Joint Astrophysics PAG Session
AAS 227th Meeting
Kissimmee, Florida
January 4, 2016

Paul Hertz
Director, Astrophysics Division
Science Mission Directorate
@PHertzNASA

This presentation will be posted at
http://cor.gsfc.nasa.gov/copag/
Visiting Experienced Scientists at NASA HQ

Looking for a few good astrophysicists….

• Seeking one or more experienced scientists
  – to take leave from their U.S. home institution
  – for a 2-year visiting position (can extend up to 6 years)
  – to work in Astrophysics at NASA Headquarters

• Duties include:
  – Management of the NASA astrophysics grants programs
  – Planning, development, and management of NASA missions
  – Strategic planning for the future of NASA astrophysics

• Requires Ph.D., research experience, familiarity with NASA award programs and/or missions, and the ability to communicate effectively

• For additional info, talk with any of the Astrophysics HQ staff.

Applications welcome until position is filled

https://jobregister.aas.org/job_view?JobID=51984
Why Astrophysics?

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
Physics of the Cosmos Program

1. How did our universe begin and evolve?

Cosmic Origins Program

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

Exoplanet Exploration Program

3. Are We Alone?

Astrophysics Explorers Program

Astrophysics Research Program

James Webb Space Telescope Program (managed outside of Astrophysics Division)
Astrophysics Programs

Physics of the Cosmos Program
Chandra
XMM-Newton (ESA)
Swift *
Suzaku (JAXA) *
Fermi
Planck (ESA)
NuSTAR *
LISA Pathfinder (ESA)
ASTRO-H (JAXA) *
NICER *

Cosmic Origins Program
Hubble
Spitzer
Herschel (ESA)
SOFIA
Webb **
CREAM ***
Euclid (ESA)
Athena (ESA)
L3 GW Obs (ESA)

Exoplanet Exploration Program
Kepler/K2
TESS *
WFIRST

Managed elsewhere:
* Astrophysics Explorers
** James Webb Program
*** Astrophysics Research
Astrophysics Programs

Physics of the Cosmos Program
GSFC
Mansoor Ahmed
Ann Hornschemeier
Peter Bertone
Bernard Seery
Thai Pham

Cosmic Origins Program
GSFC
Mansoor Ahmed
Susan Neff
Deborah Padgett
Bernard Seery
Thai Pham

Exoplanet Exploration Program
JPL
Gary Blackwood
Karl Stapelfeldt (vacant)
Nick Siegler
Nick Siegler

Center Manager
Chief Scientist
Dep Chief Sci
Chief Tech
Tech Dev Mgr

HQ Scientist
HQ Dep Sci
HQ Executive

Rita Sambruna
Dan Evans
Shahid Habib

Mario Perez
Kartik Sheth
Shahid Habib

Doug Hudgins
Martin Still
John Gagosian
Astrophysics

NASA's progress toward the 2010 Decadal Survey in Astronomy and Astrophysics
NASA’s Decadal Strategy

• Complete JWST, within budget, for launch in October 2018
• Highest priority is starting a new mission to follow JWST
  – Must be responsive to *New Worlds, New Horizons* (NWNH)
  – On track to start WFIRST in February 2016
• Driver for all planning is addressing NWNH priorities and recommendations within the available funding
  – All recommendations of NWNH are being addressed in some way
  – Due to changing budget environment, hard choices have been made. Many recommendations are not being addressed exactly as in NWNH
  – Also responsive to subsequent NRC studies (Implementing NWNH, Participating in Euclid, Assessing WFIRST-AFTA)

• Coordination and collaboration across organizational boundaries
  – International (ESA, JAXA, CSA, CNES, ASI, DLR, etc.), Interagency (NSF, DOE, NRO), Interdirectorate (HEOMD, STMD, OEd), Interdivision (PSD, ESD, HPD)

• Clear and frequent communication to the community regarding NASA’s progress and plans
  – AAS Town Halls, continuous reporting to CAA/AAAC/APS, biennial publication of Astrophysics Implementation Plan and White Papers, use of Program Analysis Groups (PAGs), use of community based study and review teams (SAGs, CSTs, SDTs, STDTs, SWGs, etc.)
Mid Term Review

• The National Academies has formed an ad hoc Committee to conduct a Review of Progress Toward the Decadal Survey Vision in New Worlds, New Horizons in Astronomy and Astrophysics.
  - Jacqueline N. Hewitt (MIT) is the Chair

• Meetings:
  - October 8-10, 2015; Washington, DC (NASA presentation summarizing progress)
  - December 12-14, 2015; Irvine, CA (symposium)
  - January 11-13, 2016; Washington, DC

• Charge: In the context of funding circumstances that are substantially below those assumed in NWNH, the committee's review will include the following tasks:
  1. Describe the most significant scientific discoveries, technical advances, and relevant programmatic changes in astronomy and astrophysics over the years since the publication of the decadal survey;
  2. Assess how well the Agencies' programs address the strategies, goals, and priorities outlined in the 2010 decadal survey and other relevant NRC reports;
  3. Assess the progress toward realizing these strategies, goals, and priorities; and
  4. In the context of strategic advice provided for the Agencies' programs by Federal Advisory Committees, and in the context of mid-decade contingencies described in the decadal survey, recommend any actions that could be taken to maximize the science return of the Agencies' programs.

http://sites.nationalacademies.org/SSB/CurrentProjects/SSB_161177
Committee on the Review of Progress Toward the Decadal Survey Vision in New Worlds, New Horizons in Astronomy and Astrophysics

• Jaqueline N. Hewitt, MIT (Chair)  [NWNH – PPP]
• Adam S. Burrows, Princeton  [Implement]
• Neil J. Cornish, Montana State  [NWNH – SFP]
• Andrew W. Howard, U. Hawaii-Manoa
• Bruce Macintosh, Stanford  [CAA, NWNH – PPP]
• Richard F. Mushotzky, U. Maryland  [NWNH – SFP]
• Angela V. Olinto, U. Chicago  [NWNH – PPP]
• Steven M. Ritz, UCSC  [CAA, NWNH, Implement]
• Alexey Vikhlinin, Harvard-Smithsonian CfA  [CAA]
• David H. Weinberg, Ohio State [NWNH – SFP]
• Rainer Weiss, MIT
• Eric M. Wilcots, U. Wisconsin  [CAA, NWNH – SFP]
• Edward L. Wright, UCLA
• A. Thomas Young, Lockheed Martin, retired [CAA, NWNH, Implement, AFTA, LLBP]

CAA - Committee on Astronomy and Astrophysics
NWNH – New Worlds, New Horizons in Astronomy and Astrophysics (Blandford, 2010)
Implement – Implementing Recommendations from the New Worlds, New Horizons Decadal Survey (Burrows & Kennel, 2011)
Euclid – Assessment of a Plan for U.S. Participation in Euclid (Spergel, 2012)
OIR – Optimizing the U.S. Ground-Based Optical and Infrared Astronomy System (Elmegreen, 2015)
LLBP – The Space Science Decadal Surveys: Lessons Learned and Best Practices (Dressler, 2015)
### Progress Toward Decadal Survey Priorities

The NASA FY16 Appropriation and the notional out year budget planning guidance in the President’s FY16 Budget Request support:

<table>
<thead>
<tr>
<th>Large-scale 1. JWST</th>
<th>JWST remains within budget guidelines and on track for an October 2018 launch.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large-scale 1. WFIRST</td>
<td>2 years of preformation and focused technology development for WFIRST-AFTA (a 2.4m version of WFIRST with a coronagraph) are complete. Formulation (new start) planned to begin February 2016.</td>
</tr>
<tr>
<td>Large-scale 2. Augmentation to Explorer Program</td>
<td>Astrophysics Explorers planned budget increased to support cadence of four AOs per decade including a SMEX AO in Fall 2014 and a MIDEX AO in Fall 2016.</td>
</tr>
<tr>
<td>Large-scale 4. IXO</td>
<td>Planning a partnership on ESA’s L2 Athena X-ray observatory; the Athena study phase, with U.S. participation, is underway. Strategic astrophysics technology investments.</td>
</tr>
<tr>
<td>Medium-scale 1. New Worlds Technology Development Program</td>
<td>Focused technology development for coronagraph on WFIRST, strategic astrophysics technology investments, exoplanet probe mission concept studies. Partnership with NSF to develop precision Doppler spectrometer as facility instrument. Exozodi survey using LBTI.</td>
</tr>
</tbody>
</table>
### The NASA FY16 Appropriation and the notional out year budget planning guidance in the President’s FY16 Budget Request support:

<table>
<thead>
<tr>
<th>Medium-scale 2. Inflation Probe Technology Development</th>
<th>Balloon-borne investigations plus strategic astrophysics technology investments. Studying partnership on JAXA’s LiteBIRD.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small-scale. Research Program Augmentations</td>
<td>Increased annual R&amp;A budget by 10% from FY10 to FY12 and another 10% from FY14 to FY16. Within R&amp;A: established Theoretical and Computational Astrophysics Networks program with NSF; funding available for astrophysics theory; funding available for lab astrophysics; funding available for suborbital payloads.</td>
</tr>
<tr>
<td>Small-scale. Intermediate Technology development</td>
<td>Established competed Strategic Astrophysics Technology program element; directed technology funding for WFIRST and other large-scale decadal priorities (e.g., WFIRST coronagraph, Athena).</td>
</tr>
<tr>
<td>Small-scale. SPICA (U.S. contribution to JAXA-led)</td>
<td>Not supported as a strategic contribution; candidate for Explorer Mission of Opportunity.</td>
</tr>
</tbody>
</table>
Astrophysics Budget by Program
FY05-FY14 Actual, FY15 Op Plan, FY16-FY20 Request

Real Year $Million

Institutional
James Webb
Exoplanet Exploration
Physics of the Cosmos
Cosmic Origins
Explorers
Research

FY05 FY06 FY07 FY08 FY09 FY10 FY11 FY12 FY13 FY14 FY15 FY16 FY17 FY18 FY19 FY20
Astrophysics Budget by Function
FY05-FY14 Actual, FY15 Op Plan, FY16-FY20 Request

- **Strategic Mission Development**
  (Fermi to FY08, Hubble to FY09, Kepler to FY09, Herschel to FY09, Planck to FY09, SOFIA to FY14, JWST to FY18, WFIRST-AFTA to end)

- **Explorers**

- **Operating Missions (including GO funding)**

- **Technology**

- **R&A**

- **Infrastructure \ Management**

**Real Year $Million**

FY05 FY06 FY07 FY08 FY09 FY10 FY11 FY12 FY13 FY14 FY15 FY16 FY17 FY18 FY19 FY20
Astrophysics in 2016
Astrophysics - Big Picture

• The FY16 appropriation provides funding for NASA astrophysics to continue its programs, missions, projects, and supporting research and technology.
  – The total funding (Astrophysics including JWST) remains at ~$1.3B.
  – Fully funds JWST to remain on plan for an October 2018 launch.
  – Funds new start for WFIRST, start of formulation planned for February 2016.
  – Will require some adjustments to FY16 plans in response to appropriation levels.

• The operating missions continue to generate important and compelling science results, and new missions are under development for the future.
  – Chandra, Fermi, Hubble, Kepler/K2, NuSTAR, Spitzer, Swift, ESA’s XMM-Newton all operating well; Senior Review is in Spring 2016 for FY17 and beyond; JAXA’s Suzaku mission ended.
  – SOFIA is in 5-year prime operations as of May 2014; Senior Review is in Spring 2018.
  – ESA’s LISA Pathfinder successfully launched on December 3, 2015.
  – WFIRST starting formulation, next Explorers being selected (SMEX in 2015, MIDEX in 2017), NASA joining ESA’s Athena and ESA’s L3 gravitational wave observatory.

• Progress being made toward recommendations of the 2010 Decadal Survey.
  – Update to the Astrophysics Implementation Plan released in December 2014.
  – NRC Mid Decade Review (with NSF, DOE) underway; Jackie Hewitt (MIT) is chair; NASA briefing at October 2015 meeting; NRC committee report expected in May 2016.
  – NASA initiating large mission concept studies as input for 2020 Decadal Survey.
NASA Astrophysics Budget:
FY04-FY16 Appropriated, FY17-FY20 Notional Planning

Real Year $Million

JWST Program

Rest of Astrophysics

includes SMD E/PO and SMD STEM activities
NASA Astrophysics Budget:
FY04-FY16 Appropriated, FY17-FY20 Notional Planning

- JWST Program
- WFIRST
- Rest of Astrophysics

Includes SMD E/PO and SMD STEM activities

Managed by JWST Program Off
Managed by Astrophysics Div
Total Astrophysics
President’s FY16 Budget Request
FY16 Appropriation

- Provides $90M for WFIRST and directs NASA to start Formulation.
- Provides full funding ($85M) for SOFIA operations and places SOFIA into the 2018 Astrophysics Senior Review.
- Provides full funding ($98M) for continued Hubble operations.
- Provides $37M for SMD STEM education activities.
- Requires reduction of $36M in rest of Astrophysics portfolio.

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Astrophysics*</td>
<td>$678</td>
<td>$685</td>
<td>$731</td>
<td>$707</td>
<td>$750</td>
<td>$986</td>
<td>$1118</td>
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<tr>
<td>JWST</td>
<td>$658</td>
<td>$645</td>
<td>$620</td>
<td>$569</td>
<td>$535</td>
<td>$305</td>
<td>$198</td>
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<tr>
<td>Total</td>
<td>$1336</td>
<td>$1330</td>
<td>$1351</td>
<td>$1273</td>
<td>$1285</td>
<td>$1291</td>
<td>$1316</td>
</tr>
</tbody>
</table>

* Excludes “SMD STEM Activities” in all years.

<table>
<thead>
<tr>
<th>($M)</th>
<th>FY16 Request</th>
<th>FY16 Approps</th>
<th>Delta</th>
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<tbody>
<tr>
<td>JWST</td>
<td>$620</td>
<td>$620</td>
<td>--</td>
</tr>
<tr>
<td>WFIRST</td>
<td>$14</td>
<td>$90</td>
<td>+$76</td>
</tr>
<tr>
<td>SOFIA</td>
<td>$85</td>
<td>$85</td>
<td>--</td>
</tr>
<tr>
<td>Hubble</td>
<td>$97</td>
<td>$98</td>
<td>+$1</td>
</tr>
<tr>
<td>Rest of Astrophys*</td>
<td>$493</td>
<td>$457</td>
<td>-$36 (-7%)</td>
</tr>
<tr>
<td>Total</td>
<td>$1309</td>
<td>$1351</td>
<td>+$42</td>
</tr>
</tbody>
</table>

* Excludes “SMD STEM Activities.”
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

2015 Accomplishments
• Completed Telescope Structure
• Completed second Telescope Pathfinder test at JSC
• All updates/fixes made to ISIM following 2nd cryovacuum test
• Spacecraft Bus Structure delivered to I&T
• Final ISIM cryovacuum test started
• Mirror installation onto Telescope Structure started

2016 Plans
• Complete ISIM cryovacuum testing
• Complete mirror installation
• Install ISIM into Telescope Structure
• Complete Flight Sunshield Membranes
• Conduct final GSE test at JSC before test of Flight telescope and instruments

http://www.jwst.nasa.gov/
JWST Hardware Progress

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

http://jwst.nasa.gov/webcam.html
**CURRENT STATUS:**

- Completed Mission Concept Review (MCR) held in December 2015
- Formulation Science Investigation Teams selected in December 2015
- Planning for Key Decision Point A (KDP-A) in Feb 2016
  - Official start of formulation phase
  - Supported by FY16 appropriations
- Industry RFI released July 2015; notification of call for industry studies announced in December 2015
- Other activities include:
  - Technology development for detectors and coronagraph (with STMD); prototyping key parts
  - Assessment of telescopes + risk mitigation
  - Mission design trades; performance simulations
- Maturing key technologies by FY19
  - H4RG infrared detectors for widefield imager
  - Internal coronagraph for exoplanet characterization
  - Milestones on road to achieve TRL-5 by end of CY16, TRL-6 by end of CY18; reports made public

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**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 pre-formulation

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http://wfirst.gsfc.nasa.gov/
## WFIRST Science Investigation Teams

<table>
<thead>
<tr>
<th>PI</th>
<th>PI Institution</th>
<th>Title</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Olivier Dore</td>
<td>JPL</td>
<td>Cosmology with the WFIRST High Latitude Survey</td>
<td>Galaxy Redshift Survey, Weak Lensing Survey</td>
</tr>
<tr>
<td>Ryan Foley</td>
<td>Illinois</td>
<td>Optimizing the WFIRST Type Ia Supernova Survey</td>
<td>Supernovae Survey</td>
</tr>
<tr>
<td>Scott Gaudi</td>
<td>Ohio State</td>
<td>Preparing for the WFIRST Microlensing Survey</td>
<td>Microlensing Survey</td>
</tr>
<tr>
<td>Jeremy Kasdin</td>
<td>Princeton</td>
<td>WFIRST Coronagraph Instrument Adjutant Scientist</td>
<td>Coronagraph Instrument</td>
</tr>
<tr>
<td>Bruce Macintosh</td>
<td>Stanford</td>
<td>Optimizing WFIRST Coronagraph Science</td>
<td>Coronagraphy</td>
</tr>
<tr>
<td>Saul Perlmutter</td>
<td>LBNL</td>
<td>Investigating the Nature of Dark Energy using Type Ia Supernovae</td>
<td>Supernovae Survey</td>
</tr>
<tr>
<td>James Rhoads</td>
<td>Arizona State</td>
<td>Cosmic Dawn with WFIRST</td>
<td>GI/GO</td>
</tr>
<tr>
<td>Brant Robertson</td>
<td>UC Santa Cruz</td>
<td>WFIRST Extragalactic Potential Observations</td>
<td>GI/GO</td>
</tr>
<tr>
<td>David Spergel</td>
<td>Princeton</td>
<td>WFIRST Wide Field Instrument Adjutant Scientist</td>
<td>Widefield Instrument</td>
</tr>
<tr>
<td>Alexander Szalay</td>
<td>Johns Hopkins</td>
<td>Archival Research Capabilities of the WFIRST Data Set</td>
<td>GI/GO</td>
</tr>
<tr>
<td>Margaret Turnbull</td>
<td>SETI Institute</td>
<td>Harnessing the Power of the WFIRST Coronagraph</td>
<td>Coronagraphy</td>
</tr>
<tr>
<td>Benjamin Williams</td>
<td>Washington</td>
<td>WFIRST Infrared Nearby Galaxy Survey</td>
<td>GI/GO</td>
</tr>
</tbody>
</table>
## Coronagraph Technology Milestones

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

## Widefield Detector Technology Milestones

<table>
<thead>
<tr>
<th>Milestone Description</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Produce, test, and analyze 2 candidate passivation techniques in banded arrays.</td>
<td>7/31/14</td>
</tr>
<tr>
<td>2. Produce, test, and analyze 1 additional candidate passivation techniques in banded arrays.</td>
<td>12/30/14</td>
</tr>
<tr>
<td>3. Produce, test, and analyze full arrays with operability &gt; 95%.</td>
<td>9/15/15</td>
</tr>
<tr>
<td>4. Produce, test, and analyze final selected recipe in full arrays demonstrating a yield &gt; 20% with operability &gt; 95%.</td>
<td>9/15/16</td>
</tr>
<tr>
<td>5. Complete environmental testing of one sensor chip assembly, as per NASA test standards.</td>
<td>12/1/16</td>
</tr>
</tbody>
</table>
Launched December 3, 2015

Dec 3 Launch
Dec 11 On way to L1
Feb 3 Uncage test masses
Mar 4 Commissioning
June/July DRS ops

https://lisapathfinder.org/
NASA’s L3 Study

• NASA intends to partner with ESA on the ESA-led Large 3 (L3) gravitational wave mission with launch in 2034. This responds to the recommendations of the 2010 Astrophysics Decadal for a space-based gravitational wave observatory.

• Following the successful launch of the LISA Path Finder, NASA is forming an L3 Study Team (L3ST) drawing membership from members of the US astrophysics community.

• The goals of the L3ST are:
  1. Analyze the options for NASA participation in the L3 mission and work with the European L3 consortium on proposals to ESA; and
  2. Prepare a report to the 2020 Decadal Survey on NASA’s participation, including possible options, in the L3 mission as a minority partner.

• Dear Colleague Letter on December 7, 2015; applications due December 21, 2015; members to be announced NLT January 15, 2016.

• The L3ST Charter, a list of FAQs, and list of selected members (after January 15) can be found at http://pcos.gsfc.nasa.gov/studies.
Athena
Advanced Telescope for High Energy Astrophysics

CURRENT STATUS:

• Selected as 2nd Large mission in ESA Cosmic Visions Program.

• Currently in 2 year Study Phase.

• NASA and US community involved in Study Phase via membership on ESA-chartered Athena Science Study Team and Science Working Groups.

• NASA budgeting for a $100M-$150M hardware contribution, plus a U.S. GO program and a U.S. data center.

• NASA will provide the sensor array for the X-ray Integral Field Unit (calorimeter).

• NASA and ESA are discussing other possible NASA contributions, such as:
  - A contribution to the Wide Field Imager
  - Use of the NASA XRCF for Calibration
  - Contribution to ESA science data center (U.S. node)

• NASA continues to invest in Athena technologies via SAT and directed investigations.

• Second ESA Cosmic Vision Large mission
  - L-class with NASA/JAXA participation
  - Decadal Survey recommendation
  - Large X-ray mirror, X-IFU and WFI instruments

• Launch Date: 2028

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

• Science Objectives: The Hot and Energetic Universe: How does ordinary matter assemble into the large scale structures that we see today? How do black holes grow and shape the Universe?
New Worlds Technology

- **2010**: Technology Development for Exoplanet Missions (TDEM) element of Strategic Astrophysics Technology (SAT) program (introduced June 2009) is refocused to support New Worlds Technology Development priorities
- **2013**: Decision to include a coronagraph technology demonstration instrument on WFIRST-AFTA
- **2013-2015**: Exoplanet Probe Studies
- **2014**: Established NN-EXPLORE partnership with NSF to develop a facility radial velocity spectrometer for the WIYN telescope
- **2015**: LBTI passed Operational Readiness Review
- **2015**: Starshade Readiness Working Group will establish investments and activities necessary to attain TRL-6 for a starshade
- **2016-2019**: Mission concept studies for two exoplanet characterization missions (HabEx and LUVOIR)
Inflation Probe Technology

- Planck extension and support of data analysis for third archival release in 2015
- Suborbital (balloon) Investigations:
  - E and B Experiment (EBEX), PI: S. Hanany (U. Minnesota). Flew in Antarctica in 2012-2013
  - Primordial Inflation Polarization Explorer (PIPER), PI: A. Kogut (GSFC). Scheduled to fly in Ft. Sumner in Fall 2016
- Technology investments (detectors and other systems):
  - APRA: total funding in 2010-2015 of $14.2M for 27 investigations; does not include ROSES-14 selections for FY16 new starts
  - SAT: total funding in 2010-2015 of $3.4M for 2 investigations; does not include ROSES-14 selections for FY16 new starts
- Pending the report from the Midterm Committee, the rest of the decade might include:
  - Continued investments in detector technology and suborbital investigations
  - Consider any Inflation Probe proposals submitted to the 2016 MIDEX AO
  - Possible downselect of LiteBIRD for flight in both Japan and U.S.
  - Consider U.S. participation proposed for a European Inflation Probe (possible M5)
  - Possible study of an Inflation Probe strategic mission for the 2020 Decadal Survey
Strategic Technology (addressing the technology gap)

- Technology gaps are identified and prioritized in the Program Annual Technology Reports (PATRs).
  - PATRs are developed with considerable community input including an open call for identification of technology gaps and use of community based Program Analysis Groups and Technology Assessment Committees to prioritize technology gaps.
  - Gap lists serve to identify where technology development is needed.

http://cor.gsfc.nasa.gov/technology/
http://exep.jpl.nasa.gov/technology/
http://pcos.gsfc.nasa.gov/technology/
Strategic Technology (addressing the technology gap)

- SAT Selections Summary

<table>
<thead>
<tr>
<th>Technology Area</th>
<th>TDEM Investment</th>
<th>TPCOS Investment</th>
<th>TCOP Investment</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Performance</td>
<td>$17 M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wavefront Sensing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Starlight Supression</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CMB Polarization</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gravitational Technologies</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>X-ray Technologies</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large Optics &amp; Heterodyne</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Optical Coatings</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>QE in Detectors</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total Investment on Technology Maturation: $64M (FY10-FY15)
Astrophysics SMEX/MO Missions in Formulation

**SPHEREx**
PI: J. Bock, Caltech
An All-Sky Near-IR Spectral Survey

**PRAxyS**
PI: K. Jahoda, GSFC
Polarimeter for Relativistic Astrophysical X-ray Sources

**IXPE**
PI: M. Weisskopf, MSFC
Imaging X-ray Polarimetry Explorer

**PI: A. Lee, UC Berkeley**
US Participation in JAXA’s LiteBIRD CMB Polarization Survey

**PI: C. Walker, U. Arizona**
GUSTO: Gal/Xgal U/LDB Spectroscopic - Stratospheric Terahertz Observatory
Astrophysics Explorers Program

- Explorer budget augmented to support 4 AOs per decade
  - 2 SMEX AOs w/ PI-managed cost cap ~$125M
  - 2 MIDEX AOs w/ PI-managed cost cap ~$250M
  - 1 MO per AO w/ PI-managed cost cap ~$70M

- Prior year spending, FY15 appropriation, and FY16 budget request support the following AO schedule (not yet adjusted for FY16 appropriation)

<table>
<thead>
<tr>
<th>AO Type</th>
<th>AO Date</th>
<th>Launch Date</th>
<th>Missions</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMEX + MO</td>
<td>February 2003</td>
<td>June 13, 2012</td>
<td>NuSTAR</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No MO downselected</td>
</tr>
<tr>
<td>SMEX + MO</td>
<td>September 2007</td>
<td>NET Nov 2015</td>
<td>GEMS; mission non-confirmed</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SXS on ASTRO-H (Partner MO)</td>
</tr>
<tr>
<td>MIDEX + MO</td>
<td>November 2010</td>
<td>August 2017</td>
<td>TESS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>August 2016</td>
<td>NICER (Small mission MO)</td>
</tr>
<tr>
<td>MO-only</td>
<td>September 2012</td>
<td></td>
<td>No selection made</td>
</tr>
<tr>
<td>SMEX+ MO</td>
<td>September 2014</td>
<td>~2020</td>
<td>IXPE, PRAXyS, or SPHEREx</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>TBD</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>LiteBIRD or GUSTO</td>
</tr>
<tr>
<td>MIDEX + MO</td>
<td>~Late 2016</td>
<td>~2023</td>
<td></td>
</tr>
<tr>
<td>SMEX + MO</td>
<td>~2019 (TBC)</td>
<td>~2025</td>
<td></td>
</tr>
<tr>
<td>MIDEX + MO</td>
<td>~2021 (TBC)</td>
<td>~2028</td>
<td></td>
</tr>
</tbody>
</table>
The target schedule for the solicitation:
- Release of draft AO: Spring 2016 (target)
- Release of final AO: Late summer 2016 (target)
- Proposals due: 90 days after AO release
- Selection for 9-month competitive Phase A studies: Summer 2017 (target)
- Down-selection: Late 2018 (target)

MIDEX Parameters
- PI-managed mission cost cap is $250M (FY17$), not including the cost of the Expendable Launch Vehicle (ELV) or any contributions.
- Standard launch services on an ELV will be provided for MIDEX missions at no charge against the mission cost cap; no MIDEX ISS-attached payloads.
- MIDEX launch readiness date no later than December 2023.

Mission of Opportunity Parameters
- PI-managed mission cost cap is $70M (FY17$) for Partner MOs and Small Complete Mission MOs, including ISS-attached payloads.
- PI-managed mission cost cap is $35M (FY17$) for suborbital-class MO.
- Small Complete Mission launch readiness date no later than December 2022.
- Partner Mission of Opportunity endorsement need date before January 2022.

Astrophysics Explorer Program planning budget is sufficient to select and execute one MIDEX mission and one MO.

http://explorers.larc.nasa.gov/APMIDEX2016/
NASA's Standard AO: Revision Process Underway

- NASA’s Science Mission Directorate (SMD) issues Announcements of Opportunity (AOs) for PI-led missions (e.g. Explorers, Discovery, Earth Venture).

- SMD develops each individual AO solicitation by customizing an SMD framework document, known as the Standard AO Template.

- The Standard AO Template is being revised with goals of reducing the burden on proposers and increasing the efficiency of review.

- Modifications that could result in shortening and/or simplifying Step 1 proposals and other suggestions may be submitted via email by January 15, 2016, to Thomas Wagner at thomas.wagner@nasa.gov and Washito Sasamoto at washito.a.sasamoto@nasa.gov.

- Revised version expected for release in April 2016.

Comments are invited from the community, due by January 15, 2016

http://soma.larc.nasa.gov/standardao/sao_templates.html
R&A Funding continues to Grow

- Core R&A Funding includes
  - Astrophysics Research and Analysis (APRA): all years
  - Astrophysics Data Analysis Program (ADAP): all years
  - Astrophysics Theory Program (ATP): all years
  - Exoplanet Research Program (XRP), was Origins of Solar Systems (OSS): all years
  - Theoretical and Computational Astrophysics Networks (TCAN): FY14+
  - Nancy G. Roman Technology Fellowships (RTF): FY12+
  - Long Term Space Astrophysics (LTSA): through FY09, then into ADAP
  - Beyond Einstein Foundation Science (BEFS): through FY06, then into ATP
  - Does not include WFIRST Preparatory Science (WPS) or mission-funded theory

"15% cut" Post NWNH growth of 22% (FY11 to FY16)

Some adjustment possible in FY16 in response to appropriation
Core Research

Community Support
(competed, grant-like programs)

- Spitzer/Herschel/Fermi "GO bump"
- 15% reduction in R&A
- Guest Observer (GO) Programs (all missions)
- Einstein, Hubble, & Sagan Fellowships
- Research and Analysis (R&A) Funding (all programs)
- Strategic Astrophysics Technology (SAT) program
- JWST GO program begins in FY19

All numbers for FY16-FY20 are notional
# Proposal Selections in 2015

**Status:** January 1, 2016

<table>
<thead>
<tr>
<th>Proposal</th>
<th>Proposal Due Date</th>
<th>Notify Date</th>
<th>Days past received</th>
<th>Number received</th>
<th>Number selected</th>
<th>% selected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kepler K2 GO – Cycle 1</td>
<td>Sep 23, 2014</td>
<td>Jan 16, 2015</td>
<td>115</td>
<td>92</td>
<td>36</td>
<td>39%</td>
</tr>
<tr>
<td>Swift GI – Cycle 11</td>
<td>Sep 25, 2014</td>
<td>Jan 6, 2015</td>
<td>123</td>
<td>165</td>
<td>39</td>
<td>24%</td>
</tr>
<tr>
<td>Roman Tech Fellows</td>
<td>Nov 6, 2014</td>
<td>Feb 3, 2015</td>
<td>89</td>
<td>8</td>
<td>3</td>
<td>38%</td>
</tr>
<tr>
<td>NuSTAR GO – Cycle 1</td>
<td>Nov 25, 2014</td>
<td>Apr 17, 2015</td>
<td>143</td>
<td>193</td>
<td>35</td>
<td>18%</td>
</tr>
<tr>
<td>Fermi GI – Cycle 8</td>
<td>Jan 22, 2015</td>
<td>June 26, 2015</td>
<td>155</td>
<td>190</td>
<td>36</td>
<td>19%</td>
</tr>
<tr>
<td>NESSF-15</td>
<td>Feb 6, 2015</td>
<td>June 2, 2015</td>
<td>116</td>
<td>134</td>
<td>10</td>
<td>7%</td>
</tr>
<tr>
<td>Kepler K2 GO – Cycle 2</td>
<td>Feb 27, 2015</td>
<td>June 12, 2015</td>
<td>105</td>
<td>76</td>
<td>35</td>
<td>46%</td>
</tr>
<tr>
<td>Chandra GO – Cycle 17</td>
<td>Mar 17, 2015</td>
<td>July 17, 2015</td>
<td>122</td>
<td>582</td>
<td>175</td>
<td>30%</td>
</tr>
<tr>
<td>APRA (Basic Research)</td>
<td>Mar 20, 2015</td>
<td>Aug 12, 2015</td>
<td>145</td>
<td>149</td>
<td>40</td>
<td>27%</td>
</tr>
<tr>
<td>SAT (Technology)</td>
<td>Mar 20, 2015</td>
<td>Aug 12, 2015</td>
<td>145</td>
<td>28</td>
<td>9</td>
<td>32%</td>
</tr>
<tr>
<td>Hubble GO – Cycle 23</td>
<td>Apr 10, 2015</td>
<td>June 24, 2015</td>
<td>75</td>
<td>1114</td>
<td>261</td>
<td>23%</td>
</tr>
<tr>
<td>EPDS (Doppler Spectr)</td>
<td>Apr 24, 2015</td>
<td>July 2, 2015</td>
<td>69</td>
<td>6</td>
<td>2</td>
<td>33%</td>
</tr>
<tr>
<td>ADAP (Data Analysis)</td>
<td>May 15, 2015</td>
<td>Sep 29, 2015</td>
<td>137</td>
<td>250</td>
<td>51</td>
<td>20%</td>
</tr>
<tr>
<td>Exoplanet Research</td>
<td>May 22, 2015</td>
<td>Oct 15, 2015</td>
<td>146</td>
<td>43</td>
<td>7</td>
<td>16%</td>
</tr>
<tr>
<td>Kepler K2 GO – Cycle 3</td>
<td>Jul 1, 2015</td>
<td>Oct 14, 2015</td>
<td>105</td>
<td>72</td>
<td>32</td>
<td>44%</td>
</tr>
<tr>
<td>SOFIA GI – Cycle 4</td>
<td>Jul 10, 2015</td>
<td>Oct 22, 2015</td>
<td>104</td>
<td>155</td>
<td>82</td>
<td>53%</td>
</tr>
<tr>
<td>Spitzer GO – Cycle 12</td>
<td>Sep 11, 2015</td>
<td>Oct 26, 2015</td>
<td>45</td>
<td>104</td>
<td>31</td>
<td>30%</td>
</tr>
<tr>
<td>SOFIA 3rd Gen Instrument</td>
<td>Oct 7, 2015</td>
<td>Dec 10, 2015</td>
<td>64</td>
<td>3</td>
<td>2</td>
<td>67%</td>
</tr>
<tr>
<td>WFIRST Sci. Inv. Teams</td>
<td>Oct 15, 2015</td>
<td>Dec 18, 2015</td>
<td>64</td>
<td>38</td>
<td>12</td>
<td>32%</td>
</tr>
<tr>
<td>Swift GI – Cycle 12</td>
<td>Sep 25, 2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roman Tech Fellows</td>
<td>Nov 6, 2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NuSTAR GO – Cycle 2</td>
<td>Dec 11, 2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**R&A Selection Rate:** 23%

**GO Selection Rate:** 28%

100% of 2015 selections announced within 155 days
Proposal Opportunities Expected in 2016

ROSES research opportunities
• APRA/SAT, Exoplanet Research in March
• ADAP in May
• Astrophysics Theory in July
• Habitable Worlds in November

ROSES Guest Observer/Guest Investigator opportunities
• Fermi GI Cycle 10 in January
• Kepler K2 GO Cycle 4 in February
• ASTRO-H GO in July
• Swift GI Cycle 13 in September
• Kepler K2 GO Cycle 5 in October
• NuSTAR GO Cycle 3 in January 2017

Other Astrophysics Guest Observer opportunities
• Chandra Cycle 18 in March
• Hubble Cycle 23 in April
• SOFIA Cycle 5 and Spitzer Cycle 13 in June
• XMM-Newton in October

Explorer MIDEX proposals: target date in late 2016
## 2016 Senior Review Timeline

<table>
<thead>
<tr>
<th>Action</th>
<th>Date</th>
<th>Done</th>
</tr>
</thead>
<tbody>
<tr>
<td>Draft Call for Proposals issued</td>
<td>August 20, 2015</td>
<td>✓</td>
</tr>
<tr>
<td>Deadline to send comments on draft to NASA</td>
<td>September 10, 2015</td>
<td>✓</td>
</tr>
<tr>
<td>Final Call for Proposals issued</td>
<td>September 25, 2015</td>
<td>✓</td>
</tr>
<tr>
<td>Senior Review Proposals due</td>
<td>January 22, 2016</td>
<td></td>
</tr>
<tr>
<td>Main panel meets in Washington, DC</td>
<td>February 22-25, 2016</td>
<td></td>
</tr>
<tr>
<td>HST review and site visit in Baltimore, MD</td>
<td>March 8-10, 2016</td>
<td></td>
</tr>
<tr>
<td>CXO review and site visit in Cambridge, MA</td>
<td>March 22-24, 2016</td>
<td></td>
</tr>
<tr>
<td>Delivery of panel reports to NASA HQ</td>
<td>April 2016</td>
<td></td>
</tr>
<tr>
<td>NASA Response/direction to projects. Reports released on APD website.</td>
<td>May-June 2016</td>
<td></td>
</tr>
</tbody>
</table>

For more information:

http://science.nasa.gov/astrophysics/2016-senior-review operating-missions/
Astrophysics

Preparing for the 2020 Decadal Survey in Astronomy and Astrophysics
Assumes (1) President’s FY16 budget request and notional runout through FY20, (2) flat funding for Astrophysics for FY21 through FY35, (3) completion of WFIRST-AFTA and other missions planned for new starts in FY16-FY20.
A 30 year vision to address the enduring questions:
  - Are we alone?
  - How did we get here?
  - How does the universe work?

http://science.nasa.gov/astrophysics/documents
Preparing for the 2020 Decadal Survey
Large Mission Concepts

• NASA will study large mission concepts as candidate prioritized large missions
  – Science case
  – Technology assessment
  – Design reference mission with strawman payload
  – Cost assessment

• Charge to the Astrophysics Program Analysis Groups (PAGs): COPAG, ExoPAG, PhysPAG (December 2014)
  – “I am charging the Astrophysics PAGs to solicit community input for the purpose of commenting on the small set [of large mission concepts to study], including adding or subtracting large mission concepts.”

• PAGs reported to the Astrophysics Subcommittee in October 2015
  – PAGs unanimously endorsed a common set of four mission concepts to study
  – Astrophysics Subcommittee reported to the NAC Science Committee that NASA should study these four mission concepts
  – All three PAG reports posted at http://cor.gsfc.nasa.gov/copag/rfi/
Preparing for the 2020 Decadal Survey
Large Mission Concepts

NASA is initiating studies of the following four large mission concepts:

• **FAR IR Surveyor** – The Astrophysics Visionary Roadmap identifies a Far IR Surveyor as contributing through improvements in sensitivity, spectroscopy, and angular resolution.

• **Habitable-Exoplanet Imaging Mission** – The 2010 Decadal Survey recommends that a habitable-exoplanet imaging mission be studied in time for consideration by the 2020 Decadal Survey.

• **Large UV/Optical/IR Surveyor** – The Astrophysics Visionary Roadmap identifies a Large UV/Optical/IR Surveyor as contributing through improvements in sensitivity, spectroscopy, high contrast imaging, astrometry, angular resolution and/or wavelength coverage. The 2010 Decadal Survey recommends that NASA prepare for a UV mission to be considered by the 2020 Decadal Survey.

• **X-ray Surveyor** – The Astrophysics Visionary Roadmap identifies an X-ray Surveyor as contributing through improvements in sensitivity, spectroscopy, and angular resolution.
NASA will initiate studies of the following four large mission concepts.

<table>
<thead>
<tr>
<th>Mission Concept</th>
<th>Community STDT Chair</th>
<th>Center Study Scientist</th>
<th>Study Lead Center</th>
<th>HQ Program Scientist</th>
</tr>
</thead>
<tbody>
<tr>
<td>Far IR Surveyor</td>
<td>TBD</td>
<td>David Leisawitz</td>
<td>GSFC</td>
<td>Kartik Sheth</td>
</tr>
<tr>
<td>Habitable Exoplanet Imaging Mission</td>
<td>TBD</td>
<td>Bertrand Mennesson</td>
<td>JPL</td>
<td>Martin Still</td>
</tr>
<tr>
<td>Large UV/Optical/IR Surveyor</td>
<td>TBD</td>
<td>Aki Roberge</td>
<td>GSFC</td>
<td>Mario Perez</td>
</tr>
<tr>
<td>X-ray Surveyor</td>
<td>TBD</td>
<td>Jessica Gaskin</td>
<td>MSFC</td>
<td>Dan Evans</td>
</tr>
</tbody>
</table>
Preparing for the 2020 Decadal Survey
Large Mission Concepts

NASA is asking for applications for membership on the four large mission concept Science and Technology Definition Teams (STDTs)

• STDTs have significant role and responsibility
  – Develop science case
  – Flow science case into mission requirements
  – Vet technology gap list
  – Direct trades of science vs cost/capability

• STDT members will be appointed by NASA HQ
  – Community call for applications will be released via NSPIRES and Astrophysics Programs mailing lists on the day after the AAS Town Hall
  – Responses requested by February 1, 2016

• STDTs will be chartered and managed by HQ
  – Charter and management plan available at

http://science.nasa.gov/astrophysics/2020-decadal-survey-planning/
Preparing for the 2020 Decadal Survey
Large Mission Concepts

• Applications for the STDTs are due to NASA by February 1, 2016.
• The application material should consist of:
  – A two-page cover letter describing
    1. The STDT of choice,
    2. The reasons for the submitter's interest in the STDT, and
    3. The capabilities and experience that the submitter brings to the STDT;
  – A short statement of commitment to perform the tasks assigned to
    the STDT within the allocated timeframe, and
  – A one or two page resume including relevant publications.

Applications are solicited from the community at U.S.-based research
and academic institutions, Government laboratories, industry, and
private individuals.

http://science.nasa.gov/astrophysics/2020-decadal-survey-planning/
Preparing for the 2020 Decadal Survey
Thinking about Probes

• Suggestion for the Decadal Survey: Recommend a Probe AO.
  – Similar to Planetary Science Division’s New Frontiers AO
  – Decadal Survey prioritizes a short list of mission concepts that should be accomplished on a Probe budget for the Probe AO
  – NASA issues a Probe AO and selects a Probe proposal that is responsive in a compelling manner to Decadal Survey identified science objectives for one of the mission concepts (determined by peer review) and can be accomplished as a Probe (determined by TMC review)
  – Funding allotted to Probes “slows down” the large mission(s) that follow WFIRST

• Suggestion for the Decadal Survey: Identify probe concepts for further study
  – NASA is considering funding “probe studies,” selected through ROSES, that do not include NASA-led mission design exercises or costing analysis
  – Decadal Survey could identify a few high priority probe concepts for further definitization and costing

• Probes continue to be discussed by Astrophysics PAGs.
• Plans for Probe Studies will be discussed at the March 2016 meeting of the Astrophysics Subcommittee.
Preparing for the 2020 Decadal Survey
Large Mission Concepts

Special Session this afternoon to discuss NASA’s large mission concept studies and the call for STDT nominations and self-nominations

<table>
<thead>
<tr>
<th>NASA Decadal Mission Studies and STDTs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wednesday, 2:00 pm - 4:00 pm, St. George 112</td>
</tr>
</tbody>
</table>

**Agenda**

<table>
<thead>
<tr>
<th>Agenda Item</th>
<th>Presenter/Scientist</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Mission Concept Study Process and the STDT Membership Call</td>
<td>Paul Hertz, Astrophysics Director, NASA HQ</td>
</tr>
<tr>
<td>The Far Infrared Surveyor Study</td>
<td>David Leisawitz, FIR Surveyor Study Scientist, GSFC</td>
</tr>
<tr>
<td>The Habitable Exoplanet Imaging Mission Study</td>
<td>Bertrand Mennesson, HabEx Study Scientist, JPL</td>
</tr>
<tr>
<td>The Large Ultraviolet/Optical/Infrared Surveyor Study</td>
<td>Aki Roberge, LUVOIR Study Scientist, GSFC</td>
</tr>
<tr>
<td>The X-ray Surveyor Study</td>
<td>Jessica Gaskin, X-ray Surveyor Study Scientist, MSFC</td>
</tr>
<tr>
<td>Discussion and Q&amp;A</td>
<td></td>
</tr>
</tbody>
</table>
Astrophysics
SMD Science Education Restructuring

• Background – FY16 Budget provides $37M for NASA Science Education

• Why Restructure? To further enable NASA scientists and engineers to engage more effectively with learners of all ages. SMD will no longer have minimum of 1 percent set-asides through our missions, or issue disparate 3-year grants. But we are taking a strategic approach, building on our science discipline-based legacy and looking for new approaches given Stakeholder priorities.

• Objectives?
  – Enable STEM Education
  – Improve US Scientific Literacy
  – Advance National Educational Goals
  – Leverage Through Partnerships

• How? Through the competitive selection of organizations that utilize NASA data, products, or processes to meet education objectives; and by enabling our scientists and engineers with education professionals, tools, and processes to better meet user needs. SME’s continue to be funded within the Divisions, where appropriate.

SMD Science Education Restructuring


• 27 Selections build upon legacy of excellence, balanced across diverse audiences, and fit within annual budget of $42M/year towards meeting NASA Science Mission Directorate’s desired Outcome and Objectives.
  – 27 of 73 compliant proposals selected (37%) for negotiations leading to cooperative agreement awards
  – 15 are from “Legacy” institutions (56%)
  – 3 selections support the 2017 Total Solar Eclipse, allowing for one full academic year of preparation
  – 15 include Astrophysics content
  – 16 include Earth Science content
  – 17 include Planetary Science content
  – 15 include Heliophysics content

• Scheduled start date for awards – January 4, 2016.
Public Access to Federal Research changes to ROSES

• All Federal research agencies must increase public access to the results of research funded by the Federal government.
  – This includes data and publications
• NASA’s policy has always been to make scientific data available
  – Starting in 2015, ROSES proposals require a Data Management Plan (DMP)
  – DMPs describe whether and how data generated will be shared and preserved
  – Minimum requirement is published results: data in figures
  – Many ROSES elements do not expect any data requiring preservation
  – DMP can be entered on NSPIRES cover page, not part of proposal text (unless otherwise instructed, e.g. ADAP)
• NASA will start making publications available
  – All peer reviewed publications generated under NASA grants must be uploaded into PubSpace
  – PubSpace is based on successful NIH PubMed
  – It will be the responsibility of the PI to ensure that publications are uploaded
  – This requirement will start on data TBD; new terms and requirements will be added to all grants
• NASA will develop training material on filling out DMPs and uploading to PubSpace
  – Read ROSES and ROSES FAQs carefully

http://science.nasa.gov/researchers/sara/faqs/dmp-faq-roses/
http://www.nasa.gov/offices/ocs/reportsPresentations.html
• We currently redact NASA Civil Servant (CS) salary and overhead from ROSES peer reviewers, but we currently don’t redact salary and overhead of non-NASA proposers.

• Starting in ROSES-2016 we will treat all proposers equally: All salaries and overhead will be included in the NSPIRES cover pages, but automatically redacted from reviewers.

• Only level of effort (FTEs/WYE:s) will be in the body of proposals and assessed by peer reviewers.