Outline

Science Mission Directorate Overview  Charts 3-8
Astrophysics Programmatic and Budget Update  Charts 9-20
Research and Analysis Update  Charts 21-31
Selected Mission Updates  Charts 32-53
Preparing for the 2020 Decadal Survey  Charts 54-63
Backups – More Selected Mission Updates  Charts 65-73
Backups  Charts 74-82
NASA Update

Science Mission Directorate
NASA SCIENCE MISSION DIRECTORATE

An Integrated Program Enabling Great Science
KEY SCIENCE THEMES

Discovering the Secrets of the Universe

Searching for Life Elsewhere

Safeguarding and Improving Life on Earth
SCIENCE BY THE NUMBERS

- **Spacecraft**: 104 missions, 88 spacecraft
- **CubeSats**: 17 science missions, 11 technology demonstrations
- **Balloon Payloads**: 13 science payloads, 13 piggyback/student payloads
- **Sounding Rocket Flights**: 14 science missions, 3 technology/student missions
- **Earth-Based Investigations**: 25 major airborne missions, 8 global networks
- **Technology Development**: ~$400M invested annually
- **Research**: 10,000+ U.S. scientists funded, 3,000+ competitively selected awards, ~$600M awarded annually

As of June 1, 2017
Nearly a quarter of SMD’s budget goes to research and technology.

SMD balances mission development and operations with research and technology across all divisions.

New and Existing Missions (PY2015 $)
NASA Astrophysics

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

1. How did our universe begin and evolve?
2. How did galaxies, stars, and planets come to be?
3. Are We Alone?

These national strategic drivers are enduring:

- 1972
- 1982
- 1991
- 2001
- 2010
Astrophysics Driving Documents

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

http://science.nasa.gov/astrophysics/documents
The FY17 appropriation and FY18 budget request provide funding for NASA astrophysics to continue its planned programs, missions, projects, research, and technology.

- Total funding (Astrophysics including Webb) remains at ~$1.35B.
- Funds Webb for an October 2018 launch, WFIRST formulation, Explorers mission development, increased funding for R&A, new suborbital capabilities, continued technology development.
- FY17 Consolidated Appropriation is less than planning budget; reductions to plans are required.
- FY18 President’s Budget Request balances current science and future missions.

NASA continues to prioritize implementation of the recommendations of the 2010 Decadal Survey.

- NASA is conducting large and medium mission concept studies for 2020 Decadal Survey.
• The operating missions continue to generate important and compelling science results, and new missions are under development for the future.
  – Senior Review in Spring 2016 recommended continued operation of all missions (Chandra, Fermi, Hubble, Kepler, NuSTAR, Spitzer, Swift, XMM); next Senior Review in 2019.
  – SOFIA is adding new instruments: HAWC+ instrument commissioned; HIRMES instrument in development; next gen instrument call planned.
  – Partnerships with ESA and JAXA on future missions create additional science opportunities: Euclid (ESA; 2020), XARM (JAXA; 2021), Athena (ESA; 2028), L3/ LISA (ESA; 2034).
FY17 Consolidated Appropriations Bill (H.R. 244)

<table>
<thead>
<tr>
<th></th>
<th>FY 2017 Request</th>
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<td>STEM Activation¹</td>
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<td>Heliophysics</td>
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<td>678.5</td>
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<td>-20.2</td>
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Note 1: $37.0M for STEM Activation is to be derived equally from Planetary Science and Astrophysics, and continue to be administered by Astrophysics.
• The FY17 Appropriation for Astrophysics resulted in a reduction of $63.0M for Astrophysics (including Webb) relative to the FY16 funding level.

<table>
<thead>
<tr>
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<td>Astrophysics w/ Webb</td>
<td>1,382.4</td>
<td>1,350.9</td>
<td>1,319.4</td>
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• The FY17 Appropriation for Astrophysics resulted in a reduction of $31.5M for Astrophysics (including Webb) relative to the FY17 budget request.

• The FY17 Appropriation for Astrophysics resulted in a reduction of up to $47.4M for Astrophysics programs excluding Webb, Hubble, SOFIA, WFIRST, relative to the FY17 budget request.
## FY17 Consolidated Appropriations Bill (H.R. 244)

<table>
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<tr>
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<th>FY17 Request</th>
<th>FY17 Approp</th>
<th>Language from Conference Committee Report</th>
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<td><strong>Total</strong></td>
<td>1,350.9</td>
<td>1,319.0</td>
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<tr>
<td><strong>Webb</strong></td>
<td>569.4</td>
<td>569.4</td>
<td>Includes $569.4M for Webb</td>
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<tr>
<td><strong>WFIRST</strong></td>
<td>90.0</td>
<td>105.0</td>
<td>Includes $105M for WFIRST; Committee directs NASA to cap WFIRST life cycle costs at no more than $3,500M through the end of its prime mission</td>
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<td><strong>SOFIA</strong></td>
<td>83.8</td>
<td>85.2</td>
<td>Provides $85.2M for SOFIA</td>
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<td><strong>Hubble</strong></td>
<td>97.3</td>
<td>98.3</td>
<td>Provides $98.3M for Hubble Space Telescope</td>
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<td><strong>Mirror Tech</strong></td>
<td>-</td>
<td>5.0</td>
<td>Includes up to $5M for segmented aperture telescope activities</td>
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<tr>
<td><strong>Starshade</strong></td>
<td>-</td>
<td>-</td>
<td>Supports continued appropriate technology development for a starshade</td>
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<tr>
<td><strong>STEM Activation</strong></td>
<td>25.0</td>
<td>18.5</td>
<td>Includes $37M for STEM Activation programs, derived from Planetary Science and Astrophysics</td>
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<tr>
<td><strong>Rest of Astrophysics</strong></td>
<td>485.4</td>
<td>438.0</td>
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- Up to $47.4M reduction to “Rest of Astrophysics” (Astrophysics excluding Webb, WFIRST, SOFIA, Hubble) relative to FY17 request; 11% reduction with 4 months remaining in FY17
### FY18 President’s Budget Request

<table>
<thead>
<tr>
<th>$M</th>
<th>FY16 Actual</th>
<th>FY17 Omnibus</th>
<th>FY18 Request</th>
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<td>SMD</td>
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<td>678</td>
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<tr>
<td>Planetary Science</td>
<td>1,628</td>
<td>1,846</td>
<td>1,930</td>
<td>+18.6 %</td>
<td>+4.6 %</td>
</tr>
<tr>
<td>Astrophysics</td>
<td>1,382</td>
<td>1,319</td>
<td>1,350</td>
<td>-2.3 %</td>
<td>+1.6 %</td>
</tr>
</tbody>
</table>

- Maintains commitment to studying our home planet and the universe
- Enables our wide ranging science work on many fronts, which continues to lead the world in its size, scope, and scientific output.
- Reinvigorates robotic exploration of the solar system, including funding for a Europa Clipper mission to fly repeatedly by Jupiter’s icy ocean moon Europa.
- Maintains a robust Earth Science program while terminating several missions.
- Supports initiatives that use smaller, less expensive satellites and/or public-private partnerships to advance science, in keeping with recent National Academies recommendations.
## FY18 President’s Budget Request

<table>
<thead>
<tr>
<th></th>
<th></th>
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<td>Physics of the Cosmos</td>
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<td>Exoplanet Exploration</td>
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<td>James Webb Telescope</td>
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<td>534</td>
<td>305</td>
<td>197</td>
<td>150</td>
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<tr>
<td><strong>Total Astrophysics</strong></td>
<td><strong>1382</strong></td>
<td><strong>1319</strong></td>
<td><strong>1350</strong></td>
<td><strong>1350</strong></td>
<td><strong>1350</strong></td>
<td><strong>1350</strong></td>
<td><strong>1350</strong></td>
</tr>
</tbody>
</table>

- Supports an SMD-wide CubeSat/SmallSat initiative that uses smaller, less expensive satellites to advance science in a cost-effective manner.
- Reflects more efficient operations of the Hubble Space Telescope, without impact to science.
- Reflects efficiencies realized by the SOFIA in the past few years. SOFIA will participate in the 2019 Astrophysics Senior Review.
Change in NASA Advisory Committee

• The NASA Astrophysics Division has three Federal advisory committees:
  – National Academies’ Committee on Astronomy and Astrophysics (CAA)
  – NSF/NASA/DOE Astronomy and Astrophysics Advisory Committee (AAAC)
  – NASA Astrophysics Advisory Committee (APAC)

• Astrophysics Advisory Committee (APAC) was previously called the Astrophysics Subcommittee of the NASA Advisory Council

• APAC has a new charter which allows it to
  – Send advice directly to the NASA Astrophysics Director
  – Have subordinate groups including the triennial Senior Reviews and the large mission concept Science and Technology Definition teams (STDTs)

• Current membership:
  Natalie Batalha (ARC)       Mark Bautz (MIT)       Jamie Bock (Caltech)
  Alan Boss (CIW)            Padi Boyd (GSFC)       Asantha Cooray (UC Irvine)
  Neil Cornish (Montana St)  Brenda Dingus (LANL)    Debra Fischer (Yale)
  Scott Gaudi (Ohio St) [Chair] Jason Kalirai (STScI)   Feryal Ozel (Ariz) [Vice Chair]
  Paul Scowen (Arizona St)   Yun Wang (IPAC)        Beth Willman (LSST Obs)

• Next meeting is July 19-20 at NASA HQ, Washington DC

https://science.nasa.gov/researchers/nac/science-advisory-committees/apac
NASA Astrophysics

Research and Analysis Update
Astrophysics Research Elements

**Supporting Research and Technology**
- Astrophysics Research & Analysis (APRA)
- Strategic Astrophysics Technology (SAT)
- Astrophysics Theory Program (ATP)
- Theoretical and Computational Astrophysics Networks (TCAN)
- Exoplanet Research Program (XRP)
- Roman Technology Fellowships (RTF)

**Data Analysis**
- Astrophysics Data Analysis (ADAP)
- GO/GI programs in ROSES for:
  - Fermi
  - Kepler/K2
  - Swift
  - NuSTAR
  - TESS (new)

**Mission Science and Instrumentation**
- SOFIA next-generation instrumentation
- Sounding rocket, balloon, cubesat, and ISS payloads through APRA

**Separately Solicited**
- GO/GI/Archive/Theory programs for:
  - Chandra
  - Hubble
  - SOFIA
  - Spitzer
  - Webb
- Postdoctoral Fellowships (Einstein, Hubble, Sagan)
- Graduate Student Fellowships (NESSF)
# Historical Budget Trends

<table>
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<tr>
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<td>APRA</td>
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<td>$44 M</td>
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<td>$46 M</td>
<td>$49 M</td>
<td>$50 M</td>
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<td>ADAP</td>
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<td>$14 M</td>
<td>$16 M</td>
<td>$17 M</td>
<td>$17 M</td>
<td>$17 M</td>
<td>$18 M</td>
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<td>$1 M</td>
<td>$3 M</td>
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Total: $75 M $73 M $74 M $85 M $82 M $80 M $88 M $87 M

![Bar Chart: Historical Budget Trends](chart.png)
## Proposed Future Budget

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<td>$73</td>
<td>$74</td>
<td>$85</td>
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<td>$100</td>
<td>$101</td>
<td>$103</td>
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All numbers in $M

FY2018 President’s Budget Request
FY16 Spending Summary

APRA: 50.3M
ADAP: 17.6M
Theory: 11.9M
XRP: 4.2M
Others: 3.3M
FY16 Spending Summary

APRA

50.3M

By discipline

High Energy
IR/submm
UV/Vis
Fund Phys
Particle Astro

By research area

Lab astro 7%
Supporting technology 20%
Detectors 21%
Balloon, rocket, and ISS payloads 52%
Program Pressure

Research Funding ($M)

Success rate (%)

Year of Funding Start

APRA + ADAP + ATP + XRP Proposals

Success Rate (%) Research Funding ($M)

FY09  FY10  FY11  FY12  FY13  FY14  FY15  FY16  FY17  FY18
# Recent Proposal Selections

<table>
<thead>
<tr>
<th>Proposal Due Date</th>
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<th>Days past received</th>
<th>Number received</th>
<th>Number selected</th>
<th>% selected</th>
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<tbody>
<tr>
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<td>May 5, 2016</td>
<td>104</td>
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<td>NESSF-16</td>
<td>Feb 8, 2016</td>
<td>June 1, 2016</td>
<td>114</td>
<td>136</td>
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<tr>
<td>Kepler K2 GO – Cycle 4</td>
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<td>July 11, 2016</td>
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<td>Chandra GO – Cycle 18</td>
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<td>APRA (Basic Research)</td>
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<td>SAT (Technology)</td>
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<td>Hubble GO – Cycle 24</td>
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<td>June 24, 2016</td>
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<td>245</td>
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<td>ADAP (Data Analysis)</td>
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<td>Sep 22, 2016</td>
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<td>Exoplanet Research</td>
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<td>Spitzer GO – Cycle 13</td>
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<td>SOFIA GI – Cycle 5</td>
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<td>Oct 25, 2016</td>
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<td>71</td>
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<td>Astrophysics Theory</td>
<td>July 8, 2016</td>
<td>Dec 9, 2016</td>
<td>154</td>
<td>201</td>
<td>36</td>
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<tr>
<td>Swift GI – Cycle 13</td>
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<td>Jan 17, 2017</td>
<td>147</td>
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<td>Kepler K2 GO – Cycle 5</td>
<td>Dec 15, 2016</td>
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<td>110</td>
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<td>28</td>
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<td>NuSTAR GO – Cycle 3</td>
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<td>May 10, 2017</td>
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<td>217</td>
<td>80</td>
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<td>Fermi GI – Cycle 10</td>
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<td>May 30, 2017</td>
<td>95</td>
<td>183</td>
<td>43</td>
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**100% of recent announcements within 154 days**

**R&A Selection Rate: 23%; GO Selection Rate: 27%**

Status: June 6, 2017
<table>
<thead>
<tr>
<th>Proposal Opportunities</th>
<th>Proposal Due Date</th>
<th>Reference</th>
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<tbody>
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<td><a href="http://www.sofia.usra.edu">www.sofia.usra.edu</a></td>
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<tr>
<td>Astrophysics Theory Program (ATP)</td>
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<tr>
<td>Webb Early Release Science</td>
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<td>jwst.stsci.edu</td>
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<td>Keck Observing</td>
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<td>Swift Guest Investigator - Cycle 14</td>
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<td>XMM-Newton - Cycle 17</td>
<td>October 6, 2017</td>
<td>heasarc.gsfc.nasa.gov</td>
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<td>K2 Guest Investigator - Cycle 6</td>
<td>Fall 2017 (Step 0); Spring 2018 (Steps 1 and 2)</td>
<td>ROSES-17 D.7</td>
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<td>NuSTAR General Observer - Cycle 4</td>
<td>Winter 2017/18</td>
<td>ROSES-16 D.10</td>
</tr>
<tr>
<td>Fermi Guest Investigator - Cycle 11</td>
<td>Winter 2017/18</td>
<td>ROSES-16 D.6</td>
</tr>
<tr>
<td>NESSF</td>
<td>Approx February 2018</td>
<td>NSPIRES</td>
</tr>
<tr>
<td>Webb General Observer Cycle 1</td>
<td>March 2, 2018</td>
<td>jwst.stsci.edu</td>
</tr>
<tr>
<td>Chandra General Observer - Cycle 20</td>
<td>Approx March 2018</td>
<td>cxc.harvard.edu</td>
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<tr>
<td>Nancy Grace Roman Technology Fellowship</td>
<td>March 15, 2017</td>
<td>ROSES-16 D.9</td>
</tr>
<tr>
<td>Strategic Astrophysics Technology (SAT)</td>
<td>March 15, 2017</td>
<td>ROSES-16 D.8</td>
</tr>
<tr>
<td>Astrophysics Research and Analysis (APRA)</td>
<td>March 15, 2017</td>
<td>ROSES-16 D.3</td>
</tr>
<tr>
<td>TESS Guest Investigator - Cycle 1</td>
<td>9 months before launch</td>
<td>ROSES-17 D.11</td>
</tr>
<tr>
<td>TCAN</td>
<td>Spring 2018</td>
<td>ROSES-17 D.12</td>
</tr>
<tr>
<td>SOFIA next-generation instrumentation</td>
<td>TBD</td>
<td>ROSES-17 D.13</td>
</tr>
</tbody>
</table>
ROSES-2017 Changes

Astrophysics Theory Program (ATP)

- ATP selection rates have been <20% for the past decade
  - Increases burden on proposers and reviewers
  - Most proposals rated VG do not receive funding
- Beginning in ROSES-2017, ATP proposals will be solicited every other year
  - No reduction to ATP budget, twice as many selections, half as often
  - Success rates likely to increase to ~30%

Theoretical and Computational Astrophysics Networks (TCAN)

- TCAN supports coordinated efforts in fundamental theory and computational techniques.
- TCAN aims to unite researchers in collaborative networks that cross institutional and geographical divides.
- NASA expects to issue a call for proposals for TCAN with its deadline late in the ROSES-2017 cycle (early CY 2018).
NASA Astrophysics Postdoctoral Fellowships
Einstein, Hubble, and Sagan Fellowships

• The balance in $$$ between research grants & the postdoctoral fellowships program has changed from 10:1 to 6:1 over the last decade. With the proposed changes we will restore this balance and increase funding to R&A.

• Starting with the Call for Proposals in CY 2017, the total number of new fellows chosen annually will be reduced from ~33 per year to ~24 per year.
  – Frees up additional ~$6M for R&A after fully implemented

• The ~24 new fellows will be selected so that the science done by the fellows will span the entire breadth of NASA astrophysics.

• There will be one application for the fellowship program (as opposed to three separate ones in the past).

• There will be a single joint review (as opposed to three separate reviews in the past) of the applications to be held in the Washington DC area annually.

• Details of the implementation plan are being worked out now.
NASA Astrophysics

Missions Update
Astrophysics Missions in Operation

<table>
<thead>
<tr>
<th>Mission</th>
<th>Phase</th>
<th>2017 GO</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hubble</td>
<td>Extended</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Chandra</td>
<td>Extended</td>
<td>Yes</td>
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<tr>
<td>XMM-Newton (ESA)</td>
<td>Extended</td>
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<tr>
<td>Spitzer</td>
<td>Extended</td>
<td>Yes</td>
<td>EOM in 2019</td>
</tr>
<tr>
<td>Swift</td>
<td>Extended</td>
<td>Yes</td>
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<tr>
<td>Fermi</td>
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<td>Yes</td>
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<tr>
<td>Kepler</td>
<td>Extended</td>
<td>Yes</td>
<td>EOM in ~2019</td>
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<tr>
<td>NuSTAR</td>
<td>Extended</td>
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<tr>
<td>SOFIA</td>
<td>Prime</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>LISA Pathfinder (ESA)</td>
<td>Extended</td>
<td></td>
<td>EOM in 2017</td>
</tr>
<tr>
<td>NICER</td>
<td>Checkout</td>
<td></td>
<td>Science in July</td>
</tr>
</tbody>
</table>
# Astrophysics Missions in Development

<table>
<thead>
<tr>
<th>Mission</th>
<th>Launch Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TESS</td>
<td>3/2018</td>
<td>Transiting Exoplanet Survey Satellite</td>
</tr>
<tr>
<td>ISS-CREAM</td>
<td>8/2017</td>
<td>Cosmic Ray Energetics And Mass</td>
</tr>
<tr>
<td>ISS-NICER</td>
<td>6/2017</td>
<td>Neutron Star Interior Composition Explorer</td>
</tr>
<tr>
<td>Webb</td>
<td>10/2018</td>
<td>James Webb Space Telescope</td>
</tr>
<tr>
<td>Euclid</td>
<td>2020</td>
<td>ESA-led Mission</td>
</tr>
<tr>
<td>IXPE</td>
<td>2020</td>
<td>Imaging X-ray Polarimetry Explorer</td>
</tr>
<tr>
<td>GUSTO</td>
<td>2021</td>
<td>Galactic/ Extragalactic ULDB Spectroscopic Terahertz Observatory</td>
</tr>
<tr>
<td>WFIRST</td>
<td>Mid 2020s</td>
<td>Wide-Field Infrared Survey Telescope</td>
</tr>
<tr>
<td>NASA is supplying the NISP Sensor Chip System (SCS)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NASA Mission

**NOTE:**

- TESS is a NASA Mission.
- ISS-CREAM is a NASA Mission.
- ISS-NICER is a NASA Mission.
- Webb is a NASA Mission.
- Euclid is an ESA-led Mission.
- IXPE is a NASA Mission.
- GUSTO is a NASA Mission.
- WFIRST is a NASA Mission.

**Details:**

- TESS: 3/2018
- ISS-CREAM: 8/2017
- ISS-NICER: 6/2017
- Webb: 10/2018
- Euclid: 2020
- IXPE: 2020
- GUSTO: 2021
- WFIRST: Mid 2020s
Neutron star Interior Composition Explorer (NICER)

- **Science:** Understanding ultra-dense matter through observations of neutron stars in the soft X-ray band
- **Launch:** June 3, 2017, SpaceX-11 resupply
- **Platform:** ISS ExPRESS Logistics Carrier (ELC), with active pointing over nearly a full hemisphere
- **Duration:** 1 month calibration + 18 months prime mission + TBD extended mission (Senior Review)
- **Instrument:** X-ray (0.2–12 keV) “concentrator” optics and silicon-drift detectors. GPS position & absolute time reference
- **Enhancements:**
  - Guest Observer program (in extended mission)
  - Demonstration of pulsar-based spacecraft navigation
- **Status:**
  - Delivered payload to KSC in June 2016
  - Payload integrated into Dragon trunk in April 2017
  - Launch from KSC on June 3, 2017
  - Arrive at ISS on June 5, 2017

https://heasarc.gsfc.nasa.gov/docs/nicer/
NICER Launch: June 3, 2017

Launch June 3, 2017
ISS Arrival June 5, 2017
Deploy June 11, 2017
Checkout June 2017
Start science July 2017
July 2015: CREAM delivered to KSC and stored at KSC until launch

August 2017 (TBC): Launch on SpaceX-12 commercial resupply service (CRS) flight to ISS.

http://cosmicray.umd.edu/iss-cream/
Medium Explorer (MIDEX) 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: NLT June 2018 launch with a 3-year prime mission including 2 years of spacecraft operations and an additional 1 year ground-based observations and analysis. High-Earth elliptical orbit (17 x 58.7 Earth radii).

http://tess.gsfc.nasa.gov/
Large Infrared Space Observatory
Top priority of 2000 Decadal Survey

**Science themes:** First Light; Assembly of Galaxies; Birth of Stars and Planetary Systems; Planetary Systems and the Origins of Life

**Mission:** 6.5m deployable, segmented telescope at L2, passively cooled to <50K behind a large, deployable sunshield

**Instruments:** Near IR Camera, Near IR Spectrograph, Mid IR Instrument, Near IR Imager and Slitless Spectrograph

**Operations:** 2018 launch for a 5-year prime mission

**Partners:** ESA, CSA

**RECENT ACCOMPLISHMENTS:**
- Completed spacecraft bus assembly
- Completed ambient testing of combined telescope and instruments
- Shipped science payload to JSC for end-to-end testing
- Issued calls for Early Release Science Notices of Intent

**2017 Plans:**
- Integrate spacecraft and sunshield
- Cryo-vacuum testing of the science payload at JSC
- Flight operations rehearsals and training

[http://jwst.nasa.gov/](http://jwst.nasa.gov/)

Webb remains on track for an October 2018 launch
Simplified JWST Schedule

<table>
<thead>
<tr>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
</table>

(months of project funded critical path (mission pacing) schedule reserve)

Spacecraft I & T

Observatory I & T

Spacecraft

OTIS = Optical Telescope + ISIM

Science Payload

7.75

Development, Testing, Release

Ground System

Northrop-Grumman

Johnson Space Center

Space Telescope Science Institute

Goddard Space Flight Center

Guiana Space Center
OTIS (Telescope + Instruments)
Spacecraft and sunshield integration underway

- All components delivered except deployable radiator shields and actuators (not planned for delivery yet anyway)

Second sunshield mid-boom installation

UPS ready for installation onto spacecraft
Soon after launch the spacecraft is controlled from the Mission Operations Center at STScI.
Telescope commissioning will take almost 3 months.
Commissioning of the science instruments will start 4 months after launch and is completed in 1.5 months.
0.5 months are held on reserve to the nominal start of Cycle 1 science in April 2019.
**Objectives:**
- Characterize the history of cosmic acceleration and structure growth
- Understand how planetary systems form and evolve and determine the prevalence of planets in the colder outer regions
- Understand the compositions and atmospheric constituents of a variety of planets around nearby stars and to determine the properties of debris disks around nearby stars
- A peer-reviewed Guest Observer program allocated 25% of mission time.

**Mission Duration:** 6 ¼ years

**Orbit:** Sun-Earth L2

**Ground Stations:** Near Earth Network (Ka-band, S-band)

**Space Network:** S-band for launch

**Ground System:** MOC/Science Center/IOC

**Launch Vehicle:** Delta IV Heavy or Falcon Heavy

**Launch Site:** Eastern Range
 CURRENT STATUS:

• Successfully completed three-year technology demonstration activities on WFIRST’s two critical mission technologies (near infrared detectors and coronagraph technologies)

• Completed industry formulation studies on Wide Field Instrument Optomechanical Assembly

• Conducting WFIRST Independent External Technical/Cost/Management Review (WIETR) in response to findings and recommendations in National Academies’ Midterm Assessment
  – NASA is managing WFIRST with major emphasis on cost control
  – WFIRST will proceed to SRR/MDR and KDP-B after responding to WIETR recommendations

• WFIRST does not have a starshade; but NASA is studying a starshade for the next Decadal Survey’s consideration.
  – Starshade compatibility is being studied during Phase A; mandated minimum impact on WFIRST.
  – NASA will decide by fall 2017 whether to maintain starshade compatibility.

• Jeff Kruk is new Project Scientist following loss of Neil Gehrels

Wide-Field Infrared Survey Telescope
Top priority of 2010 Decadal Survey

Science themes: Dark Energy, Exoplanets, Large Area Near Infrared Surveys

Mission: 2.4m widefield telescope at L2; using existing hardware, images 0.28deg² at 0.8-2μm

Instruments (design reference mission): Wide Field Instrument (camera plus IFU), Coronagraph Instrument (imaging/IFS)

Phase: Currently in Formulation (Phase A)

https://wfirst.gsfc.nasa.gov/
Q: What fraction of WFIRST observing time has been set aside for a specific survey, investigator, or observation?  
A: 0%
WFIRST is a mission conducting major surveys for the community along with a guest observer program for individuals or small groups.

- The existing Formulation Science Working Group (FSWG) is in place only during formulation. It will be disbanded in early 2021. Present plans from the FSWG only establish a design reference mission – no time allocated.
- All WFIRST observing time is available – no particular survey implementations or investigators have been selected yet.
- All data provided in the WFIRST archive are publicly available – there will be no proprietary period.
- A new “Operations Science Working Group” will be selected via an open competition to conduct the survey observations.
• WFIRST is the highest priority large space mission from the 2010 Decadal Survey in Astronomy and Astrophysics
  – The 2016 Astrophysics Midterm Assessment recognized the continued compelling science value of WFIRST.
  – After several years of mission concept studies and technology investments, NASA began formulation of WFIRST in 2016
• Two National Academies studies have recommended that NASA conduct an independent technical/management/cost (TMC) review of WFIRST before beginning Phase B and before proceeding to the Preliminary Design review
  – Both reports expressed concern that mission cost growth could endanger the balance of NASA's astrophysics program and the alignment of its scientific priorities with those put forward by the Decadal Survey.
  – The studies are the 2014 WFIRST/AFTA study (F. Harrison et al.) and the 2016 Astrophysics Midterm Assessment (J. Hewitt et al.)
• NASA is implementing these recommendations and establishing the WFIRST Independent External TMC Review (WIETR)
• The Review will begin as soon as the panel members are identified
  – Once begun, the review should take ~2 months
  – The WFIRST System Requirements Review (SRR) / Mission Design Review (MDR), planned for Summer 2017, and beginning of Phase B, planned for Fall 2017, will be deferred until after the WIETR so that any findings and recommendations can be incorporated into the WFIRST project plan
Chandra image of Cen A, showing soft X-rays (red) and hard X-rays (blue). The jet extends 4 arcmin NE from the core. The white circle denotes IXPE’s 30 arcsec half-power diameter (HPD); the white square, the IXPE detector’s field of view (FOV). The imaging capability of IXPE enables mapping the X-ray polarization degree and position angle and thus the magnetic-field geometry in X-ray emitting regions along the jet.

• Next Astrophysics SMEX: IXPE, PI: Martin Weisskopf, MSFC (announced January 2017)
• IXPE has a 2-8 keV energy range, proportional counter energy resolution, 11´ FOV, and ≤ 30" angular resolution
• IXPE targets AGNs and microquasars, pulsars and pulsar wind nebulae, magnetars, accreting X-ray binaries, supernova remnants, the Galactic center.
• Addresses fundamental questions about:
  o the geometries of the flows, emission regions, and magnetic fields
  o physical processes leading to particle acceleration and X-ray emission
  o physical effects of gravitational, electric, & magnetic fields at their extreme limits
GUSTO Suborbital Explorer (MO)

GUSTO (Galactic/Extragalactic ULDB Spectroscopic Terahertz Observatory) led by PI Chris Walker from the University of Arizona, is an Astrophysics Explorer (MO) balloon mission and is an advanced version of STO-2 balloon payload.

GUSTO uses large-scale surveys & spectral diagnostics of the Interstellar Medium (ISM) to answer key questions about the Life Cycle of the ISM and massive star formation.

GUSTO surveys will provide Milky Way and Large Magellanic Cloud (LMC) templates from which star formation can be understood throughout cosmic time.

~300 dedicated SOFIA flights would be required to equal the GUSTO survey.
Astrophysics Missions under Study

**XARM**
JAXA-led Mission
2021

NASA is supplying the SXS Detectors, ADRs, and SXTs

**Athena**
ESA-led Mission
Late 2020s

NASA is supplying elements for both instruments

**L3**
ESA-led Mission
Mid 2030s

NASA is developing technology for both the payload and the mission
NASA Astrophysics

Preparing for the 2020 Decadal Survey

HabEx, LUVOIR, Lynx, OST
Large Mission Concept Studies

Astrophysics Probes
Medium-class Mission Concept Studies
Preparing for the 2020 Decadal Survey
Large Mission Concepts

<table>
<thead>
<tr>
<th>Community STDT Chairs</th>
<th>Center Study Scientist</th>
<th>Study Lead Center</th>
<th>HQ Program Scientist</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large UV/Optical/IR Surveyor <a href="http://asd.gsfc.nasa.gov/luvoir">asd.gsfc.nasa.gov/luvoir</a></td>
<td>Debra Fischer* Bradley Peterson</td>
<td>Aki Roberge</td>
<td>GSFC</td>
</tr>
<tr>
<td>Lynx X-ray Surveyor <a href="http://wwwastro.msfc.nasa.gov/lynx">wwwastro.msfc.nasa.gov/lynx</a></td>
<td>Feryal Ozel* Alexey Vikhlinin</td>
<td>Jessica Gaskin</td>
<td>MSFC</td>
</tr>
</tbody>
</table>

* Astrophysics Advisory Committee member

Habitable Exoplanet Imaging Mission (HabEx)

https://www.jpl.nasa.gov/habex

- Study Leads:
  - Community Chairs: Scott Gaudi (Ohio State), Sara Seager (MIT)
  - Study Scientist: Bertrand Mennesson (JPL), Study Manager: Keith Warfield (JPL)
- 9 science and technology working groups
- Building upon the Exo-C and Exo-S probe study reports
- Currently studying trades for a 4-m monolithic-mirror telescope with coronagraph and/or starshade source suppression
  - Additional trade study planned for a 6.5-m segmented mirror
- Investigating optical, UV and NIR for suitable molecular biosignatures
  - $R \sim 100$, $IWA \lesssim 0.1$ arcsec, planet-star contrast $\sim 10^{-10}$
- Potential general astrophysics instrumentation under investigation:
  - Imaging $\sim$ FOV 3’x3’, UV spectrograph $R \sim 5,000$, $\lambda > 100$nm, multi-object spectroscopy
The STDT decided in November 2016 to study two distinctly sizes of LUVOIR mission (15-m and ~9-m telescopes; Architecture A and B, respectively).

- Architecture A will have four instrument bays. Three instruments will be designed at GSFC (a coronagraph, a UV multi-object spectrograph, and a wide-field imager). A fourth instrument will be studied by a European consortium, with leadership from the French Space Agency (CNES). Architecture B will have a different combination of three instruments.

The LUVOIR team has developed several observation simulation tools, available at https://asd.gsfc.nasa.gov/luvoir/tools/. Work has begun on writing the Interim Report.

LUVOIR capabilities were presented at the Planetary Science Vision 2050 workshop and at the HST/JWST 5 conference the week of March 20.

A Cooperative Agreement Notice (CAN) was issued for industry partners to contribute to the LUVOIR System Studies. In April 2017, two one-year awards were given to:

- Northrop Grumman, Harris Corporation, and Ball Aerospace to jointly address all of the topics described in the solicitation.
- Lockheed Martin to develop their vibration isolation precision pointing system (Disturbance Free Payload).
A very high angular resolution, very large area X-ray Observatory for the 2030s

- Study Leads:
  - Community Chairs: Feryal Özel (Arizona), Alexey Vikhlinin (SAO)
  - Study Scientist: Jessica Gaskin (MSFC), Study Manager: Karen Gelmis (MSFC)
- 10 science, optics, and instrumentation working groups, over 200 members
- Currently studying trades for a 3m diameter x 10m focal length telescope.
  - Also considering 6m diameter x 20m focal length configuration.
- MSFC Advanced Concepts Office studies underway.
- Instruments under consideration include a High Definition X-ray Imager (HDXI), a large-format X-ray calorimeter, and a grating spectrometer.
- Extensive engagement with industry.
- “From Chandra to Lynx” workshop, August 8-10, Cambridge, MA
• A large (~9m), cold (~4K) telescope, 6—600 µm with a 0.3 sq degree FOV.
• Community Chairs: Margaret Meixner (STScI), Asantha Cooray (UC Irvine)
  – GSFC Study team: Ruth Carter, Dave Leisawitz, Johannes Staguhn
  – 7 science and technology working groups / groups + wiki open to community
• In current design, telescope has a 9.1 m segmented primary (building on Webb + Herschel lessons + SAFIR, SPICA)
• 5 instruments under study (2 GSFC, 1 JPL, 1 CNES and 1 JAXA)
  – Mid-IR instrument w/ coronagraph for molecular biosignatures (e.g., water, ozone, methane) + inner regions proto-planetary disks / far-out Saturn/Jupiters
  – Mid-IR medium-res spectrometer & FIR high-res spectrometer for rise of metals, dust, disk masses across all evolutionary stages of a proto-planetary disk, co-evol black holes and galaxies + water across cosmic time
  – FIR Imager / Polarimeter for large galaxy surveys, solar system science, and ISM energetics (polarimetry)
  – Heterodyne spectrometer for Galactic star formation and ISM studies
• Second concept design study planned
# Preparing for the 2020 Decadal Survey

## Large Mission Concepts

<table>
<thead>
<tr>
<th>Mission</th>
<th>Community STDT Chairs</th>
<th>Upcoming Meetings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Habitable Exoplanet Imaging Mission</td>
<td>Scott Gaudi, Sara Seager</td>
<td>August 1-4 @ JPL</td>
</tr>
<tr>
<td><a href="http://science.nasa.gov/astrophysics/2020-decadal-survey-planning/">www.jpl.nasa.gov/habex</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large UV/Optical/IR Surveyor</td>
<td>Debra Fischer, Bradley Peterson</td>
<td>July 5 @ STScI</td>
</tr>
<tr>
<td><a href="http://science.nasa.gov/astrophysics/2020-decadal-survey-planning/">asd.gsfc.nasa.gov/luvoir</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lynx X-ray Surveyor</td>
<td>Feryal Ozel, Alexey Vikhlinin</td>
<td>August 8-10 @ SAO</td>
</tr>
<tr>
<td><a href="http://science.nasa.gov/astrophysics/2020-decadal-survey-planning/">www.astro.msfc.nasa.gov/lynx</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Origins Space Telescope</td>
<td>Asantha Cooray, Margaret Meixner</td>
<td>June 14-15 @ Washington DC</td>
</tr>
<tr>
<td><a href="http://science.nasa.gov/astrophysics/2020-decadal-survey-planning/">asd.gsfc.nasa.gov/firs</a></td>
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</tr>
</tbody>
</table>
Astrophysics Probes

• In August 2016, NASA issued a solicitation requesting proposals for mission concept studies for medium-size missions (Probes)
  – 27 proposals were received on November 15, 2016, spanning a broad range of science disciplines

• The proposals were evaluated by peer review
  – Reviewers evaluated the proposals based on intrinsic science merit, relevance to NASA, value of the study in the context of other studies, and likelihood that the mission concept is Probe-class (<$1B).
  – Each panel was requested to provide general guidelines on how to assemble the Probes portfolio.
  – Panels recommended proposal selection spanning a broad range of science disciplines and mission concepts.

• NASA has selected 10 proposals for mission concept studies involving a PI-led science team and NASA mission design labs at JPL and Goddard.
  – An independent cost assessment of the resulting mission concepts will be conducted by NASA

• The results of the mission concept studies will be provided by NASA to the 2020 Decadal Committee for their consideration
# Selected Probe Mission Concept Studies

<table>
<thead>
<tr>
<th>PI</th>
<th>Affiliation</th>
<th>Short title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jordan Camp</td>
<td>NASA GSFC</td>
<td>Transient Astrophysics Probe</td>
</tr>
<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>
</tr>
<tr>
<td>Shaul Hanany</td>
<td>Univ. of Minnesota</td>
<td>Inflation Probe</td>
</tr>
<tr>
<td>Richard Mushotzky</td>
<td>Univ. of Maryland</td>
<td>High Spatial Resolution X-ray Probe</td>
</tr>
<tr>
<td>Angela Olinto</td>
<td>Univ. of Chicago</td>
<td>Multi-Messenger Astrophysics Probe</td>
</tr>
<tr>
<td>Peter Plavchan *</td>
<td>Missouri State Univ.</td>
<td>Precise Radial Velocity Observatory</td>
</tr>
<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

# 2020 Decadal Survey

## Notional Schedule

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018 March</td>
<td>Astro 2020 proposal submitted to Agencies</td>
</tr>
<tr>
<td>2018 December</td>
<td>Chair nominated</td>
</tr>
<tr>
<td>2019 January</td>
<td>AAS Town Hall</td>
</tr>
<tr>
<td>2019 Feb/March</td>
<td>Committee begins meeting</td>
</tr>
<tr>
<td>2019 May/June</td>
<td>Panels begin meeting</td>
</tr>
<tr>
<td>2020 May</td>
<td>Panels complete reports and deliver to Committee</td>
</tr>
<tr>
<td>2020 August</td>
<td>Review of survey and panel reports begins</td>
</tr>
<tr>
<td>2020 December</td>
<td>Astro 2020 completed and report released to Agencies and public</td>
</tr>
</tbody>
</table>
NASA Astrophysics

Backup

More Selected Mission Updates
SOFIA
Stratospheric Observatory for Infrared Astronomy

CURRENT STATUS:
• In prime mission operation since May 2014
• Observing status:
  – 535 observing hours awarded for Cycle 5 which started in February 2017.
  – Commissioned new Upgraded German REceiver for Astronomy at Terahertz (upGREAT) High Frequency Array (HFA) in October 2016.
  – High-resolution Airborne Wideband Camera-plus (HAWC+) commissioning completed in December 2016.
  – High Resolution Mid Infrared Spectrometer (HIRMES) instrument under development.
  – Next Gen instrument solicitation planned

• World’s Largest Airborne Observatory
• 2.5-meter telescope
• 80/20 Partnership between NASA and the German Aerospace Center (DLR)
• Science Center and Program Management at NASA-Ames Research Center
• Science Flight Operations at NASA-Armstrong Flight Research Center
• Four U.S. and two German science instruments commissioned
  – Provide imaging, spectroscopy, photometry and polarization-mapping with emphasis across mid- and far-infrared wavelengths
  – Advanced science instruments under development for future operation

https://www.sofia.usra.edu/
Euclid

BACKGROUND:
• Use two independent probes (weak lensing and galaxy clustering) to examine the nature of dark energy and dark matter, the initial conditions of the Universe, and the growth of large-scale structure.
• Examine expansion and star formation history of the Universe, investigate galaxy formation and evolution, conduct a deep NIR survey to explore the high-redshift Universe.

NASA CONTRIBUTION:
• Flight detectors for the NISP instrument: Multiple number of Sensor Chip Systems (SCS) where each chip consists of 2k x 2k HgCdTe array.
• NASA funded US Science Team.
• Ground system node and U.S. science center.

CURRENT STATUS:
• Flight hardware is being fabricated.
• First NASA flight units delivered to ESA in March 2017.
• ESA working toward a Dec 2020 launch date.

ESA Mission with NASA Collaborating
• ESA Cosmic Vision 2015-2025 Mission, M-Class
• Category 3 - Risk Class B
• Optical and NIR Observatory with 1.2-m Telescope
• U.S. Providing Characterized NIR Detectors
• Launch Date: Dec 2020
• ~70 U.S. Science Team members selected by NASA HQ
• Euclid NASA Science Center at IPAC

http://sci.esa.int/euclid/
X-ray Astronomy Recovery Mission

• XARM is the successor to Hitomi.
• Designed to provide breakthrough advances in our knowledge of winds, outflows, clusters, and dark matter.
• Mission will include an X-ray microcalorimeter and an X-ray imager.
• XARM approved by Japanese Diet, NASA formulation this summer.
• US Community Involvement
  – The US science community should expect a high level of involvement in the planning and execution of the XARM science mission.
  – NASA will openly solicit US participation at an appropriate time.
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-ray Integral Field Unit (XIFU) and Wide Field Imager (WFI) instruments

Launch Date: 2028

Breakthrough Capabilities:
- High Throughput, High spectral resolution X-ray Astronomy, Wide FOV
- 10x Chandra area, 100x improved non-dispersive spectral resolution, 5x FOV.

Enabling Technologies: Silicon pore optics, 3000+ pixel μ-calorimeter (XIFU), large DEPFET array (WFI)

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 second Large mission in ESA Cosmic Visions Program.
- Currently in 2-year Study Phase.
- NASA budgeting for a $100M-$150M hardware contribution, plus a U.S. GO program and a U.S. data center.
- NASA will contribute to both the X-IFU and the WFI.
- NASA and ESA are discussing other possible NASA contributions to the observatory.
- NASA and U.S. community involvement in Athena Science Study Team (including its SWG) and Instruments facilitated via series of RFI and CAs.
- Athena team will expand at Adoption in 2020; NASA anticipates this will provide an opportunity to expand U.S. community involvement.

www.the-athena-x-ray-observatory.eu
Status of the Large 3 (L3) Mission

• NASA established an L3 Study Office at Goddard Space Flight Center within the PCOS/COR Program Office in January 2017.
  - The L3 Study Office will coordinate technology development for the NASA hardware contribution to L3
  - The L3 Study Office will implement directions for US participation in the ESA-led mission concept study.

• The LISA Consortium has submitted a proposal to ESA for a space-based gravitational wave observatory in January 2017 in response to ESA’s call for proposals for its “Gravitational Wave Universe” theme.
  - The proposal identifies laser interferometry as the baseline for the proposed mission, based on a three-arm architecture. ESA will announce proposal selection in June 2017
  - US participation was led by the NASA-appointed L3 Study Team. 21 US scientists (out of 82 total) are named as the core team on the LISA proposal.

• Technical Interchange Meetings were held between ESA and NASA in ESTEC, Netherlands, in early May to discuss the ESA Phase 0 study, possible NASA hardware contributions, and NASA participation in ESA system engineering activities.

• NASA is funding technology development in the following areas, as discussed in the LISA consortium proposal:
  – Phasemeters, microthrusters, lasers, telescopes, charge management system

https://www.elisascience.org/
**HaloSat (X-ray)**

- **PI:** Phil Kaaret, U Iowa
- **Co-I** at WFF, GSFC, JHU, CNRS
- **LRD:** Spring 2018, APRA-2014 selection
- **Science Objectives:** HaloSat will map the distribution of hot gas in the Milky Way and determine whether it fills an extended, and thus massive halo, or whether the halo is compact, and thus does not contribute significantly to the total mass of the Milky Way.
- **Operations:** 2 month minimum, 1 year goal

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**CUTE (UV)**

- **PI:** Kevin France, Colorado U
- **LRD:** Spring 2020, APRA-2015 selection
- **Science Objectives:** The Colorado Ultraviolet Transit Experiment (CUTE) will take multiple medium resolution UV spectra of hot Jupiters during transit, in order to measure the composition of the atmosphere being ablated away.
- **Operations:** 1 month minimum, 6 month full survey of 14 exoplanets.
2017 Balloon Campaigns

- Completed Spring FY17 Super Pressure Balloon Campaign @ New Zealand
  - **EUSO** (Extreme Universe Space Observatory on a Super Pressure Balloon)
    A. Olinto, U of Chicago -
    - **Launched**: April 24 from Wanaka, New Zealand.
    - First experiment to observe individual Ultrahigh Energy Cosmic Rays from top of the atmosphere using air fluorescence.
    - **Flight duration**: 12.2 days: Flight terminated due to (suspected) leak in super pressure balloon. Balloon and payload was dropped into the Pacific Ocean ~255 miles SE of Easter Island.

- Summer FY17 Conventional Balloon Campaign @ Palestine, TX (June 2017).
  - PIPER (Primordial Inflation Polarization Explorer)/A. Kogut/GSFC.
  - BETTI (Balloon Experimental Twin Telescope for Infrared Interferometry)/S. Rinehart/GSFC.
  - Superbit (Balloon-borne Imaging Telescope)/W. Jones/Princeton.

- Fall FY17 Conventional Balloon Campaign @ Fort Sumner, NM
  - PIPER (Primordial Inflation Polarization Explorer)/A. Kogut/GSFC.
  - FIREBALL (Faint Intergalactic medium Redshift Emission Balloon)/C. Martin/Caltech

- Winter FY18 Long Duration Balloon Campaign in Antarctica (December 2017)
  - Payloads TBD

https://www.nsbf.nasa.gov/index.html
2017 & early 2018 Sounding Rocket Launches

CHESS3
(Colorado High-resolution Echelle Stellar Spectrograph)
PI - K. France / Univ. of Colorado Jun 2017
Technology development for future UV missions, characterizing ISM towards nearby stars.

DEUCE
(Dual-channel Extreme Ultraviolet Continuum Experiment)
PI - J. Green / Univ. of Colorado Oct 2017
Technology development for future UV missions, physics of re-ionization from B stars at extreme UV.

Micro-X
PI - E. Figueroa / Northwestern Univ. ~Feb 2018
Characterize plasma conditions in Puppis A SNR using Transition-Edge Sensors.

CIBER-2
(Cosmic Infrared Background Experiment)
PI - J. Bock / Caltech Mar 2018
Characterize the extragalactic near-infrared background light.
NASA Astrophysics

Backup
NASA Events in Austin before the Town Hall

- Webb Proposal Planning Workshop – Sun June 4 @ 8:30 am (Salon 1)
- Science Highlights from SOFIA – Mon June 5 @ 4:30 pm (Salon 5)
- Preparing for Webb Observations – Mon June 5 to Thu June 8 @ 10:00 am & 2:00 pm (Salon 3)
- NASA Exoplanet Exploration Program Update – Tue June 6 @ 2:00 pm (Room 205)
- NASA Town Hall – Wed June 8 @ 12:45 pm (Salon 5)
NASA Events in Austin after the Town Hall

- NASA Town Hall – Wed June 8 @ 12:45 pm (Salon 5)
- Preparing for Webb Observations, Wed June 8 @ 2:00 pm and Thu June 9 @ 10:00 am (Salon 3)
Developing
- ISS-NICER
- ISS-CREAM
- TESS
- Webb
- IXPE
- Euclid (ESA)
- GUSTO
- WFIRST

Opportunities
- Explorer
- SOFIA

Operating
- Hubble
- Chandra
- XMM-Newton (ESA)
- Spitzer
- Swift
- Fermi
- Kepler/K2
- NuSTAR
- SOFIA
- LPF(ESA)/ST-7
- Balloons
- Rockets

Event Dates:
- June 3
- Aug TBC
- Mar TBC
- Oct
- KDP-E
- ISS-NICER
- ISS-CREAM
- TESS
- Webb
- IXPE
- Euclid (ESA)
- GUSTO
- WFIRST

Launch Dates:
- June 3
- August TBC

End Dates:
- EOM

Implementation Dates:
- SMEX AO
- MIDEX AO
- 3G Instrument
- 4G Instrument

Senior Reviews:
- SR Rev

EO Os:
- EOM
## Responding to the 2010 Decadal Survey
### Responding to the Midterm Assessment

<table>
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<tr>
<th>Prioritized Recommendation</th>
<th>NASA plans (partial list)</th>
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<tr>
<td><strong>LARGE ACTIVITIES</strong></td>
<td></td>
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<tr>
<td>WFIRST</td>
<td>In Phase A, launch in mid-2020s, <em>independent technical/management cost review</em></td>
</tr>
<tr>
<td>Explorers</td>
<td>Executing 4 AOs per decade, <em>maintain cadence</em></td>
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<tr>
<td>LISA</td>
<td>Partnering on ESA’s space-based gravitational wave observatory; <em>increased contribution</em></td>
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<td>IXO</td>
<td>Partnering on ESA’s Athena x-ray observatory</td>
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<tr>
<td><strong>MEDIUM ACTIVITIES</strong></td>
<td></td>
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<tr>
<td>Exoplanet technology</td>
<td>WFIRST coronagraph, <em>reductions being considered for starshade and coronagraph technology development beyond the WFIRST coronagraph</em></td>
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<tr>
<td>Inflation Probe technology</td>
<td>3 balloon-borne technology experiments</td>
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<tr>
<td><strong>SMALL ACTIVITIES</strong></td>
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<tr>
<td>R&amp;A augmentations</td>
<td>R&amp;A up 20% since FY10; <em>not targeted except TCAN</em></td>
</tr>
<tr>
<td>Mid-TRL technology</td>
<td>Initiated Strategic Astrophysics Technology program; focused on identified missions</td>
</tr>
<tr>
<td>Suborbital missions</td>
<td>Initiated super pressure balloon capability</td>
</tr>
</tbody>
</table>
Internal Funding Model for NASA Civil Servant Scientists
Goals

• The amount of directed Research and Analysis (R&A) work at the Centers will be increased
  – This will result in a decrease in R&A proposals from NASA Center scientists
  – NASA civil servant scientists may still compete for R&A, but in reduced numbers
  – Mission AOs and mission-funded guest observer (GO) programs will not be directed
• All directed R&A work will be collaboratively planned between the Centers and HQ/SMD Divisions
  – The amount and type of directed work will vary between individual Centers and Divisions
• All directed R&A work will be peer reviewed
  – This will include both initial and periodic external peer reviews
• The fraction of R&A funding going to the Centers will remain consistent with historical levels and the increase in directed R&A work at the Centers will not impact the balance between internal and external funding
Internal Funding Model for NASA Civil Servant Scientists

Changes

• NASA is adjusting its internal funding model for civil servant scientists to include more directed work for critical-sized groups
  – This is an internal realignment to use NASA civil servant scientists more efficiently
  – It focuses on work that can best be done or only be done at NASA Centers
  – It does not affect the balance between internal and external funding
  – All directed work will be externally reviewed

• Objectives and benefits of this new model
  – Enhance the value of Agency funds by having the NASA civil servant scientists work on tasks that are substantial, strategic, focused, and that enable the broader science community, rather than compete with the external science community
  – Ensure that NASA civil servant scientists advance tasks that meet NASA objectives and can best/only be done at NASA Centers, resulting in science, technology, capabilities, and missions that are tightly integrated
  – Ensure a critical mass of selected capabilities necessary to conduct complex research on key topics
  – Adopt a strategic implementation that will reduce the number of proposals written by NASA civil servant scientists and improve the efficiency of inherently governmental work

• There will be no change in the balance of the research budget allocated between NASA civil servant scientists and the external community
  – The new funding model is designed to be neutral regarding the fraction of funding going to the external scientific community
2017 Transition

Robert Lightfoot
Lesa Roe

Gale Allen
Douglas Terrier

Andrew Hunter
Rebecca Lee
Mike Kincaid
Jen Rae Wang

Legend
New
Acting
Mixed

www.nasa.gov
Language relevant to NASA Astrophysics includes:

- Calls for a balanced portfolio of space science missions and directs NASA to follow the Decadal Survey, but adjusting “mission priorities, schedule, and scope in light of changing budget projections”
- Notes the value of Webb and includes a requirement that NASA maintain a robust surveillance of the performance and cost of Webb
- Notes the value of the WFIRST mission
- Expands the list of purposes for NASA to include astrobiology
- Requires senior reviews be conducted every three years versus the current requirement for every two years
- Forbids NASA from terminating SOFIA before December 31, 2017
- Requires NASA to contract with the National Academies to develop a science strategy for the study and exploration of extrasolar planets; due in 18 months
- Requires NASA to contract with the National Academies to develop a science strategy for astrobiology; due in 18 months

Plus a whole lot of reports