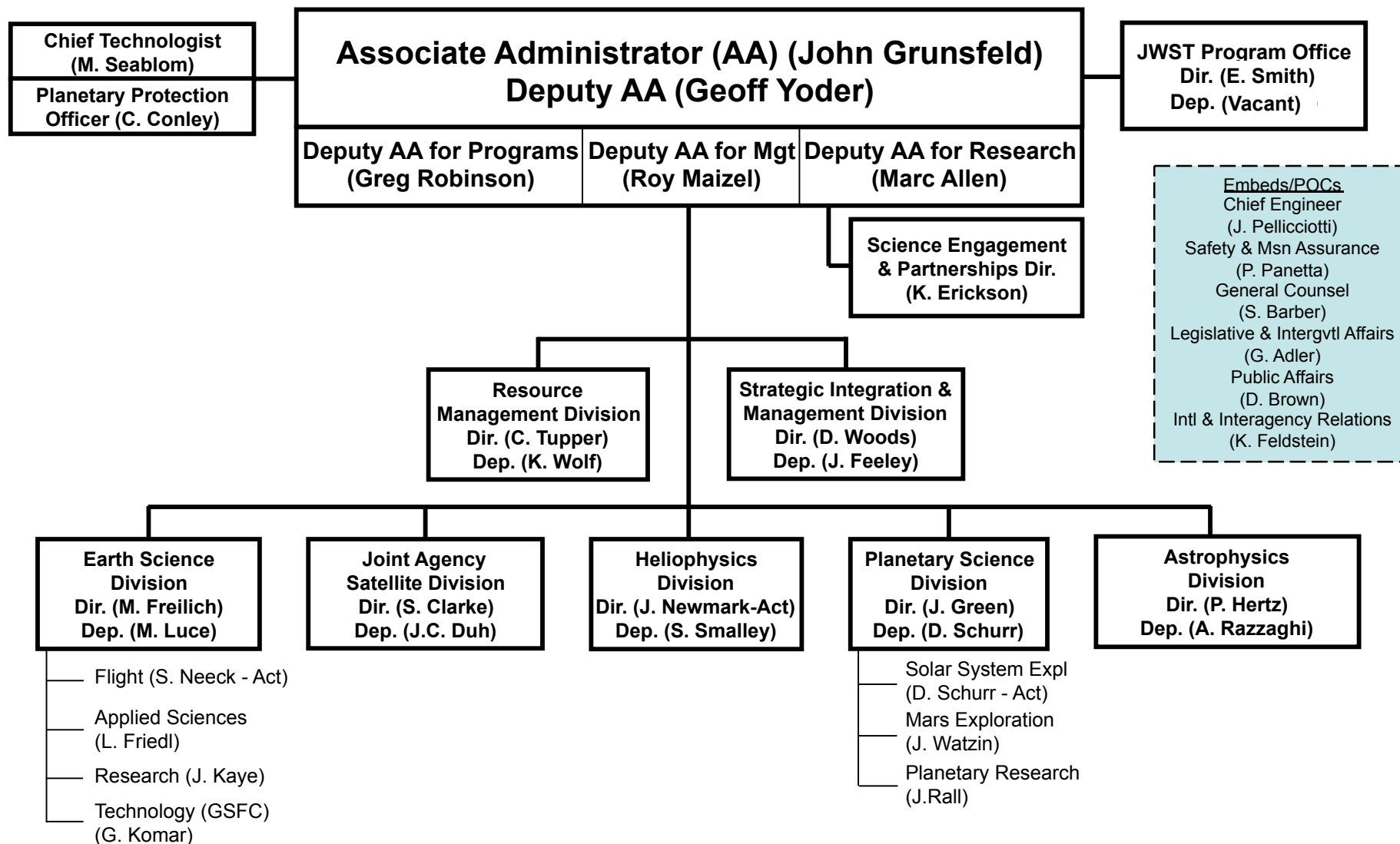


2015 ROSES and GO Due Dates

Proposal Opportunity	Due Date	Reference
Fermi Guest Investigator – Cycle 8	January 22	ROSES-14
Kepler K2 Guest Observer – Cycle 2	February 27	ROSES-14
Chandra X-ray Observatory – Cycle 17	March 17	chandra.harvard.edu
Astrophysics R&A (APRA)	March 20	ROSES-14
Strategic Astrophysics Technology (SAT)	March 20	ROSES-14
Hubble Space Telescope – Cycle 23	April 10	www.stsci.edu/hst
Astrophysics Data Program (ADAP)	May 15	ROSES-15
Exoplanet Research Program (XRP)	May 22	ROSES-15
SOFIA – Cycle 4	~June	www.sofia.usra.edu
Spitzer Space Telescope – Cycle 12	August	ssc.spitzer.caltech.edu
Kepler K2 Guest Observer – Cycle 3	September 23	ROSES-15
Swift Guest Investigator – Cycle 12	September 25	ROSES-15
N.G. Roman Technology Fellowships (RTF)	November 6	ROSES-15
NuSTAR Guest Observer – Cycle 2	November 16	ROSES-15
Astrophysics Theory Program (ATP)	Not this year	



SMD Organization



* Direct report to NASA Associate Administrator

March 2015

Astrophysics Division - Science Mission Directorate

February 3, 2015

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: Billy Lightsey*

Division E/PO POC: Hashima Hasan (Lead Comm Team)

Division Public Affairs POC: Lisa Wainio*

Information Manager: Lisa Wainio*

Hubble 25 Coordinator: Amber Straughn*

Astrophysics Research

Program Manager: Wilt Sanders*

Program Support: Janet Larson*

Astrophysics Data Analysis: Doug Hudgins

Astrophysics Theory: Keith MacGregor*

Exoplanet Research: Mario Perez*

APRA lead: Michael Garcia*

Cosmic Rays, Fund 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*,

Martin Still*, Debra Wallace*

IR/Submillimeter/Radio: Dominic Benford*, Doug

Hudgins, Eric Tollestrup*

Lab Astro: Vacant

Theory & Comp Astro Net: Keith MacGregor*

Roman Tech Fellows: Billy Lightsey*

Data Archives: Hashima Hasan(PS), Debra Wallace(PE)

Astrophysics Sounding Rockets: Wilt Sanders*

Balloons Program: Vernon Jones(PS), Mark Sistilli (PE)

Programs / Missions

Program Scientist

Program Executive

Exoplanet Exploration (EXEP)

Program

Doug Hudgins

John Gagosian

Keck

Hashima Hasan

Mario Perez*

Kepler/K2

Debra Wallace*

Keith Chamberlin*/Jeff Hayes

LBTI

Hashima Hasan

Mario Perez*

NExSci

Hashima Hasan

Mario Perez*

Cosmic Origins (COR)

Program

Mario Perez*

Jeanne Davis

Herschel

Dominic Benford*

Jeff Hayes

Hubble

Michael Garcia*

Jeff Hayes

JWST

Hashima Hasan

N/A ^

SOFIA

Eric Tollestrup*

John Gagosian

Spitzer

Keith Macgregor*

Jeff Hayes

Physics of the Cosmos (PCOS)

Program

Rita Sambruna

Jeanne Davis

Athena

Michael Garcia*

Jeanne Davis

Chandra

Stefan Immler*

Jeff Hayes

Euclid

Eric Tollestrup*

Keith Chamberlin*

Fermi

Keith MacGregor*

Jeff Hayes

Planck

Rita Sambruna

Jeff Hayes

ST-7/LPF

Wilt Sanders*

Keith Chamberlin*

XMM-Newton

Stefan Immler*

Jeff Hayes

Astrophysics Explorers (APEX)

Program

Wilt Sanders*

Mark Sistilli

ASTRO-H

Lou Kaluzienski

Jeanne Davis

NICER

Rita Sambruna

Jeanne Davis

NuSTAR

Lou Kaluzienski

Jeff Hayes

Suzaku

Stefan Immler*

Jeff Hayes

Swift

Martin Still*

Jeff Hayes

TESS

Doug Hudgins

Mark Sistilli

WFIRST/AFTA Dominic Benford*

John Gagosian

+ Member of the Resources Mgmt Division

* Detailee, IPA, or contractor

^ JWST now part of the JWST Program Office.

Linda Sparke on detail to MSFC