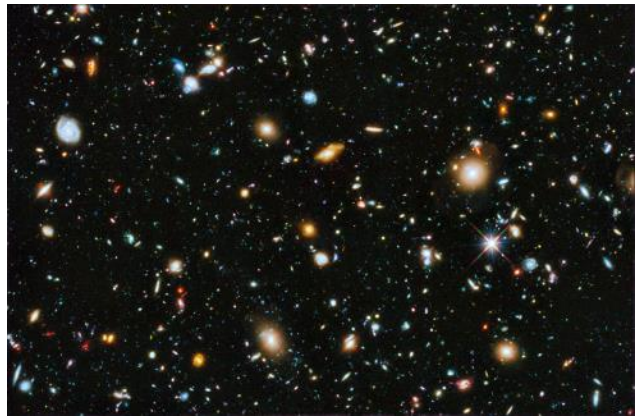
National Aeronautics and Space Administration

# ASTROPHYSICS

## NASA Astrophysics Update

AAAC Meeting
June 27, 2018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Science Mission Directorate
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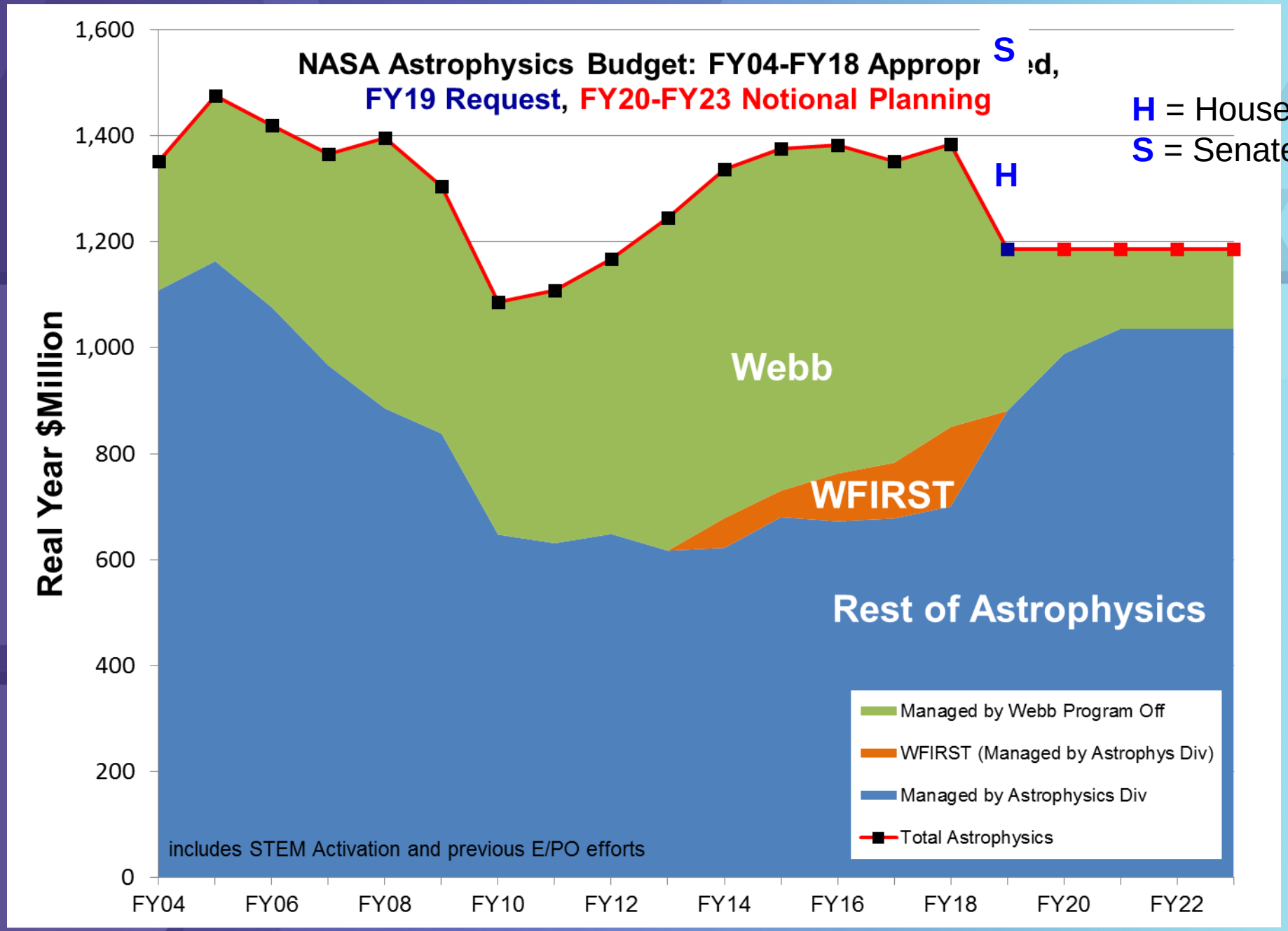
# Astrophysics Budget Overview

- The FY18 consolidated appropriation provides funding for NASA Astrophysics to continue its planned programs, missions, projects, research, and technology.
  - Total funding provided for FY18 (Astrophysics including Webb) rises from $1.352B in FY17 to $1.384B in FY18, an increase of ~$32M (2.4%) from FY17.
  - The NASA Astrophysics FY18 appropriation funds Webb for progress toward launch, WFIRST formulation into Phase B, Explorers mission development and SMEX AO, increased funding for R&A, continued operating missions, suborbital missions and CubeSats, technology development, and mission studies.
  - $10M (2.2%) reduction in rest of Astrophysics to accommodate directed spending increases for WFIRST, Hubble, and SOFIA.
- The FY19 budget request proposes a reduced level of funding for NASA Astrophysics.
  - Total requested funding for FY19 (Astrophysics including Webb) is ~$1.185B, a reduction of $200M (14%) from FY18 appropriation.
  - Webb included as project within Astrophysics budget, integration and testing continues toward launch.
  - Given its significant cost within a proposed lower budget for Astrophysics and competing priorities within NASA, WFIRST is terminated with remaining WFIRST funding redirected towards competed astrophysics missions and research.

# Astrophysics Budget – FY19 Appropriations

| ($M) | Admin Request | House Markup | Senate Markup | Comments |
|---|---|---|---|---|
| Astrophysics (w/ Webb) | 1,185.4 | 1,333.6 | 1,547.8 | Senate: Start Astro2020 on time |
| Webb | 304.6 | 304.6 | 304.6 | Both: $8B cost cap |
| Hubble | 78.3 | | 98.3 | Senate: Reject cutting costs |
| SOFIA | 74.6 | 85.2 | | House: No Senior Review<br>Senate: Encourage Senior Review |
| WFIRST | 0.0 | 150.0 | 352.0 | House: $20M for starshade tech<br>Both: $3.2B cost cap |
| R&A | 83.4 | 83.4 | | |
| Science Activation | 44.6 | 44.0 | 45.0 | |
| Technosignatures | 0.0 | 10.0 | | |
| Search for Life Tech | >>15.0 | | 15.0 | |
| Rest of Astrophysics | 678.2 | 656.4 | | -21.8 (-3.2%) |
| Rest of Astrophysics | 757.9 | | 747.9 | -10.0 (-1.3%) |


NASA Astrophysics Budget: FY04-FY18 Appropr ed,
FY19 Request, FY20-FY23 Notional Planning
S
H
H = House markup
S = Senate markup
Real Year $Million
1,600
1,400
1,200
1,000
800
600
400
200
0
FY04
FY06
FY08
FY10
FY12
FY14
FY16
FY18
FY20
FY22
Webb
WFIRST
Rest of Astrophysics
includes STEM Activation and previous E/PO efforts
Managed by Webb Program Off
WFIRST (Managed by Astrophys Div)
Managed by Astrophysics Div
Total Astrophysics

# 2019 Explorers AOs: SMEX and Missions of Opportunity

- Next Astrophysics Explorers AOs will be issued in Spring 2019
- Small Explorers (SMEX) missions
  - PI-managed Cost Cap: $195M (FY20$) including launch
  - NASA-provided launch (ELV or ISS) for $50M charge
  - PI-provided alternative access to space permitted
- Missions of Opportunity
  - PI-managed Cost Cap: $75M (FY20$) for: Partner MOs, New Missions with Existing Spacecraft MOs, Small Complete Mission MOs
  - PI-managed Cost Cap: $35M for: Suborbital-class MOs, SmallSat MOs
- Community Announcement coming soon
- Draft AOs planned for late 2018

# Senior Review 2019

- Chandra X-ray Observatory
- Fermi Gamma-ray Space Telescope
- Hubble Space Telescope
- Neutron star Interior Composition ExploreR (NICER)
- Nuclear Spectroscopic Telescope Array (NuSTAR)
- Stratospheric Observatory for Infrared Astronomy (SOFIA) [pending clarification of Congressional language]
- Neil Gehrels Swift Observatory
- Transiting Exoplanet Survey Satellite (TESS)
- X-ray Multi-mirror Mission-Newton (XMM-Newton)

# Decadal Survey Planning

- NASA's highest aspiration for the 2020 Decadal Survey is that it be ambitious.
  - The important science questions require new and ambitious capabilities.
  - Ambitious missions prioritized by previous Decadal Surveys have always led to paradigm shifting understanding of the universe.

- There are two areas where NASA has recently worked to ensure an ambitious Decadal Survey:
  - The timing of the Decadal Survey.
  - The scope of the large mission studies.

# Decadal Survey Timing

- NASA  AA for Science Thomas Zurbuchen expressed concern about whether an ambitious and forward-looking Decadal Survey could take place during a period of uncertainty regarding Webb and WFIRST
  - He charged the community with considering whether there was any alternative to delaying the Decadal Survey
- National Academies Astro2020 consultation group and leadership of CAA, SSB, and BPA discussed the issue.
  - Considered input from the community survey conducted by NASA's Program Analysis Groups (https://cor.gsfc.nasa.gov/copag/rfi/copag-rfi.php)
- Academies group recommended that the start of the Astro2020 Decadal Survey not be delayed
- On May 24, Zurbuchen accepted the recommendation
  - Zurbuchen explained in blog entry at https://blogs.nasa.gov/drthomasz/

# Decadal Survey Planning
# Large Mission Concept Studies

- All four STDTs have submitted interim reports to NASA
  - These reports are being reviewed by an independent review team
  - Feedback will be provided to the STDTs to allow them to improve their final reports
- The interim reports contain each STDT's Architecture A
- NASA has directed the STDTs to develop a less costly Architecture B during the next year
  - This will provide the Decadal Survey with ranges of scientific scope for their missions, as well as a range of science goals at different budget levels
  - This was recommended by the NAS study "Powering Science" (2017)
  - All were already considering a less costly Architecture B
- NASA expects that all of the architectures may be submitted to the Decadal Survey for consideration

# Take Away

- R&A opportunities increasing
- Explorers AOs and launches proceeding at high cadence
- TESS science mission begins this month
- Webb independent review will lead to new launch date
- WFIRST beginning Phase B
- Decadal Survey planning proceeding with goal of an ambitious science program in the 2020s


+ MIDEX/MO (2023), SMEX/MO (2025), etc.
Spitzer 8/25/2003
Kepler 3/7/2009
Formulation
Implementation
Primary Ops
Extended Ops
WFIRST Mid 2020s
Webb 2021
Euclid (ESA) 2022
Chandra 7/23/1999
XMM-Newton (ESA) 12/10/1999
TESS 4/18/2018
NuSTAR 6/13/2012
Swift 11/20/2004
Fermi 6/11/2008
IXPE 2021
Hubble 4/24/1990
XRISM (XARM) (JAXA) 2022
ISS-NICER 6/3/2017
ISS-CREAM 8/14/2017
GUSTO 2021
SOFIA Full Ops 5/2014
Revised June 20, 2018 Consistent with FY18 Appropriation
+ Athena (late 2020s), LISA (mid 2030s)