National Aeronautics and Space Administration

Astrophysics

Astronomy and Astrophysics Advisory Committee

Paul Hertz
Director, Astrophysics Division

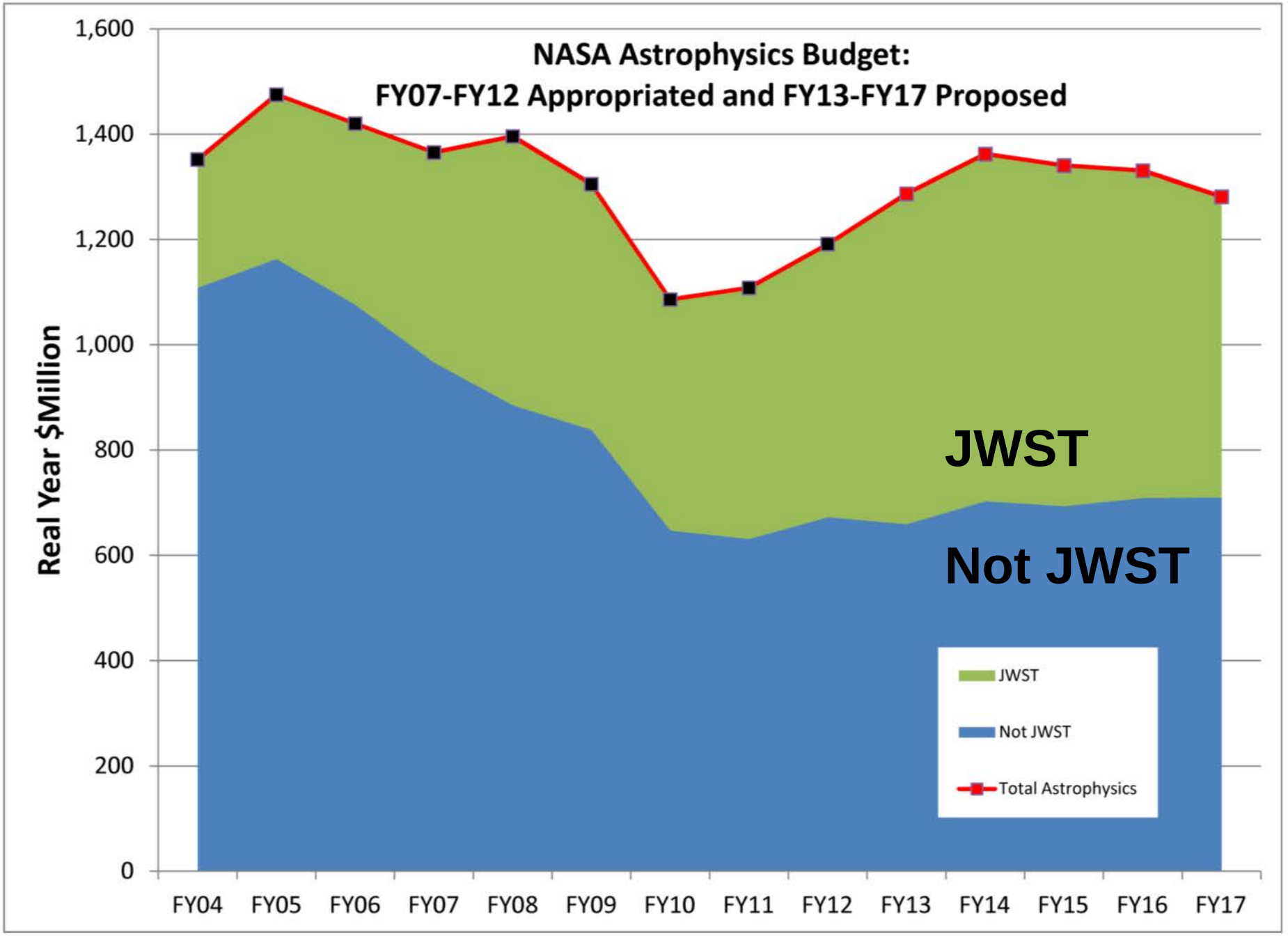
February 12, 2013

www.nasa.gov

The Big Picture…..

- **This is a time of opportunity for NASA Astrophysics**
  - The total Astrophysics budget is at a high level.
  - Large and small space-based observatories spanning the electromagnetic spectrum are currently studying the universe.
  - The James Webb Space Telescope, the highest priority of the community, is on schedule for an October 2018 launch.
  - Astounding suborbital-class investigations are being conducted on sounding rockets, balloons, and the International Space Station.
  - Individual investigators are leading data analysis, theory, and technology development projects selected through open, competitive, peer reviewed solicitations.
  - We are preparing for the strategic mission that will be developed following JWST.

- **The budgetary future is uncertain**
  - “If you can’t live with uncertainty, please don’t come to work at NASA Headquarters.” (Paul Hertz, quoted in Space News, 2012 Nov 11 issue)

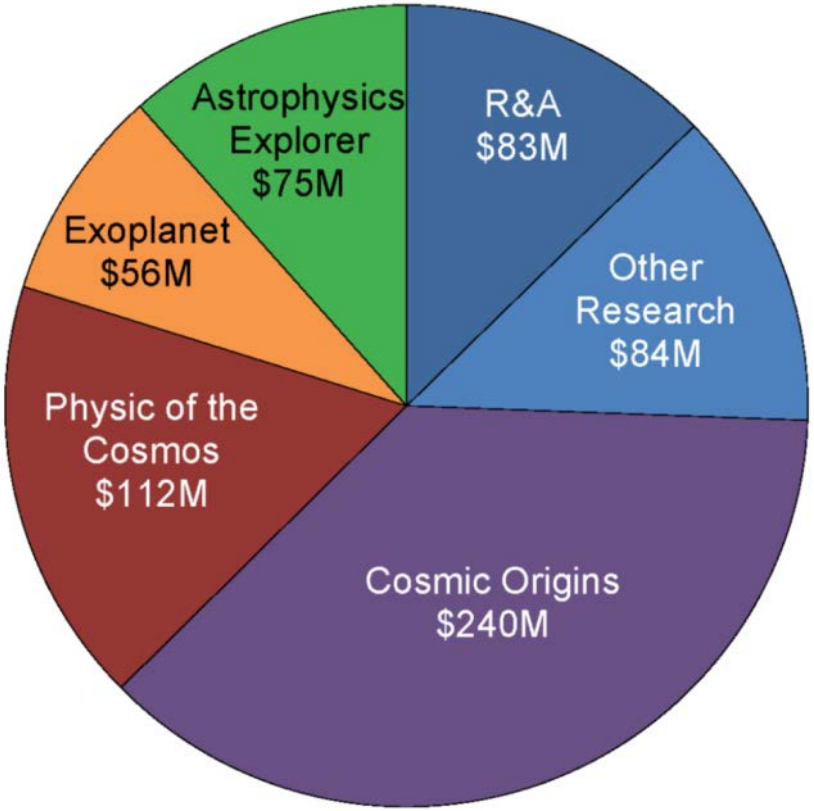

NASA Astrophysics Budget:
FY07-FY12 Appropriated and FY13-FY17 Proposed
Real Year $Million
1,600
1,400
1,200
1,000
800
600
400
200
0
FY04
FY05
FY06
FY07
FY08
FY09
FY10
FY11
FY12
FY13
FY14
FY15
FY16
FY17
JWST
Not JWST
JWST
Not JWST
Total Astrophysics

Astrophysics Division Program Update

Paul Hertz
Director, Astrophysics Division

FY2013 President's Budget

Total FY13 Budget (excluding JWST)*
$649M



* Final funding levels pending an FY13 appropriation by Congress and the concurrence of Congress on NASA's initial FY13 operating plan

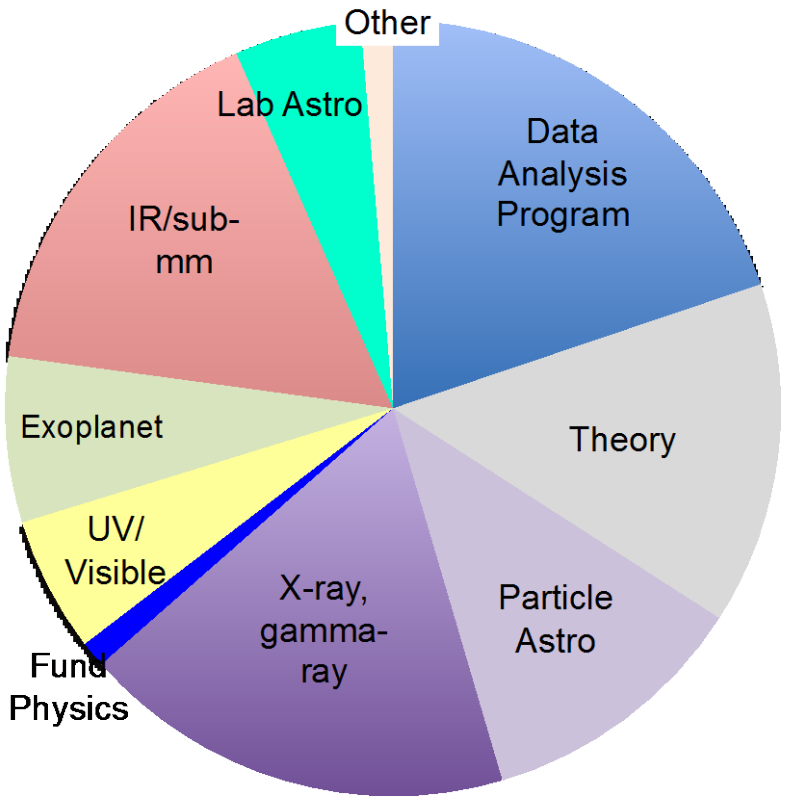
- Astrophysics Research includes:
  - R&A Programs (APRA, ADAP, ATP, OSS, RTF, TCAN)
  - Research Support: Balloon Program, Astrophysics Data Archives, Senior Review Wedge
- Cosmic Origins includes:
  - Hubble, SOFIA, Herschel, Spitzer, technology development
- Physics of the Cosmos includes:
  - Chandra, Fermi, Planck, XMM, LPF, Euclid, technology development
- Exoplanet Exploration includes:
  - WFIRST, Kepler, Keck Ops, LBTI, technology development
- Astrophysics Explorer includes:
  - Astro-H, NuSTAR, Swift, WISE, WMAP, Suzaku, GALEX, EX-1 and EX-MO, future Explorers

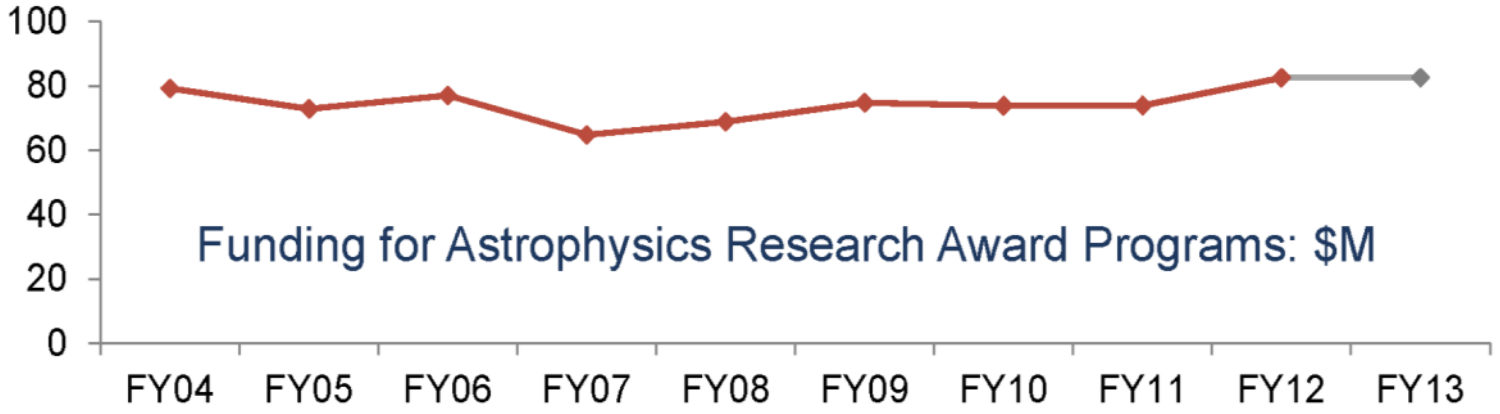
Astrophysics Research Awards (does not include GO programs)

Most recent competitions:

	Proposals Rec'd	Year-1 $M	Success
RTF-11	16	0.6	19%
APRA-11	162	12	27%
SAT-11	48	8	21%
ADAP-12	291	9	31%
OSS-12	46	2	26%
ATP-12	181	4	15%

Split of $82.562M spent in FY12
PI Award programs plus management overhead





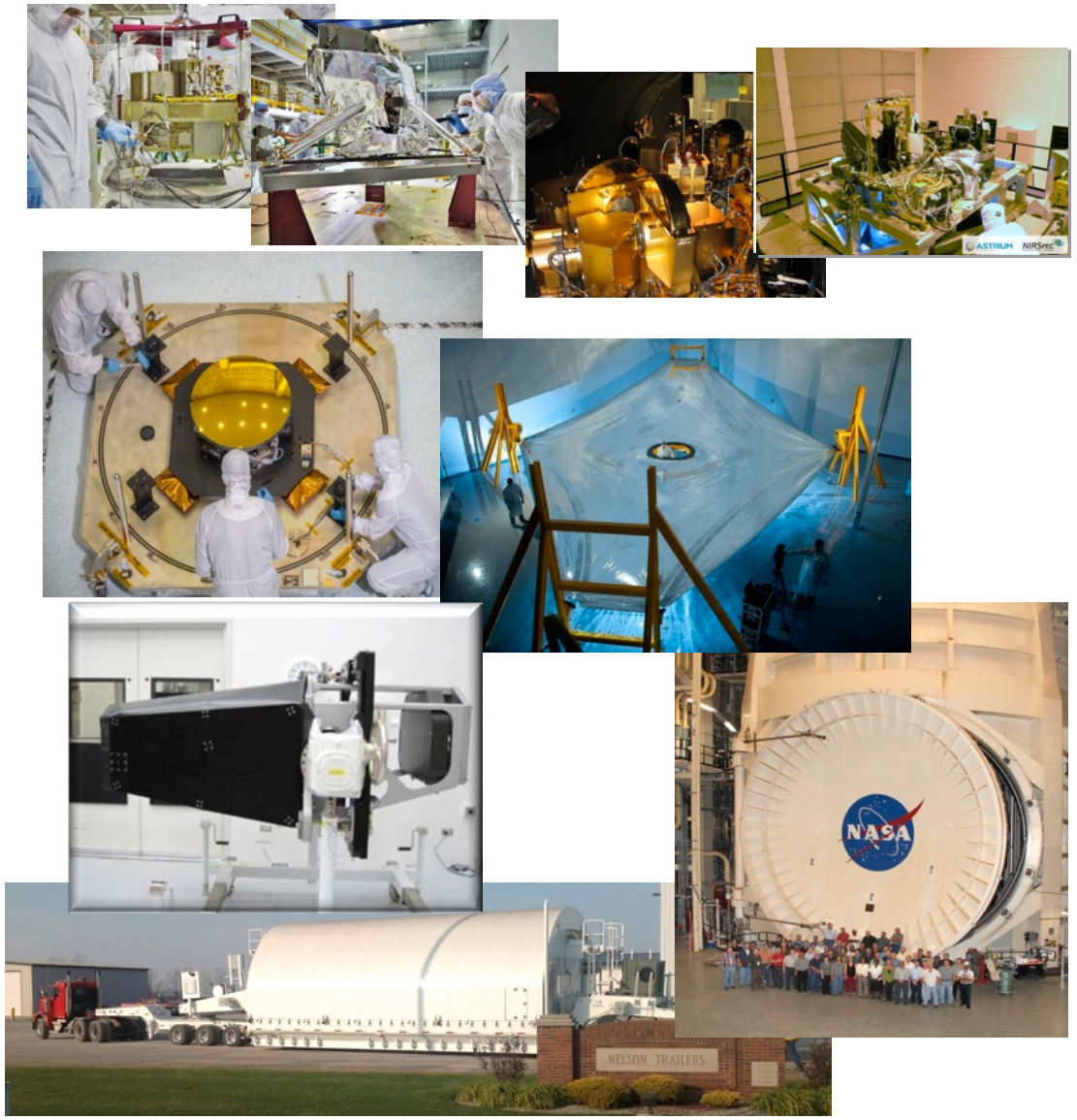
New Opportunity: TCAN
Theory & Computational Astrophysics Networks

- Astro2010 recommended that NASA, NSF, and DoE jointly provide awards to Theory and Computation Networks that address major theoretical questions raised in Astro2010 that are ripe for a breakthrough.
- **Theoretical and Computational Astrophysics Networks (TCAN) is a joint program with NSF.**
  - The text of this solicitation can be found on the NSF web page at http://go.usa.gov/Yehz
  - Information for NASA proposers is in Appendix D.12 of ROSES-12.
  - All proposals must be submitted via NSF's FastLane at https://www.fastlane.nsf.gov/
  - Proposers and their institutions must be registered in FastLane for proposal submission.
- **The window for proposal submission on FastLane opens on February 1, 2013 and closes on February 14, 2013 at 5 pm local time for the proposer.**
  - The NASA point of contact for TCAN, Joan Centrella, can be reached at Joan.Centrella@nasa.gov or (202) 358-2522.
  - The NSF point of contact for TCAN, Thomas Statler, can be reached at tstatler@nsf.gov or (703) 292-4910.

Program Update - JWST

JWST 2012 Progress

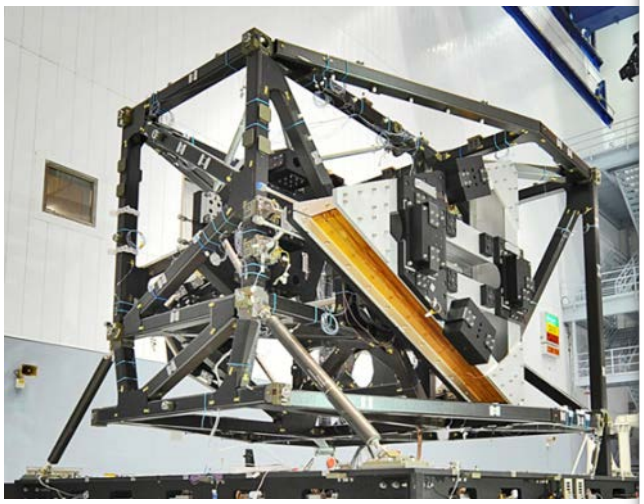
- 2 of 4 flight instruments delivered
- Other 2 instruments in cryo-vac testing right now, delivery this Summer
- 3 primary mirror segments and secondary mirror delivered
- All Aft Optics System testing completed
- 3 of 5 engineering template sunshields complete, 1 nearly complete, 1 being assembled
- Modifications to JSC chamber A completed and test objectives met
- Ground and air transport container for Observatory delivered



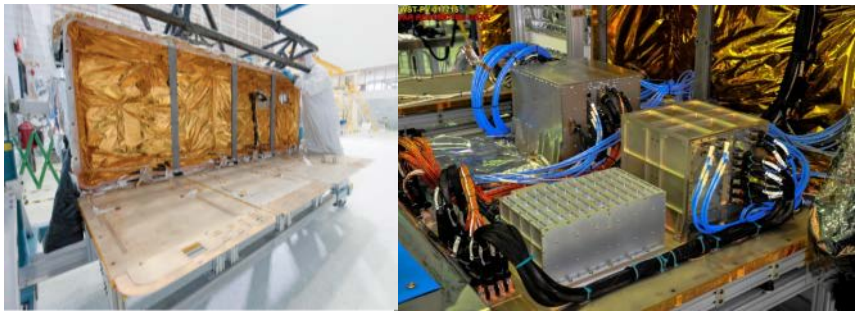
On Schedule for October 2018 launch

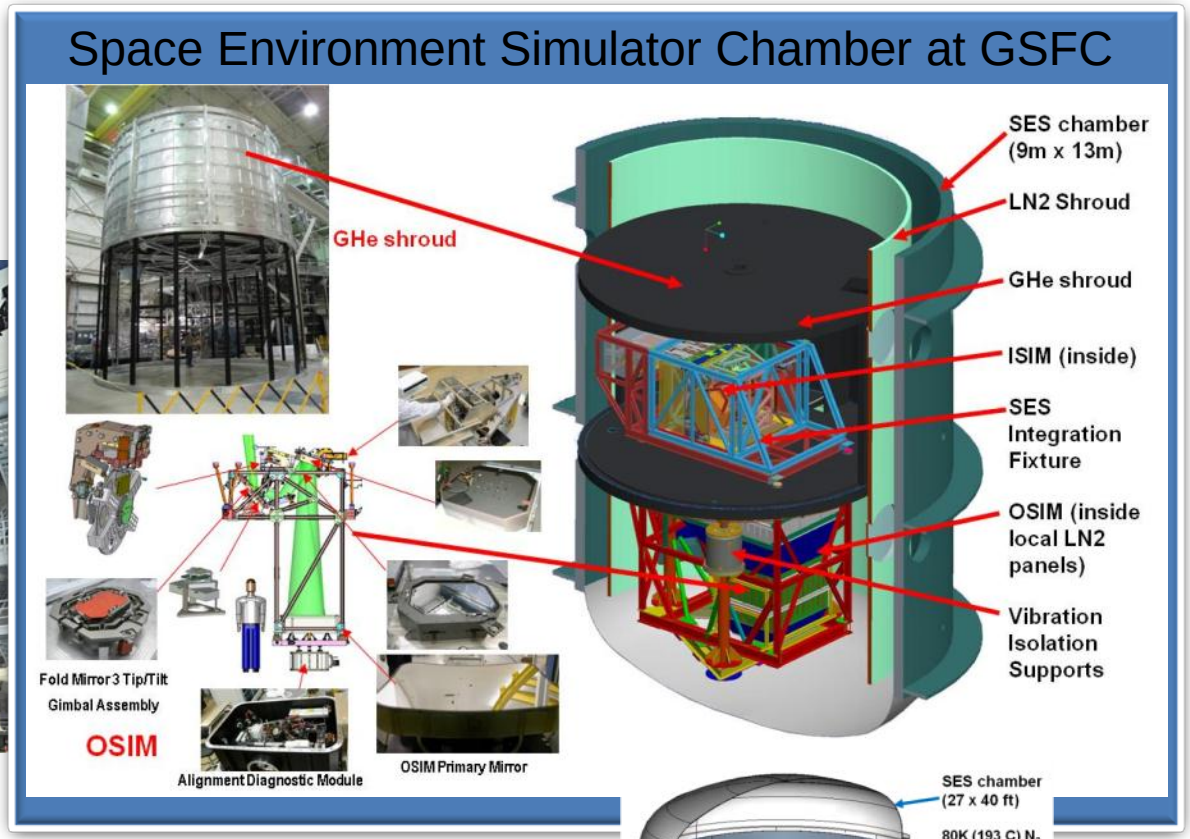
Integration of the JWST Integrated Science Instrument Module (ISIM) Is Well Underway

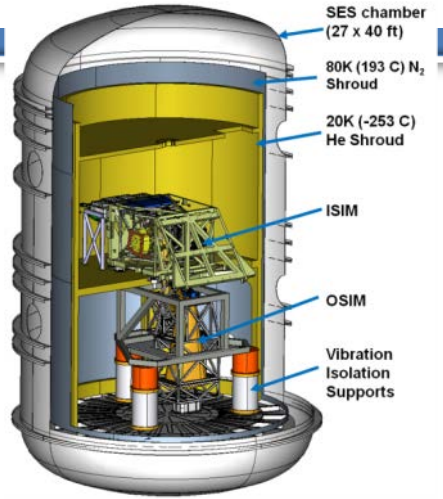
ISIM Structure



ISIM Electronics

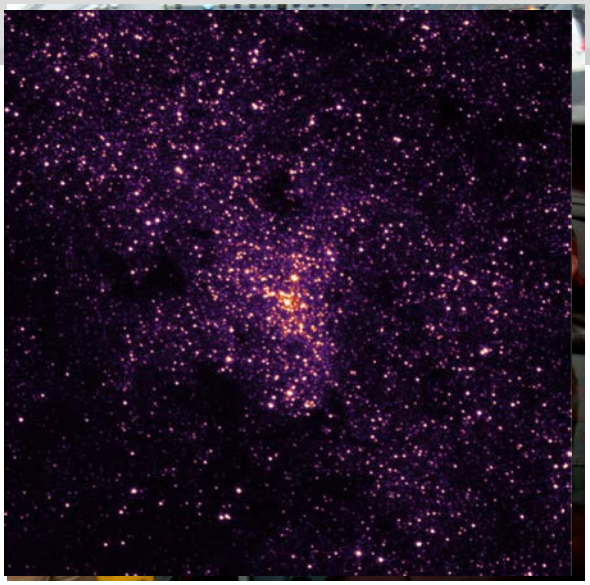




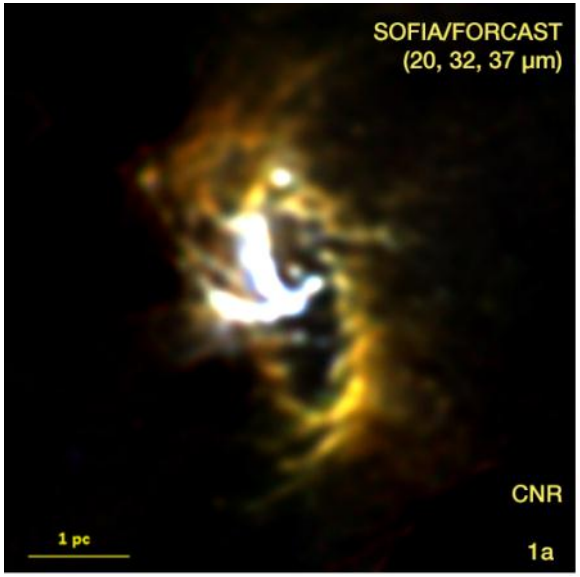


Program Update - SOFIA

- Completed Avionics Check Flight #4 on Jan 14.
  - Demonstrated that the remaining significant avionics anomaly (2 Hz yoke chatter) has been fixed.
  - Performed observatory Verification and Validation (V&V) flights on Jan 23.
  - Installation of upgraded Focal Plane Imager (FPI) has begun.
  - Instrument commissioning and remaining observatory V&V scheduled for Feb-May 2013.
- Released two FORCAST mid-infrared images of galactic center at AAS Winter Meeting.
- Cycle 1 Science scheduled for May-Dec 2013.
  - First Cycle 1 science flight is now scheduled for May 4, a Pluto occultation observation using HIPO.
  - Includes Southern Hemisphere deployment to New Zealand.
- Delayed completion of avionics upgrade / check flights challenges completion of Cycle 1 science in 2013.



Hubble image of the same region at the same scale.

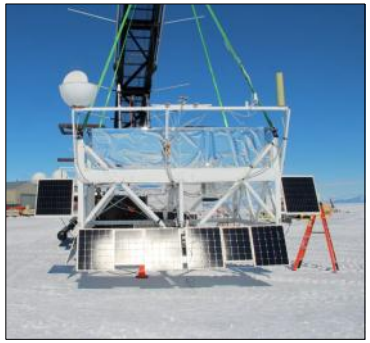


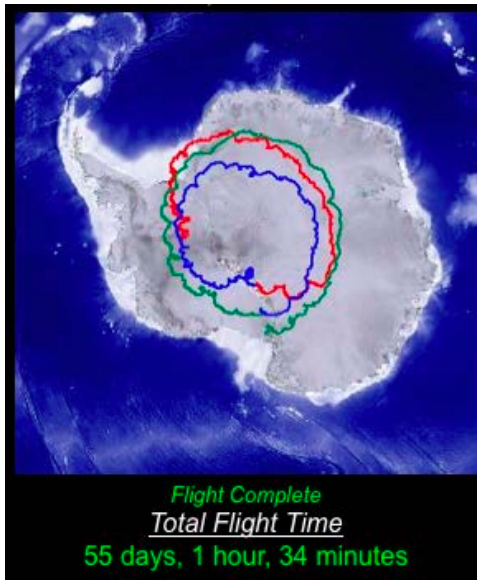
SOFIA FORCAST image of Milky Way Circumnuclear Ring

Antarctic Campaign 2012-2013

Super-TIGER (R. Binns, WUStL)

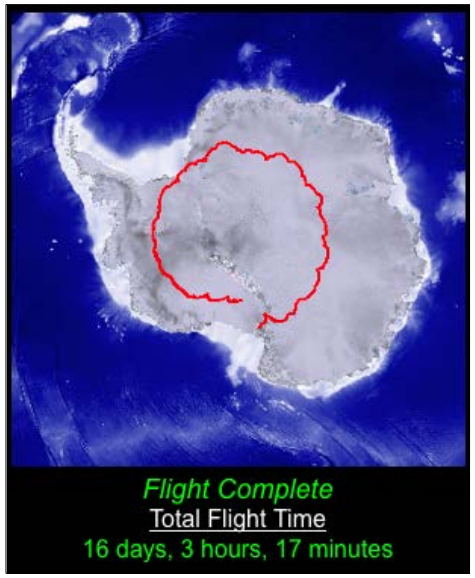
Trans-Iron Galactic Element Recorder, measure ultra-heavy cosmic rays. Launched Dec 8, 2012; landed Feb 1, 2013.





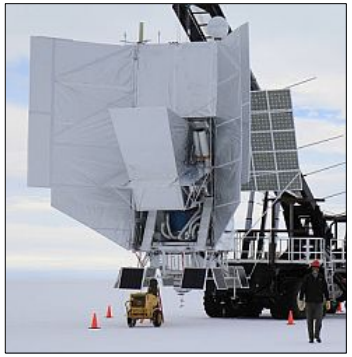
BLAST (M. Devlin, U Penn)

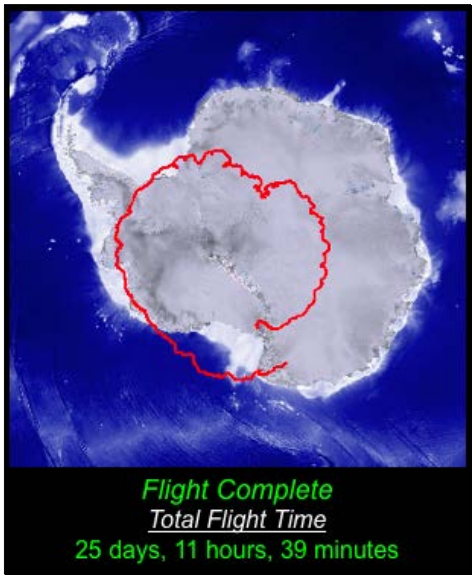
Balloon-borne Large-Aperture Submillimeter Telescope, map large-scale magnetic fields of star forming molecular clouds. Launched Dec 25, 2012; landed Jan 10, 2013.



EBEX (S. Hanany, U Minn)

The E and B Experiment, measure the intensity and polarization of the cosmic microwave background. Launched Dec 28, 2012; landed Jan 23, 2013; recovery underway Jan 30, 2013.





Program Update – WFIRST

- **WFIRST Science Definition Team (SDT) delivered its final report in August 2012**
  - First Design Reference Mission (DRM1) is a proof of concept that a mission can be constructed that is compliant with the Astro2010 recommendation. [1.3m mirror, current technology detectors, 5 year mission]
  - Second Design Reference Mission (DRM2) does not duplicate capabilities of Euclid, LSST, and JWST in advancing science objectives of WFIRST and looks for cost savings. [1.1 m mirror, evolved technology detectors, 3 year mission]
  - SDT report shows that (a) DRM1 is fully responsive to the objectives of Astro2010 and (b) DRM2 offers a low-cost near-IR survey opportunity, but the limited 3-year life precludes full compliance with Astro2010 goals.
- **Astrophysics Focused Telescope Assets (AFTA) SDT studying use of 2.4m telescope assets for advancing the science objectives of WFIRST**
  - See next slide
- **WFIRST Study Office at GSFC is continuing to revise DRM and study trades**
- **NASA is investing in evolved detector technology through the competitive SAT program**
  - Enable the continued maturation of the H4RG-10 near-IR detector array to TRL-5
  - Achieve HgCdTe detector design/process improvements that will benefit WFIRST and other applications

http://wfirst.gsfc.nasa.gov/

Astrophysics Focused Telescope Assets (AFTA) Study

- **Seven month study planned to assess the use of the 2.4m telescope to implement an Astro2010 mission to accomplish the WFIRST science.**
- **Science Definition Team formed to support study activities.**
- **Decisions made by SDT as of November 30, 2012.**
  - GEO orbit (baselined, but pros and cons still being discussed by SDT members).
  - 3 x 6 array of H4RG10 detectors.
  - Grism (not prism) for the spectrograph.
  - Diffraction limited at 1.2 micron (versus 1.0 micron in prior DRMs).
  - Coronagraph will be a Lyot with a shaped pupil mask.
  - Cut down baffling so obscuration will be 30% instead of the current 40%. This is being done for the coronagraph instrument.
- **SDT face-to-face meeting held in conjunction with AAS Meeting in Long Beach on Jan 10-11, 2013.**
- **Preliminary findings are that science increase over WFIRST DRM1 and DRM2 is substantial.**

Mock up of the 2.4m telescope now located at GSFC

Astrophysics Division Implementation Plan

Paul Hertz
Director, Astrophysics Division

Astrophysics Division Responsibilities

- **The Astrophysics Division is responsible for the stewardship of the Nation's capabilities in space astrophysics and for advancing the Nation's space astrophysics goals and objectives.**
- **The guiding principles used by the Division in implementing its strategy for meeting those responsibilities include:**
  - Enable the science and priorities given by the Decadal Survey with new activities as well as through ongoing missions, including large missions, medium missions, and Explorers.
  - Invest in the Astrophysics Research Program for developing the science cases and technologies of new missions and for maximizing the scientific return from operating missions.
  - Receive community input and advice through the APS and its associated PAGs, the CAA, and the AAAC, and use this input and advice to inform decisions made by the Division.
  - Implement the program through choices made by the Astrophysics Division in the context of the science and priorities set by the Decadal Survey, and work with the Science Mission Directorate, NASA Administrators office, and White House Office of Management and Budget (OMB) to move those choices into budget realities.
  - Use processes that are as transparent as possible.
  - Preserve and nurture core capabilities at NASA Centers and throughout the Nation.
  - Maintain flexibility needed in an environment that is constantly changing.

Astrophysics Budget Reality

- **There is inadequate available budget to implement the Astro2010 Decadal Survey recommendations as written; there is also changed external context.**
  - JWST was rebaselined for a 2018 launch with an increased cost commitment LCC of $8.8B, an increase of $3.1B.
  - Although the total funding for astrophysics is higher than the Decadal Survey assumed, the increased cost of JWST has left insufficient funding over the decade to address the Decadal Survey recommendations for new projects and activities.
  - Due to budget constraints, no new astrophysics missions other than Explorers can enter formulation before FY17, when JWST approaches launch.
  - NASA and ESA have ended the joint LISA and IXO studies.
  - NASA has committed to a partnership with ESA on Euclid.
  - NASA is considering whether the NRO 2.4m telescope assets can enable astrophysics priorities or other NASA objectives.
- **Large strategic missions in the future are possible only with the Astrophysics budget that is freed up as JWST spending begins to decrease in FY17 and out.**
  - A new strategic mission can be started as early as FY17 subject to available funding.

Astrophysics Near-term Goal and Strategy

- **The goal is to be prepared to start a new strategic Astrophysics mission to follow JWST as soon as funding becomes available while continuing to advance the science during the interim.**
  - It cannot be assumed that the authority to start a new large mission (i.e., WFIRST) will be granted in 2017, therefore concepts for moderate cost missions, probes that cost no more than approximately $1B, must also be considered.
  - Any mission concept studied must derive from the science objectives of the Decadal Survey's prioritized activities.
- **The strategy is to use the science and prioritized activities of the Astro2010 Decadal Survey to guide strategy and inform choices.**
  - In the absence of new missions, progress against decadal priorities is maintained through the core research program, through continued operation of existing missions and their GO programs, through the suborbital programs, and through frequent Explorer opportunities.
- **In order to prepare for a new strategic mission**
  - A near term program of mission concept studies and technology development will be undertaken
  - These studies will inform a mid-decade decision on which mission will begin formulation starting as early as FY17.

Astrophysics FY 2013 Budget Request

- **The President's FY 2013 budget request for the Astrophysics Division includes:**
  - An Astrophysics Explorer Program that can support four mission selections and four Missions of Opportunity (MO) selections over a decade (depending on the cost caps chosen and launch vehicle availability).
  - Extensions of astrophysics operating missions and their associated GO programs.
  - Continued development and operation of the SOFIA airborne observatory.
  - A new program for mid-TRL level technology development (the Strategic Astrophysics Technology (SAT) program element in ROSES).
  - An augmented competitive Astrophysics Research Program that maintains growth realized in FY 2012.
  - New research opportunities: Theory and Computation Networks (in partnership with NSF), laboratory astrophysics consortia, and the Nancy Grace Roman Technology Fellowships for early career researchers.
- Following the formulation of the Presidents FY 2013 budget request and an NRC study, NASA has undertaken a partnership with ESA to provide a contribution of detector subsystems for the NISP instrument on the Euclid mission in exchange for appointing NASA-selected members in the Euclid Consortium and the Euclid Science Team.

Response to Decadal Survey

Scale	Decadal Survey Recommendation	Response included in the FY 2013 President's Budget Request
Large	WFIRST	SDT and DRMs in FY 2011 and FY 2012; AFTA study in FY 2013; technology investments in detectors through SAT program; participation in Euclid
Large	Explorer Augmentation	Augment budget to support selection of 2 EX missions, 2 SMEX missions, and 4 Missions of Opportunity over a decade; MO AO in 2012, SMEX AO in 2013/2014, and EX AO in 2015
Large	LISA	Complete ST-7/LISA Pathfinder mission; technology investments through SAT program; Community Science Team (CST) study in 2012
Large	IXO	Technology investments through SAT program; CST study in 2012; potential probe study
Medium	New Worlds Technology	Technology investments through technology testbeds and SAT program; probe studies in FY 2013 and FY 2014
Medium	Inflation Probe Technology	Technology investments through APRA program including three suborbital balloon payloads; complete Planck mission and data analysis; potential probe study after Planck results

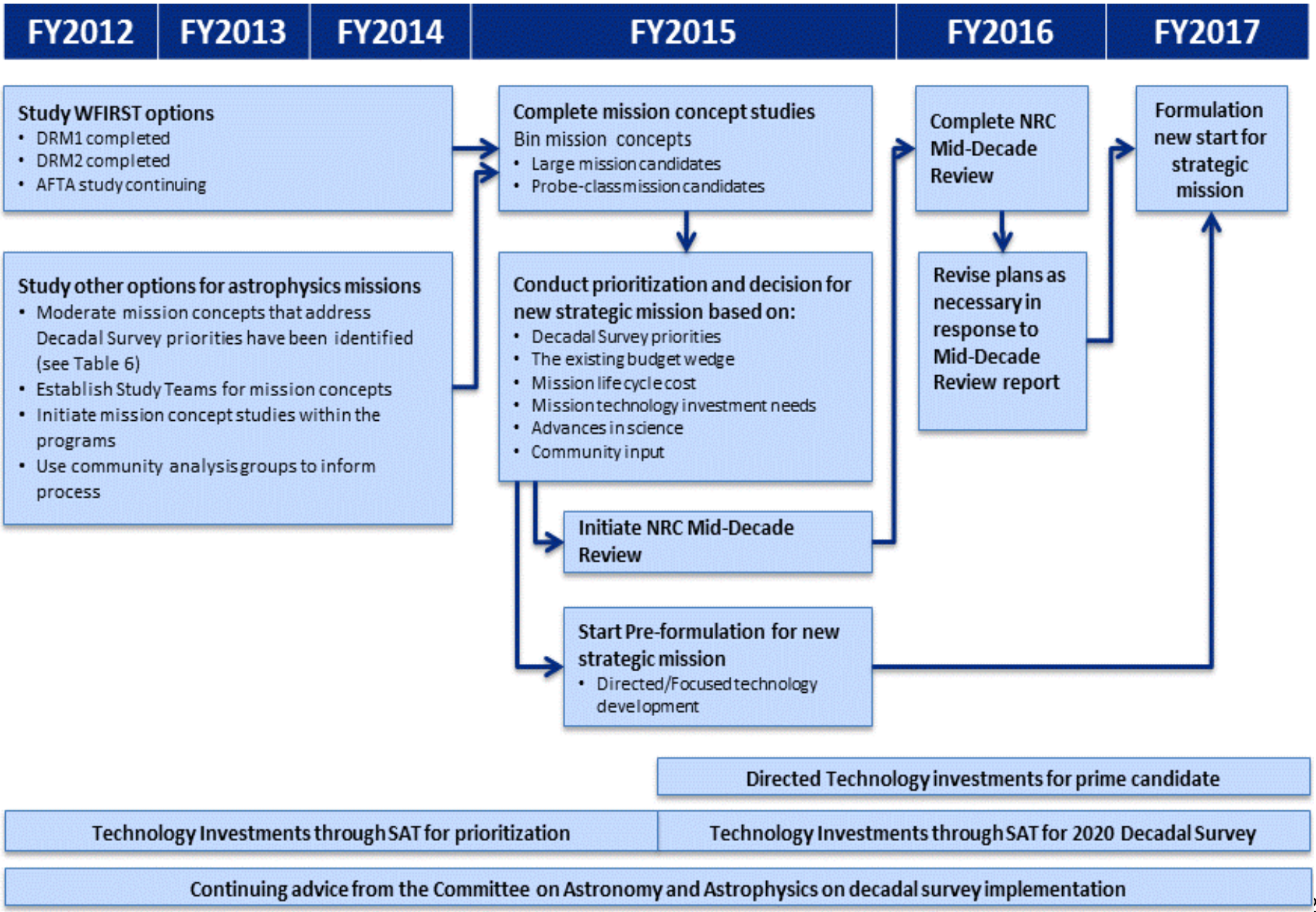
Response to Decadal Survey

Scale	Decadal Survey Recommendation	Response included in the FY 2013 President's Budget Request
Small	Astrophysics Theory Program Augmentation	Small augmentation starting in FY 2012 and maintained
Small	(Definition of) a future UV-optical space capability	Technology investments through SAT program; science driver studies in FY 2012 and responsive mission studies in FY 2013 leading toward next decadal survey
Small	Intermediate Technology Development Augmentation	Initiated SAT program in FY 2010
Small	Laboratory Astrophysics Augmentation	Augmentation to select laboratory consortia
Small	SPICA (U.S. contributions to JAXA-led)	Not supported as a strategic contribution; candidate for Explorer Mission of Opportunity
Small	Suborbital Program Augmentation	Small augmentation for payloads; augmentation to support development of ULDB platforms and WASP
Small	Theory and Computation Networks (NASA, NSF, DOE)	Solicitation for proposals in FY 2013 (with NSF)
N/A	Additional core program augmentations	Initiated Nancy Grace Roman Technology Fellows program; small augmentation for ADAP program; small augmentation for APRA program

Preparing for the Next Strategic Mission

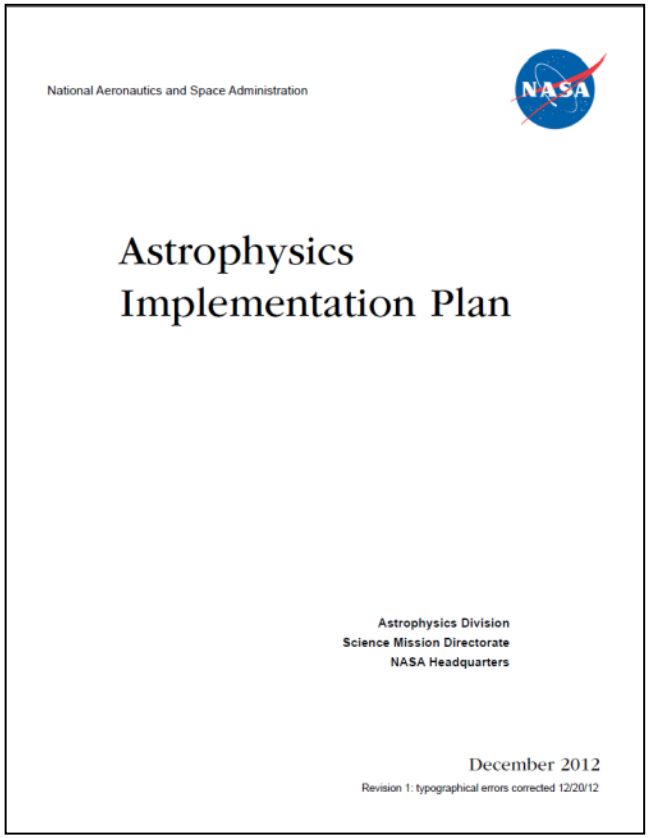
Strategic Mission Concepts	Derived from Recommendation	Status of Studies	Plan for Future
WFIRST: Large Strategic Mission (DRM1)	Large 1st : WFIRST	Completed in 2012	Candidate large mission for mid-decade
WFIRST: Probe-size Strategic Mission (DRM2)	Large 1st : WFIRST	Completed in 2012	Candidate probe for mid-decade
Use of the 2.4m telescope assets to advance the science of WFIRST (study includes an optional second instrument to advance exoplanet science)	Large 1st : WFIRST (Medium 1: New Worlds Technology)	Started in 2012	Candidate large mission for mid-decade
Gravitational Wave missions to advance the science of LISA	Large 3rd : LISA	Completed in 2012	Candidate large mission for next decade; candidate for international partnership
X-ray missions to advance the science of IXO	Large 4th : IXO	Completed in 2012; under consideration for study in 2014	Candidate probe for mid-decade; candidate large mission for next decade; candidate for international partnership
Exoplanet probes to advance the science of a planet characterization and imaging mission	Medium 1st : New Worlds Technology	Planned for 2013	Candidate probe for mid-decade; candidate large mission for next decade
Cosmic Microwave Background Polarization Probe	Medium 2nd : Inflation Probe Technology	Study under consideration for study in 2015	Candidate probe or large mission for next decade
Science and technology drivers for a UV/Visible mission	Small: (Definition of) a future UV-optical space capability	Started in 2012	Candidate probe or large mission for next decade

Astrophysics Near-term Strategy



Astrophysics Implementation Plan

- **Astrophysics Implementation Plan**
  - White paper developed by Astrophysics Division
  - Describes Astrophysics Division strategy in response to the Decadal Survey recommendations
  - Consistent with current (FY13) budget guidance
  - Was discussed with the Committee on Astronomy and Astrophysics (CAA) and the NAC Astrophysics Subcommittee (APS) prior to finalization



- The Astrophysics Implementation Plan is available for download at http://science.nasa.gov/astrophysics/documents/

Astrophysics Roadmap

- **In 2013, the Astrophysics Division will develop a Roadmap**
  - Articulate NASA's astrophysics vision looking out 30 years
  - Science-based → identify key science investigations and challenges for the future
  - Identify notional mission concepts & technologies needed to enable the science
  - Will be developed by a task force of the NAC Astrophysics Subcommittee (APS)
    - Expect APS will set up the task force at the Feb. 14 telecon
  - Will include community input, including Town Halls
  - Plan to release publicly in mid-December 2013, and present at AAS meeting in January 2014

- **What is the difference between the Implementation Plan and the Astrophysics Roadmap?**
  - Implementation Plan describes *response* to 2010 Decadal Survey
  - Roadmap *looks forward to and beyond* the 2020 and 2030 Decadal Surveys

Astrophysics Missions timeline

Last updated: December 20, 2012

Decadal Survey Mission

Explorer 2013/14 Mission

SMEX AO in 2013/2014

Euclid (ESA)

Explorer 2012 Mission of Opportunity

To be selected in Summer 2013

JWST (ESA, CSA)

Explorer 2011 Mission of Opportunity

Explorer 2011 Mission

To be downselected in Spring 2013

ASTRO-H (JAXA)

ST-7/LPF (ESA)

NuSTAR (ASI, Denmark)

SOFIA (DLR)

Herschel (ESA, UK, Netherlands)

Planck (ASI, CNES, UK, ESA)

Kepler

Fermi (DOE, Intl team)

Suzaku (JAXA)

Swift (ASI, UK)

Spitzer

GALEX (South Korea)

GALEX NASA science mission ended February 2012. Caltech mission began in May 2012.

XMM-Newton (ESA)

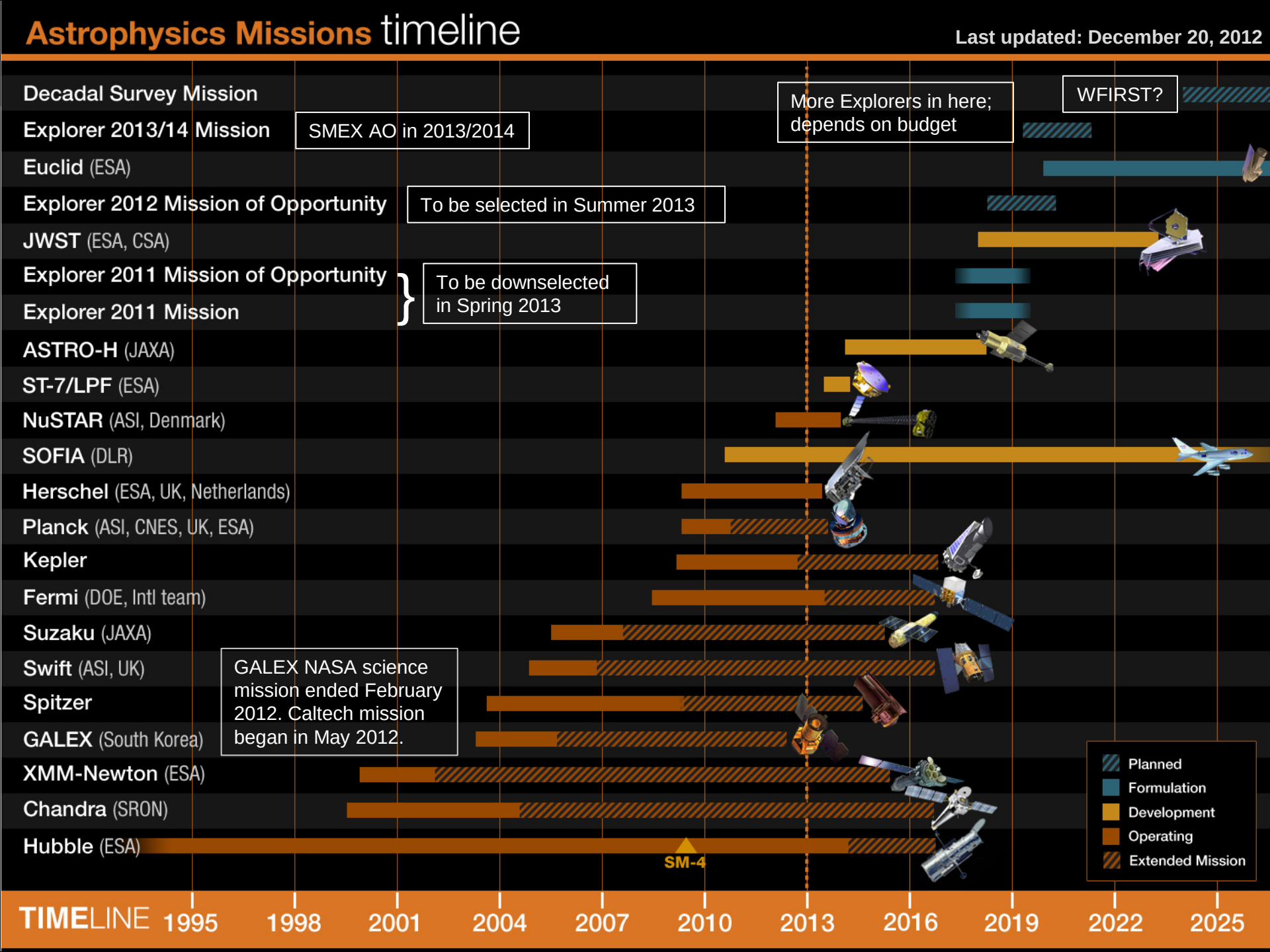
Chandra (SRON)

Hubble (ESA)

SM-4

More Explorers in here; depends on budget

WFIRST?

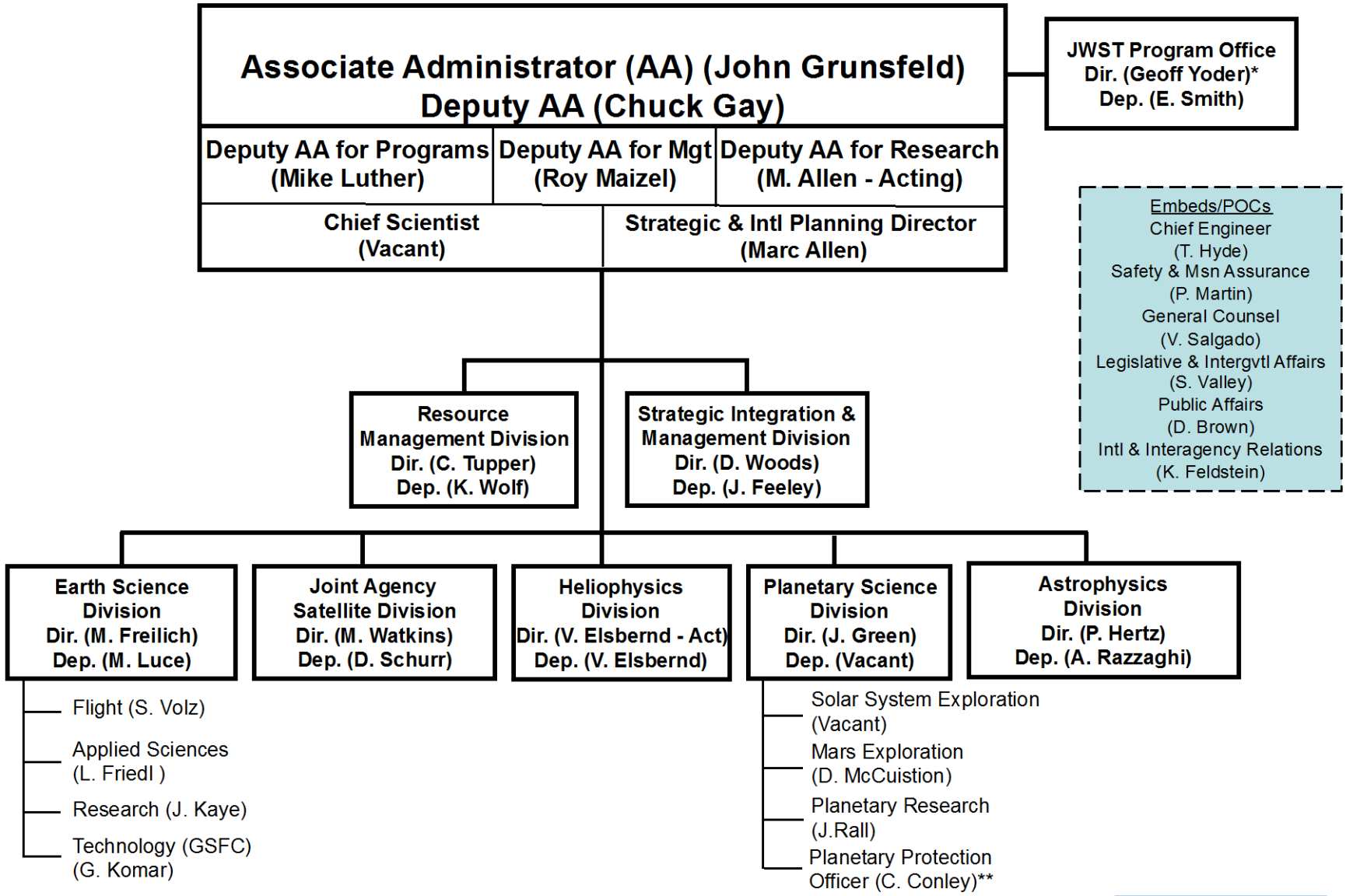


Planned
Formulation
Development
Operating
Extended Mission

TIMELINE 1995 1998 2001 2004 2007 2010 2013 2016 2019 2022 2025

Back-up

SMD Organization



* Direct report to NASA Associate Administrator
** Co-located from the Front Office

January 2013

Astrophysics Division Organization Chart

Resource Management
Omana Cawthon +
Peifen Anawalt +

Director
Paul Hertz
Deputy Director
Andrea Razzaghi

Lead Secretary: Leslie Allen (acting)
Secretary: Christie Ashley *
Program Support Specialist: Sheila Gorham

Cross Cutting
Technology Lead: William (Billy) Lightsey *
Strategic Integration: Joan Centrella *
Division E/PO POC: Hashima Hasan (Lead Comm Team)
Division PAO POC: Lisa Wainio *
Information Manager: Lisa Wainio *

Astrophysics Research

Program Manager: Linda Sparke
Astrophysics Data Analysis: Doug Hudgins, Debra Wallace
Astrophysics Theory: Linda Sparke
Origins of Solar Systems: Larry Petro *
APRA lead: Michael Garcia *
Cosmic Rays, Fundamental Physics: Joan Centrella*, Vernon Jones, Keith MacGregor*
Gamma Ray/X-ray: Michael Garcia*, Lou Kaluzienski, Wilt Sanders*
Optical/Ultraviolet: Michael Garcia, Richard Griffiths, Hashima Hasan, Mario Perez *, Larry Petro *
IR/Submillimeter/Radio: Richard Griffiths, Doug Hudgins, Larry Petro, Glenn Wahlgren*
Lab Astro: Glenn Wahlgren*
Data Archives: Hashima Hasan
Astrophysics POC for Sounding Rockets: Wilt Sanders *
Balloons Program: Vernon Jones (PS), Mark Sistilli (PE)

February 11, 2013

Programs / Missions

	Program Scientist	*Program Executive*
Exoplanet Exploration (EXEP)		
LEADS	**Doug Hudgins**	**Tony Carro ***
Keck	Hashima Hasan	Mario Perez *
Kepler	Doug Hudgins	Tony Carro *
LBTI	Hashima Hasan	Mario Perez *
NExScI	Hashima Hasan	Mario Perez *
Cosmic Origins (COR)		
LEADS	**Michael Garcia ***	**John Gagosian**
Herschel	Glenn Wahlgren *	John Gagosian
Hubble	Richard Griffiths *	John Gagosian
JWST	Hashima Hasan	N/A
SOFIA	Glenn Wahlgren *	John Gagosian
Spitzer	Glenn Wahlgren *	John Gagosian
Physics of the Cosmos (PCOS)		
LEADS	**Richard Griffiths ***	Lia LaPiana
Chandra	Wilt Sanders *	Lia LaPiana
Euclid	Richard Griffiths *	Lia LaPiana
Fermi	Lou Kaluzienski	Lia LaPiana
Planck	Joan Centrella *	Lia LaPiana
ST-7/LPF	Wilt Sanders *	Anne-Marie Novo-Gradac
XMM-Newton	Lou Kaluzienski	Lia LaPiana
Astrophysics Explorers (APEX)		
LEADS	**Wilt Sanders ***	**Anne-Marie Novo-Gradac**
Astro-H	Lou Kaluzienski	Anne-Marie Novo-Gradac
GALEX	Larry Petro *	Anne-Marie Novo-Gradac
NuSTAR	Lou Kaluzienski	Mark Sistilli
Suzaku	Lou Kaluzienski	Anne-Marie Novo-Gradac
Swift	Michael Garcia *	Anne-Marie Novo-Gradac
WISE	Hashima Hasan	Anne-Marie Novo-Gradac

\+ *Member of the Resources Mgmt Division*
* *Detailee, IPA, or contractor*
JWST now part of the JWST Program Office.

Kelly Johnson on detail until Aug. 2013.
Rita Sambruna on detail until Sept. 2013

ROSES Selections Since October

	Proposal Due Date	Notify Date	Days since received	Number received	Number selected	% selected
Astrophysics Theory Program	Jul 13	Dec 6	146	181	28	15%
Euclid Science Team	Aug 31	Nov 7	68	8	3	38%
Swift Guest Investigators	Sep 26	Dec 18	83	158	45	28%
Nancy Grace Roman Technology Fellowships	Nov 8	[1]		12		
Kepler Guest Observer	Jan 18	[2]		62		
Fermi Guest Observer	Jan 18	[3]		233		

[1] Peer review in January
[2] Peer review in April
[3] Peer review in March

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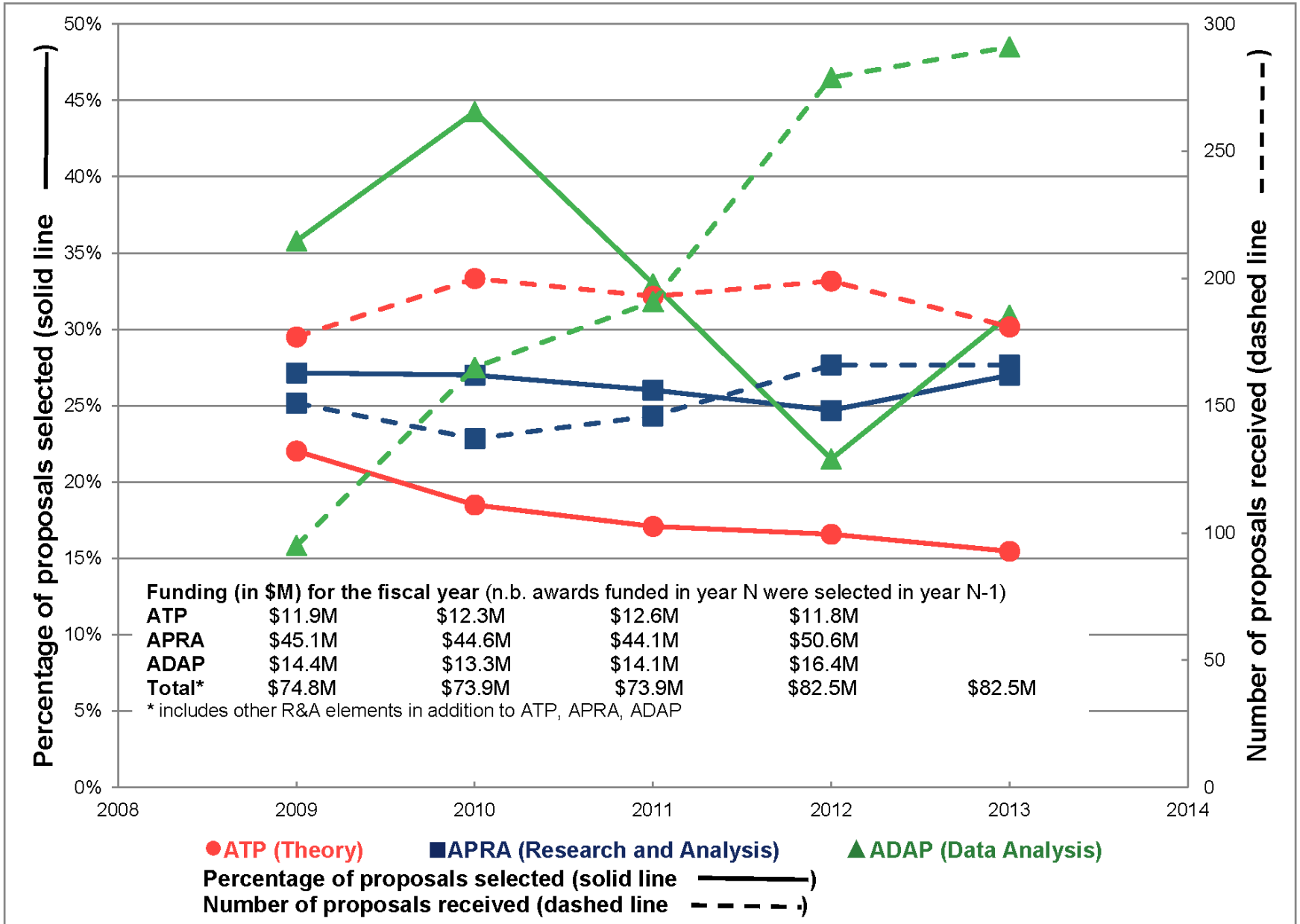
Astrophysics R&A Funding Trends



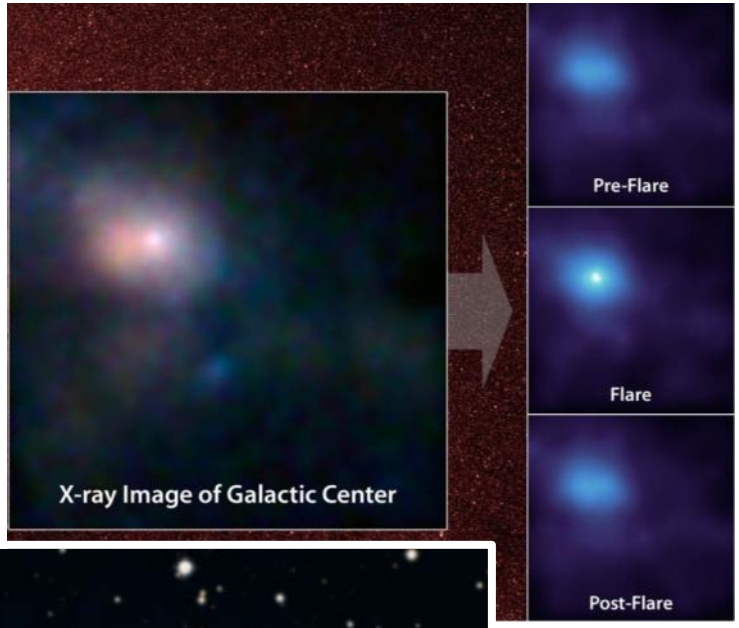
Funding Opportunities in 2013

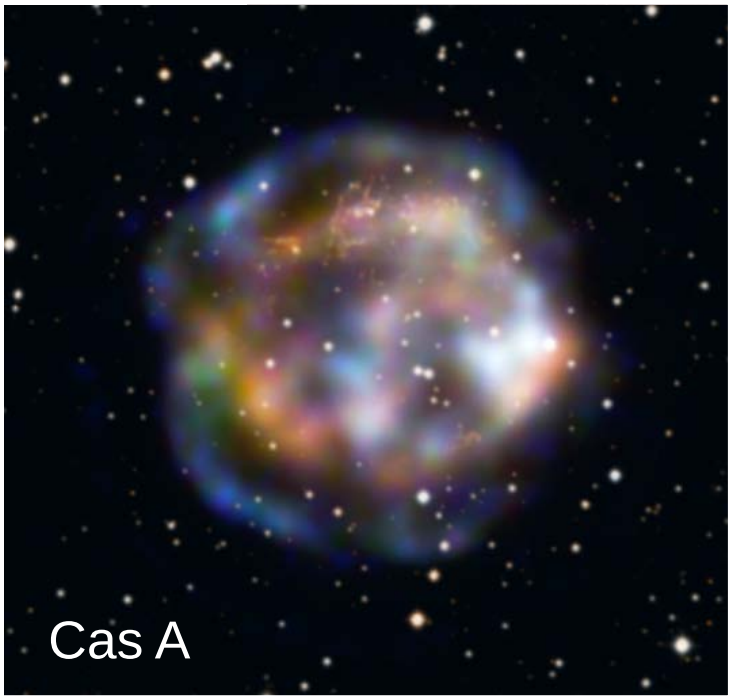
- **ROSES-13 is currently planned for release on February 14, 2013**
  - Delay in release of the President's budget may cause a delay in the release of ROSES-13
  - All solicitations are subject to availability of budget; the President's FY13 budget request (not yet appropriated by Congress) includes a 1.8% increase for R&A
  - Caveats: No FY13 appropriation, possible sequestration, no FY14 budget request
- **ROSES-13 will include the usual Astrophysics R&A and GO solicitations:**
- **Due Dates will be about the same time as last year. Upcoming 2013 due dates:**

January 18, 2013	Fermi Guest Investigator -- Cycle 6	ROSES-12
January 18, 2013	Kepler Guest Observer -- Cycle 5	
February 14, 2013	Theory and Computational Astrophysics Networks (via NSF FastLane)	
March 1, 2013	Kepler Participating Scientist Program	
March 22, 2013	Astrophysics Research and Analysis: APRA-12 Strategic Astrophysics Technology: SAT-12	
May 17, 2013	Astrophysics Data Analysis: ADAP-13	ROSES-13
May 23, 2013	Origins of Solar Systems: OSS-13	
July 12, 2013	Astrophysics Theory Program: ATP-13	
September 26, 2013	Swift Guest Investigator -- Cycle 10	
November 1, 2013	Nancy Grace Roman Technology Fellowships for early career researchers (RTF-13)	

Program Update - NuSTAR

- 2-year Prime Mission started Aug 1, 2012.
- Early pointing and alignment issues have largely been mitigated.
  - Unexpected thermal displacements of both the star tracker camera head units and mast structure.
  - Initial alignment of star cameras was off by ~4mm instead of the planned 1mm.
- Science observations proceeding well.
- NuSTAR working with other missions for coordinated observations (e.g., viewing 3C273 along with Chandra, XMM-Newton, Swift, Suzaku, and INTEGRAL).
- Multiple results reported at AAS including:
  - Cas A: 10-30keV images constrain shock acceleration
  - ULXs: high energy spectra imply super-Eddington accretion



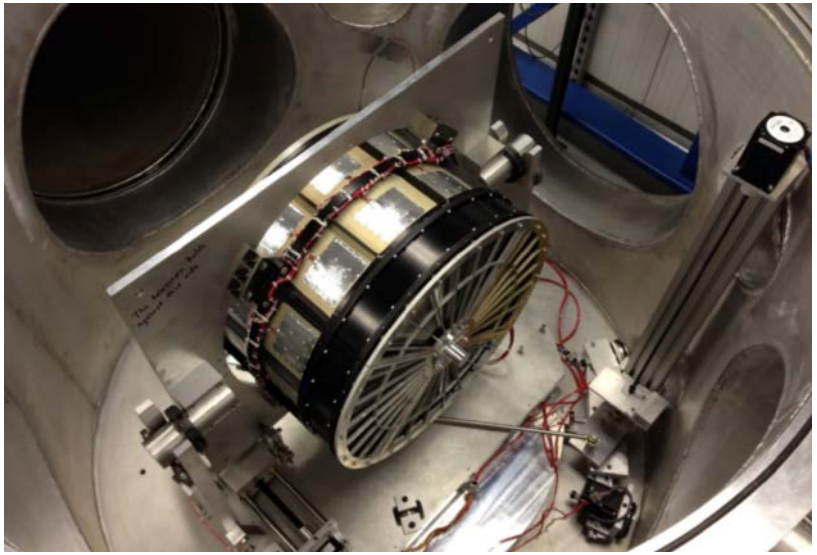


Blue:15-20 keV
Green: 8-10 keV
Red: 4.5-5.5 keV

Program Update - Astro-H

- Dec 17, 2012 meeting at HQ with T. Takahashi.
- Feb 18-22: Engineering and Science Team meetings at Tsukuba, Japan.
- NASA flight model hardware fabrication is on track.
- Engineering model instrument performance test concluded Dec 13.
- NASA detector verified to have ~5eV resolution (7eV requirement). Detector was cooled to 50 mK using method developed in lab at GSFC as work-around to failed heat switch.
- Severe issue with JAXA cryocoolers identified. Cryocoolers produce microphonics that induce heating in the NASA microcalorimeter detector which degrades the resolution to ~ 60 eV. (Requirement = 7eV) JAXA is working redesign of cryocooler suspension system.
- JAXA schedule under review to accommodate resolution of these issues.
- Two step DPMC planned to release UFE and increase LCC to support new schedule.

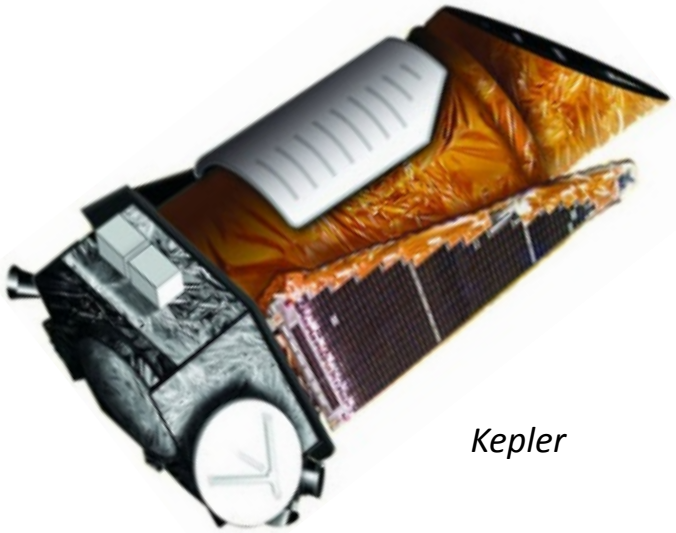
EM instrument testing in Japan



FM x-ray Mirror in testing at GSFC

Program Update - Kepler

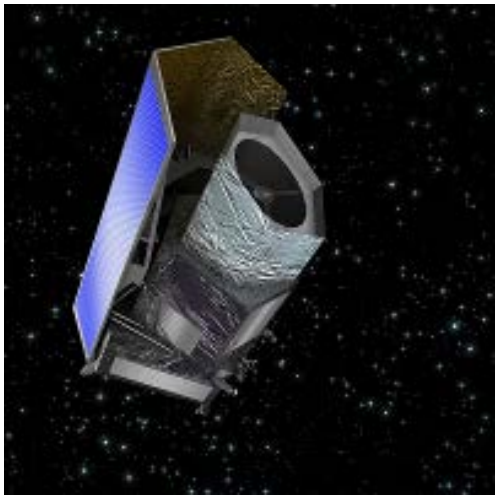
- Announced additional 461 planet candidates (61 HZ candidates of all sizes, including one super-Earth around sun-like star) at AAS.
- Completed Quarter 15 Month 3 Science Data download.
- Elevated friction on wheel 4 seen in X-band on January 7.
- After observing persistence of elevated friction, wheel placed in rest position for 10 days starting January 17
- Reaction wheels restarted on January 27, less than 1 hour spent in low speed state.
- Returned to science mode on January 28.
- Next Ka band downlink scheduled for March 6.
    - Will determine status of elevated friction on wheel 4 at that time.



Kepler

Program Update - Euclid

- **The ESA and NASA have signed the MOU in January 2013.**
- **NASA's portion of the project approved to enter Phase B on Dec. 21, 2012.**
  - NASA is providing the flight sensor chip subsystems (SCS or triplet) for the Euclid NISP instrument; SCS consists of H2RG sensor chip subassembly, SIDECAR ASIC, and flex-cable
  - NASA Euclid project is at JPL
  - Characterization of SCS will be done at GSFC
  - NASA Confirmation is planned for late Summer 2013



- **NASA has selected 3 proposals for Euclid science investigations**
  - ESA has appointed Jason Rhodes (JPL) to the ESA Euclid Science team. This confirms NASA's selection and nomination.
  - NASA has nominated to ESA 40 members of the Euclid Consortium and Jason Rhodes to the Euclid Consortium Board. The Euclid Consortium has approved all of NASA's nominations in January 2013.
    - Precision Studies of Galaxy Growth and Cosmology Enabled Through a Physical Model for Nebular Emission
      - PI R. Chary (Caltech), 3 members
    - Looking at Infrared Background Radiation Anisotropies with Euclid
      - PI A. Kashlinsky (GSFC), 7 members
    - Constraining Dark Energy and Gravity with Euclid
      - PI J. Rhodes (JPL), 36 members (+ some current EC members)

Study on Applications of Large Space Optics (SALSO)

- In June 2012, NASA announced that it had acquired the use of two sets of 2.4m space-qualified telescope optics systems and supporting components.
- Although their most obvious applications are in astrophysics, **NASA is interested in identifying possible uses for these systems to address a broader range of its science, exploration, and technology goals.**
  - In November 2012, NASA released an RFI soliciting broad community inputs focused on utilization of the telescope assets for Agency goals in space technology, human exploration and operations, heliophysics, planetary science, and astrophysics (excluding a wide field infrared survey).
  - A workshop was held February 5-6, 2013, in Huntsville AL to provide a forum for concept presentation and discussion of innovative ideas.
  - Astrophysics concepts included UV/Visible observatories, exoplanet observatories, solar system observatories, time domain observatory, deep imaging observatories, exo-ecliptic observatory, binocular observatory, balloon borne observatory, etc.
  - This will be followed by additional study by NASA of representative concepts presented at the workshop.
- **NASA will use all of the information gathered to formulate and evaluate future strategies for utilizing the assets to advance Agency goals.**
  - A final study report will contain the workshop briefings and the results of follow-on analyses. This report will be completed about May 2013 and publicly released thereafter.

http://science.nasa.gov/salso/

Explorer Program

- The Astro2010 Decadal Survey stated that “NASA should support the selection of two new astrophysics MIDEX missions, two new astrophysics SMEX missions, and at least four astrophysics MoOs over the coming decade.”
- **The Astrophysics Explorer budget has been significantly augmented to enable selection of 4 PI-led missions and 4 PI-led Missions of Opportunity (MOs) over a decade.**
  - NASA will downselect in Spring 2013 one mission and one MO from the projects currently conducting Phase A studies (FINESSE/TESS, GUSSTO/NICER).
  - NASA will select in Summer 2013 one (or more) MO from the proposals received in December 2012.
- **Astrophysics Division is planning a series of AOs (subject to budget approval):**
  - An AO for a SMEX in late-2013/early 2014 with the cost caps and dates TBD (no MO call in this AO – the late 2012 MO solicitation was the associated MO call).
  - An AO for an EX and MO in 2015.
  - AOs, each for a mission and MO, will be approximately 2.5 years apart (4 per decade), subject to budget availability.