Why Astrophysics?

How did our universe begin and evolve?

How did galaxies, stars, and planets come to be?

Are we alone?

Enduring National Strategic Drivers

Astrophysics is humankind’s scientific endeavor to understand the universe and our place in it.
Outline

• Overview
  - NASA at AAS Meeting
  - Diversity and Inclusion

• Program and Budget Update
  - Science Highlights
  - Budget Update
  - R&A Update

• Missions Update
  - TESS
  - Webb
  - WFIRST
  - Explorers
  - Senior Review

• Planning for Astro2020
NASA-related events at the 232nd AAS Meeting

• Infrared Astrophysics in the SOFIA Era I – Mon 10:40 am & Mon 2:50 pm & Tue 10:40 am in Governor’s Square 12
• NASA Town Hall – Mon 1:40 pm in Plaza Ballroom E
• The Promise of Multi-messenger Astrophysics Town Hall, Mon 6:40 pm in Plaza Ballroom E
• Preparing for JWST Science with the Early Release Science Programs – Tue 10:40 am & Tue 2:50 pm & Wed 10:40 am & Wed 2:40 pm in Governor’s Square 11
• Astrophysics Archives in the 2020’s – Tues 2:50 pm in Governor’s Square 16
• STScI Town Hall – Wed 1:40 pm in Plaza Ballroom E
• Contributions from NASA's Nancy Grace Roman Technology Fellows – Wed 2:50 pm in Governor’s Square 10
NASA Astrophysics Diversity and Inclusion

• The NASA Astrophysics Division is actively taking steps to advance diversity, inclusion, and equal opportunity in the NASA workforce and among NASA grantee institutions.

• NASA Astrophysics is committed to:
  - Setting the expectancy of diversity and inclusion in the composition of: proposal teams, peer review panels, science and technology definition teams, and mission and instrument teams.
  - Recruiting diversity on NASA-selected groups (e.g., advisory groups, peer review panels, science teams).
  - Recruiting a diverse Astrophysics Division staff.
  - Working with the NASA Office of the Chief Scientist and our peer review contractors to address unconscious bias in peer reviews.
  - Establishing a Code of Conduct for peer review panel chairs and members
  - Sharing best practices in peer reviews with other agencies.
  - Observing the demographics of R&A proposers and awardees as an indicator of issues.

• The demographics of R&A proposers and awardees – we notice that:
  - The inferred gender balance of awardees does reflect that of proposers.
  - The inferred gender balance of proposers does not always reflect that of the community.
NASA’s Universe of Learning
An Integrated Astrophysics STEM Learning and Literacy Program

Contact PI/Dr. Denise Smith for free resources and how to get involved: dsmith@stsci.edu
Keep informed about NASA

• NSPIRES mailing list – information about NASA solicitations
  - https://nspires.nasaprs.com/

• Cosmic Origins mailing list, Exoplanet Exploration mailing list, Physics of the Cosmos mailing list – information about NASA missions and science
  - https://exoplanets.nasa.gov/exep/exopag/announcementList/

• NASA Astrophysics Federal Advisory Committees
  - Astrophysics Advisory Committee (APAC) https://science.nasa.gov/researchers/nac/science-advisory-committees/apac
  - NAS Committee on Astronomy and Astrophysics (CAA) http://sites.nationalacademies.org/bpa/bpa_048755
  - Astronomy and Astrophysics Advisory Committee (AAAC) https://www.nsf.gov/mps/ast/aaac.jsp

• Sign up to be a panel reviewer:
  - https://science.nasa.gov/researchers/volunteer-review-panels
Some NASA Science Stories of 2018

UL: Hubble
UR: Chandra
LL: NICER
LR: Hubble & Spitzer
Major Accomplishments: June 2017 – May 2018

• Two missions launched to International Space Station (ISS)
  – Neutron Star Interior Composition Explorer (NICER) June 2017
  – Cosmic Ray Energetics and Mass (CREAM) August 2017
• Arcus/FINESSE/SPHEREx Medium-class Explorer (MIDEX) and CASE/COSI-X/TAO-ISS Mission of Opportunity (MO) proposals selected August 2017 for competitive Phase A concept studies
• Widefield Infrared Survey Telescope (WFIRST) Independent External Technical/Management/Cost Review (WIETR) completed October 2017; WFIRST directed to reduce cost
• Webb payload completed cryotesting December 2017; Webb sunshield integrated with spacecraft January 2018; Webb payload shipped January 2018
• X-ray Astronomy Recovery Mission (XARM) passed KDP-C January 2018 and began implementation (Phase C)
• Webb launch delay announced and Webb Independent Review Board (WIRB) formed March 2018
• Transiting Exoplanet Survey Satellite (TESS) launched April 2018
• WFIRST passed KDP-B May 2018 and began preliminary design phase (Phase B); funds appropriated by Congress in FY18 will allow WFIRST to begin Phase B
Planned Accomplishments June 2018 – June 2019

• Webb Independent Review Board will report in June 2018, and NASA will submit Webb replan cost and schedule report to Congress
• IXPE will complete preliminary design review and enter Phase C August 2018
• Next Astrophysics MIDEX and Mission of Opportunity missions will be downselected by January 2019
• Astrophysics Decadal Survey will begin January 2019
• Astrophysics Senior Review will be conducted Spring 2019
• Next Astrophysics SMEX and Mission of Opportunity AO will be released in Spring 2019
• Webb observatory integration in 2019
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.
NASA Astrophysics Budget: FY04-FY18 Appropriated, FY19 Request, FY20-FY23 Notional Planning

- Webb
- WFIRST
- Rest of Astrophysics

Managed by Webb Program Off
WFIRST (Managed by Astrophys Div)
Managed by Astrophysics Div
Total Astrophysics

Includes STEM Activation and previous E/PO efforts
NASA Astrophysics
Research and Analysis Update
Growth in R&A Funding

<table>
<thead>
<tr>
<th>Program</th>
<th>FY09</th>
<th>FY10</th>
<th>FY11</th>
<th>FY12</th>
<th>FY13</th>
<th>FY14</th>
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<th>FY21</th>
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<td>$97</td>
<td>$102</td>
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<td>CubeSat</td>
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<td>$73</td>
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<td>$102</td>
<td>$107</td>
<td>$112</td>
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<td>$74</td>
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<td>$107</td>
<td>$112</td>
<td>$115</td>
<td>$118</td>
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FY18 Appropriation
28% increase in R&A support over the next 5 years (FY18 – FY23)

FY19 Budget Request
CubeSat initiative

26% increase in R&A support since Decadal Survey (FY10 – FY18)
# Proposal Status Update

Status: June 1, 2018

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<tr>
<th>Solicitation</th>
<th>Proposal Due Date</th>
<th>Notify Date</th>
<th>Days since received</th>
<th>Number received</th>
<th>Number selected</th>
<th>% selected</th>
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<td>Chandra GO – Cycle 19</td>
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<td>July 10, 2017</td>
<td>116</td>
<td>574</td>
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<td>Roman Tech Fellowship</td>
<td>Mar 17, 2017</td>
<td>Sep 8, 2017</td>
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<tr>
<td>SAT (Technology)</td>
<td>Mar 17, 2017</td>
<td>Sep 8, 2017</td>
<td>175</td>
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<tr>
<td>APRA (Basic Research)</td>
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<td>Hubble GO – Cycle 25</td>
<td>Apr 7, 2017</td>
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<td>ADAP (Data Analysis)</td>
<td>May 16, 2017</td>
<td>Sep 11, 2017</td>
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<td>Exoplanet Research</td>
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<td>TESS – Cycle 1</td>
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<td>K2 – Cycle 6</td>
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<td>176</td>
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<td>5%</td>
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<tr>
<td>NESSF-18</td>
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<td>103</td>
<td>176</td>
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<td>XARM Participating Scientist</td>
<td>Dec 13, 2017</td>
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<td>NuSTAR – Cycle 4</td>
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<td>Segmented Telescope Design</td>
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<td>40%</td>
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<td>Fermi GI – Cycle 11</td>
<td>Feb 23, 2018</td>
<td>May 26, 2018</td>
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<td>138</td>
<td>42</td>
<td>30%</td>
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<tr>
<td>Spitzer GI – Cycle 14</td>
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<td>May 29, 2018</td>
<td>67</td>
<td>116</td>
<td>50</td>
<td>43%</td>
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<tr>
<td>ADAP (Data Analysis)</td>
<td>May 17, 2018</td>
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<td>15</td>
<td>246</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

GO Selection Rate = 30%
R&A Selection Rate = 23%
Look-ahead to R&A in 2018/2019

- New ROSES element for LISA Preparatory Science (LPS) now open
  - Proposals due 6/14/18
- New ROSES element for Astrophysics Science SmallSat Studies now open
  - Proposals due 7/13/18
- Next Astrophysics Theory Program (ATP) solicitation in 2019
  - ATP solicitations are in alternate years
- ROSES element for TESS GI program
  - Cycle 1 selections announced, 38 proposals selected
  - Cycle 2 proposals due 10/3/18
- New ROSES element for NICER GO program is planned
  - After NICER completes prime mission in June
- Continue best practices in managing our R&A programs, reviews, and awards, including:
  - Actively taking steps to advance diversity, inclusion, and equal opportunity in the NASA workforce and among NASA grantee institutions
  - Created a Code of Conduct for peer review Panelists and Chairs which is being used in all reviews
NASA Astrophysics
Missions Update: TESS, Webb, WFIRST
Astrophysics Missions in Development

**TESS**
- NASA Mission
- 4/2018
- Transiting Exoplanet Survey Satellite

**Webb**
- NASA Mission
- 2020
- James Webb Space Telescope

**Euclid**
- ESA-led Mission
- 2021
- NASA is supplying the NISP Sensor Chip System (SCS)

**IXPE**
- NASA Mission
- 2021
- Imaging X-ray Polarimetry Explorer

**GUSTO**
- NASA Mission
- 2021
- Galactic/ Extragalactic ULDB Spectroscopic Terahertz Observatory

**XARM**
- JAXA-led Mission
- 2021
- NASA is supplying the SXS Detectors, ADRs, and SXTs

**MIDEX/MO**
- NASA Mission
- 2022/2023
- Arcus, FINESSE, or SPHEREx CASE, COSI-X, or ISS-TAO

**WFIRST**
- NASA Mission
- Mid 2020
- Wide-Field Infrared Survey Telescope
TESS
Transiting Exoplanet Survey Satellite

https://tess.gsfc.nasa.gov/
https://tess.mit.edu/
TESS
Transiting Exoplanet Survey Satellite
Launched April 18, 2018

https://tess.gsfc.nasa.gov/
https://tess.mit.edu/
30-minute exposure full frame images (FFI)
(>30 million stars and galaxies in survey...)

1300 successive FFI’s for each sky segment
(27 days)

One TESS Camera: 24 degrees

- Moon ~0.2 deg²
  => 10,000 moons would fit inside the TESS FOV

Kepler FOV ~100 deg²
TESS 2-sec coarse-point test image
circle size = transit depth
TESS Follow-up Program

• Ground-based follow-up program required for
  - Confirmation of exoplanet candidates
  - False-positive identification
  - Host star characterization
  - Planet mass determination

• Space-based follow-up program required for
  - Atmosphere detection
  - Molecule detection and atmosphere characterization for planets down to super-Earth sizes (Webb)
TESS Guest Investigator Program

- The TESS GI program will maximize the science return from the TESS mission, for exoplanet discovery, and many other areas of astrophysics
- TESS Cycle 1 (southern ecliptic hemisphere) GI investigations have been selected
  - Cycle 1 projects cover asteroids, stellar oscillations, flares, exoplanet studies, compact objects, blazars, and more
  - More than 140 proposals received, requesting ~100,000 targets
- There are opportunities for synergy with all of NASA’s operating missions
- Cycle 2 (northern ecliptic hemisphere) proposals will be due December 2018

https://heasarc.gsfc.nasa.gov/docs/tess
March 2018, Webb prepares for additional testing at Northrop Grumman in Redondo Beach, CA.
Webb Sunshield Deployed
Fall 2017
Webb OTIS after Thermal Vacuum Testing

Nov 2017
Transporting Webb OTIS to NGAS California

Feb 2018
Webb Mission Status - March 23, 2018

Webb Observatory Elements at Northrop Grumman (NGAS) Redondo Beach, CA

Spacecraft
- Element
- Sun-Shield
- Spacecraft

Optical Telescope Element (with instruments)
Spacecraft Element in Acoustics Facility

Apr 2018
Remaining I&T Activities

Science Payload
• OTIS Deployments at NGAS (secondary mirror & ISIM radiator)

Spacecraft Element
• Acoustics, vibe, and thermal vacuum tests
• Post-Environment deployment and stow

Blue font indicates “first time” activities

Observatory Integration
• Pre-environmental Observatory deployments
• Observatory fold & stow
• Observatory system (electrical) test
• Observatory vibration, acoustics tests
• Observatory deployment
• Observatory stow for launch
• Observatory final system test
Webb Independent Review Board (WIRB)

- External team to evaluate all factors influencing mission success, including
  - Those identified by the Project and Standing Review Board
  - The approach to completing Integration and Test (I&T), launch campaign, and commissioning of the Webb telescope.
- Deliverable - Non-consensus final report with observations, findings, concerns, and recommendations
- The WIRB final report and NASA’s response to the WIRB report will be released in late June.
WIRB Members

- Mr. Thomas Young, NASA/Lockheed Martin in Bethesda, Maryland – Retired (Chair)
- Dr. William Ballhaus, Aerospace Corporation, El Segundo, California - Retired
- Mr. Steve Battel, Battel Engineering, Inc., Scottsdale, Arizona
- Mr. Orlando Figueroa, NASA Headquarters and Goddard Space Flight Center, Greenbelt, Maryland – Retired
- Dr. Fiona Harrison, Caltech University, Pasadena, California
- Ms. Michele King, NASA Office of Chief Financial Officer/Strategic Investments Division, Washington, DC
- Mr. Paul McConnaughey, NASA/ Marshall Space Flight Center/Webb Standing Review Board (Chair), Huntsville, Alabama
- Ms. Dorothy Perkins, NASA Goddard Space Flight Center, Greenbelt, Maryland - Retired
- Mr. Pete Theisinger, Jet Propulsion Laboratory, Pasadena, California
- Dr. Maria Zuber, Massachusetts Institute of Technology, Cambridge, Massachusetts

- Mr. Dan Woods, NASA, Washington, DC (Review Manager)
- Dr. John Karcz, NASA, Washington, DC (Executive Secretary)
Webb Summary

• Spacecraft Element (Sunshield + Spacecraft bus)
  - In environmental test program, completed shock separation test and acoustics testing. Test instrumentation data indicate successful tests.
  - Analyzing post-acoustics hardware status after detailed inspections showed some membrane cover hardware (fasteners) came loose

• OTIS (Optical Telescope + Integrated Science instruments)
  - Post cryo-test deployment and electrical testing underway

• Programmatic
  - Webb Independent Review Board (WIRB) completing review, will report to NASA in June 2018
  - Agency final decision on launch date, incorporating WIRB findings, test results, and schedule assessment targeted for end of June

• Science
  - Cycle 1 General Observer proposal due date moved to NET February 2019
WFIRST
Wide Field Infrared Survey Telescope

Primary mirror assembly / Harris Corporation
WFIRST Update

- Conducted WFIRST Independent External Technical/Cost/Management Review (WIETR) in response to National Academies’ Midterm Assessment
- WFIRST directed by SMD AA in November 2017 to reduce cost and complexity sufficient to have a cost estimate consistent with $3.2B cost target set at Phase A beginning
  - Coronagraph is technology demonstration instrument
  - Independent cost assessment validated estimated cost of rescoped mission, consistent with $3.2B cost target
- WFIRST passed SRR/MDR, approved in May 2018 to enter Phase B (preliminary design phase)
WFIRST Update (2)

- Given its significant cost within a proposed lower budget for Astrophysics and competing priorities within NASA, the President’s FY19 Budget Request proposes that WFIRST be terminated with remaining WFIRST funding redirected towards competed astrophysics missions and research.

- Funds appropriated by Congress in FY18 will allow WFIRST to begin Phase B in May 2018.

- If Congress adopts the Administration’s request to terminate WFIRST, the funds made available would enable a competed mission AO in FY19.
## Comparison of Webb and WFIRST Development Risk at KDP-B

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<tr>
<th>Webb @ KDP-B</th>
<th>WFIRST @ KDP-B</th>
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</thead>
<tbody>
<tr>
<td>Novel, complex segmented Be mirror development</td>
<td>Existing 2.4m monolithic ULE mirror</td>
</tr>
<tr>
<td>Numerous technology developments</td>
<td>High TRL: basis of Decadal selection, recent investments</td>
</tr>
<tr>
<td>Complex cryo-cooler</td>
<td>Passive Al radiator</td>
</tr>
<tr>
<td>ISIM structure materials development (30 K)</td>
<td>Reuse of Webb design in instrument carrier (190K)</td>
</tr>
<tr>
<td>IR detector manufacturing problem uncovered after KDP-C</td>
<td>IR detectors presently at TRL-6, flight growth initiated at start of Phase B; Greater maturity and understanding of Webb-derived detector technologies reduces risk of encountering problems late in the WFIRST program</td>
</tr>
<tr>
<td>Four highly configurable instruments (inherent complexity), major international roles, separate guider</td>
<td>Single primary instrument + tech demo, no separate guider</td>
</tr>
<tr>
<td>Many complex deployments</td>
<td>Standard deployments</td>
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</tbody>
</table>

WFIRST risks are lower than those retired on Webb, and typical of high TRL missions. Incorporated numerous Webb lessons learned.
WFIRST Science

• NASA considering changes in WFIRST key programs and how observing time will be determined
  - Three key science pillars (Dark Energy, Exoplanets, Great Observatory Astrophysics) all important; no specific amounts of observing time reserved for specific science pillars, surveys, or observing programs
  - Allocation of WFIRST observing time through open-access, nonproprietary, peer-reviewed competition of programs addressing scientific imperatives of 2020s, including dark energy and exoplanets; observing program will be selected as close in time to observations as possible
  - Investigate alternate ways of organizing community-based key project teams
  - Consider openly-competet “Early Release Demonstration Programs” performed at start of WFIRST operations to inform peer-reviewed time allocation process during prime mission

• WFIRST Formulation Science Working Group (FSWG) is reviewing proposed change
Astrophysics Explorers Program

Small and Mid-Size Missions

Missions of Opportunity

- TESS
- SWIFT
- NuSTAR
- NICER
- GUSTO
- IXPE
- MIDEX 2011
- SMEX 2014
- MIDEX 2016
- SMEX 2019 (planned)

* CASE partners with ARIEL selected as ESA’s M4 mission

Directed 2017

XARM
Astrophysics Explorers in Competitive Phase A

**Arcus**
PI: R. Smith/SAO
High resolution x-ray spectroscopy to explore the origin of galaxies

**CASE**
PI: M. Swain/JPL
Contribution of detectors to ESA’s ARIEL

**FINESSE**
PI: M. Swain/JPL
NIR transit spectroscopy to explore exoplanet atmospheres

**COSI-X**
PI: S. Boggs/UCB
ULDB balloon mission to study origin of elements in the galaxy

**SPHEREx**
PI: J. Bock/Caltech
NIR spectral survey addressing cosmology, galaxy evolution, and origin of ices

**ISS-TAO**
PI: J. Camp/GSFC
All-sky x-ray survey to study transients and search for GW sources
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
NASA Astrophysics
2019 Astrophysics Senior Review
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<tr>
<th>Mission</th>
<th>Launch Date</th>
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<td>Hubble</td>
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<td>NASA Strategic Mission</td>
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<td>Chandra</td>
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<td>XMM-Newton</td>
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<td>Spitzer</td>
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<td>Fermi</td>
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<td>Kepler</td>
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<td>X-ray Multi Mirror - Newton</td>
<td>Spitzer Space Telescope</td>
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<td>Swift Gamma-ray Burst Explorer</td>
<td>Fermi Gamma-ray Space Telescope</td>
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<tr>
<td>Kepler Space Telescope</td>
<td>Nuclear Spectroscopic Telescope Array</td>
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<tr>
<td>Stratospheric Observatory for Infrared Astronomy</td>
<td>Neutron Star Interior Composition Explorer</td>
</tr>
<tr>
<td>Cosmic Ray Energetics And Mass</td>
<td>Transiting Exoplanet Survey Satellite</td>
</tr>
</tbody>
</table>
Senior Review Paradigm:

• NASA conducts regular reviews of its operating science missions in order to assess their continued science productivity and whether their operations should be continued through approval of a mission extension.
  - The NASA Authorization Act of 2005 (P.L. 109-155) states that “The Administrator shall carry out biennial reviews within each of the Science divisions to assess the cost and benefits of extending the date of the termination of data collection for those missions that have exceeded their planned mission lifetime.” The NASA Transition Authorization Act of 2017 (P.L. 115-10) modified the cadence to be triennial reviews.

• These reviews of operating missions are NASA’s highest form of peer review, as the subject is not a single science investigation, or even a single space mission, but rather a portfolio of operating missions.
  - The reviews of operating missions are referred to as senior reviews, in recognition of the high level of the peer review.
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)
Senior Review 2019 Schedule

2018:
✓ APAC approves Terms of Reference for the Senior Review Subcommittee
• Establish Senior Review Subcommittee, including appointment of subcommittee members compliant with FACA
• Draft call for proposals issued
• Final call for proposals issued

2019:
• Senior Review proposals due
• Rest-of-missions, Chandra, Hubble, and SOFIA* panels meet
• Reports from Rest-of-missions, Chandra, Hubble, and SOFIA* panels due to Senior Review Subcommittee
• Senior Review Subcommittee meets
• Senior Review Subcommittee reports to APAC
• APAC delivers formal recommendations to NASA
• NASA responds to Senior Review and provides direction to projects

* Deposition dependent on final Congressional language
Astrophysics Strategic Planning

2016 update includes:
• Response to Midterm Assessment
• Planning for 2020 Decadal Survey

To be updated in 2018 (per GPRAMA)

https://science.nasa.gov/astrophysics/documents
ASTROPHYSICS

Decadal Survey Missions

1972
Decadal Survey
Hubble

1982
Decadal Survey
Chandra

1991
Decadal Survey
Spitzer

2001
Decadal Survey
JWST, SOFIA

2010
Decadal Survey
WFIRST
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

• NASA has initiated studies for large (Flagship) and medium (Probe) size mission concepts to inform the 2020 Decadal Survey Committee in an organized and coherent way
  - Main purpose is to provide the Decadal Survey Committee with several well-defined mission concepts to facilitate their deliberations

• Specifically, NASA is:
  - Sponsoring 4 community-based Science and Technology Definition Teams (STDTs) to partner with a NASA Center-based engineering team and study large (strategic) mission concept studies selected from the NASA Astrophysics 30-year Visionary Roadmap, a community-based report, and the 2010 Decadal Survey
  - Supporting 10 PI-led Study Teams for Probe-size mission concept studies, selected competitively
  - Supporting several other planning activities / studies / white papers

• All material related to NASA’s 2020 Decadal Survey planning activities are posted at https://science.nasa.gov/astrophysics/2020-decadal-survey-planning
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 (large version)

- NASA has directed the STDTs to develop a smaller 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 smaller Architecture B

- NASA expects that all of the architectures (large and small) may be submitted to the Decadal Survey for consideration
### Decadal Survey Planning

#### Large Mission Concept Studies

<table>
<thead>
<tr>
<th>Mission Name</th>
<th>Community STDT Chairs</th>
<th>Center Study Scientist</th>
<th>Study Lead Center</th>
<th>HQ Program Scientist</th>
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<tbody>
<tr>
<td>Habitable Exoplanet Imaging Mission</td>
<td>Scott Gaudi, Sara Seager</td>
<td>Bertrand Mennesson</td>
<td>JPL</td>
<td>Martin Still</td>
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<td>Habitable Exoplanet Imaging Mission <a href="#">www.jpl.nasa.gov/habex</a></td>
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<td>Large UV/Optical/IR Surveyor</td>
<td>Debra Fischer, Bradley Peterson</td>
<td>Aki Roberge</td>
<td>GSFC</td>
<td>Mario Perez</td>
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<tr>
<td>Large UV/Optical/IR Surveyor <a href="#">asd.gsfc.nasa.gov/luvoir</a></td>
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<td>Lynx X-ray Surveyor</td>
<td>Feryal Ozel, Alexey Vikhlinin</td>
<td>Jessica Gaskin</td>
<td>MSFC</td>
<td>Dan Evans* Rita Sambruna</td>
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<td>Lynx X-ray Surveyor <a href="#">wwwastro.msfc.nasa.gov/lynx</a></td>
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<td>Origins Space Telescope</td>
<td>Asantha Cooray, Margaret Meixner</td>
<td>David Leisawitz</td>
<td>GSFC</td>
<td>Kartik Sheth</td>
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<tr>
<td>Origins Space Telescope <a href="#">asd.gsfc.nasa.gov/firs</a></td>
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</table>

* Dan Evans is on detail to OMB through July 2018

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[www.jpl.nasa.gov/habex](#): [Habitable Exoplanet Imaging Mission](#)
[asd.gsfc.nasa.gov/luvoir](#): [Large UV/Optical/IR Surveyor](#)
[wwwastro.msfc.nasa.gov/lynx](#): [Lynx X-ray Surveyor](#)
[asd.gsfc.nasa.gov/firs](#): [Origins Space Telescope](#)
Decadal Survey Planning
Probe Mission Concept Studies

<table>
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<tr>
<th>PI</th>
<th>Affiliation</th>
<th>Short title</th>
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<tr>
<td>Jordan Camp</td>
<td>NASA GSFC</td>
<td>Transient Astrophysics Probe</td>
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<tr>
<td>Asantha Cooray</td>
<td>Univ. California, Irvine</td>
<td>Cosmic Dawn Intensity Mapper</td>
</tr>
<tr>
<td>Bill Danchi</td>
<td>NASA GSFC</td>
<td>Cosmic Evolution through UV Spectroscopy Probe</td>
</tr>
<tr>
<td>Jason Glenn</td>
<td>Univ. of Colorado</td>
<td>Galaxy Evolution Probe</td>
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<tr>
<td>Shaul Hanany</td>
<td>Univ. of Minnesota</td>
<td>Inflation Probe</td>
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<tr>
<td>Richard Mushotzky</td>
<td>Univ. of Maryland</td>
<td>High Spatial Resolution X-ray Probe</td>
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<tr>
<td>Angela Olinto</td>
<td>Univ. of Chicago</td>
<td>Multi-Messenger Astrophysics Probe</td>
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<tr>
<td>Peter Plavchan *</td>
<td>Missouri State Univ.</td>
<td>Precise Radial Velocity Observatory</td>
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<tr>
<td>Paul Ray</td>
<td>Naval Research Lab</td>
<td>X-ray Timing and Spectroscopy Probe</td>
</tr>
<tr>
<td>Sara Seager *</td>
<td>MIT</td>
<td>Starshade Rendezvous Mission</td>
</tr>
</tbody>
</table>

* Partial Selections

Decadal Survey Planning
Other NASA-sponsored Input

NASA HQ is sponsoring, planning, or contemplating several additional studies as input
- These are independent of studies being initiated and conducted by NASA scientists at NASA Centers without HQ sponsorship

• Balloon Program Roadmap
  - Conducted by community-based Roadmap team chaired by Peter Gorham (U Hawaii)

• Evolution of NASA Data Centers
  - In planning stage, draws on efforts including STScI study on big data, NASA Big Data Task Force on adapting archives to technology, and IPAC led study of joint data processing from LSST/Euclid/WFIRST

• SmallSats
  - RFI for Astrophysics science and technology concepts; ROSES call for Mission Concept Proposals

• In-Space Servicing/In-Space Assembly
  - NASA-led study initiated, joint SMD/STMD/HEOMD

• System-Level Segmented Telescope Technology Program
  - Initial selections announced March 2018 (selected teams led by Ball Aerospace and Lockheed Martin)

• NASA asked the CAA to provide input on its Decadal Planning activities by Sep 2018
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