National Aeronautics and Space Administration

Astrophysics

Paul Hertz

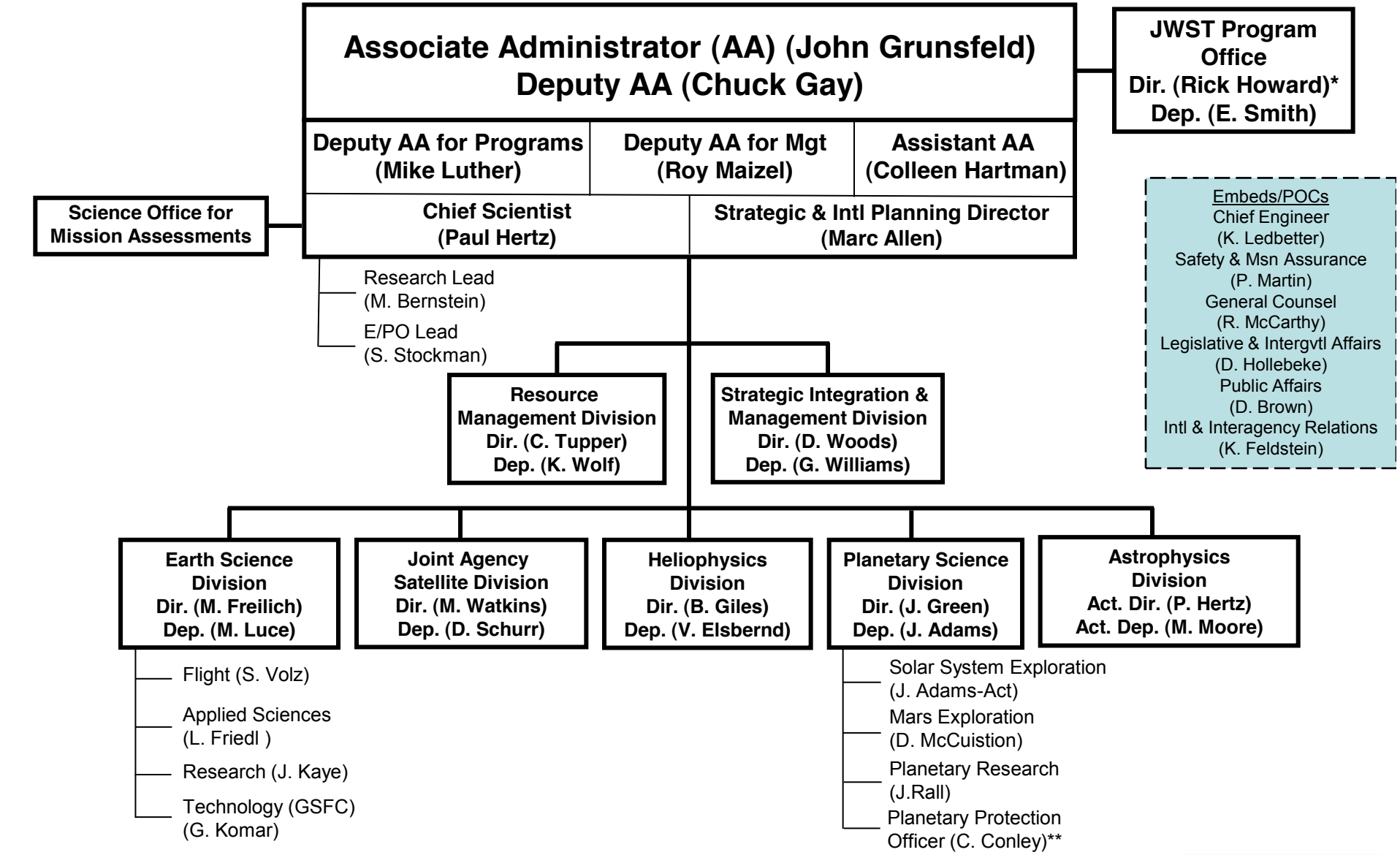
Astronomy and Astrophysics Advisory Committee

February 11, 2012

Agenda

- Organization Charts
- Missions and Significant Accomplishments
- Senior Review
- X-Ray and Gravitational Wave Concept Studies
- ESA Cosmic Vision Status
- Euclid
- WFIRST
- Theory and Computational Networks
- Kepler Candidates

SMD Organization Chart



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

January 2012

Astrophysics Division Organization Chart

February 1, 2012

Resource Management
Holly Degn +
David Darbouze +

Director (Acting)
Paul Hertz
Deputy Director (Acting)
Michael Moore

Lead Secretary: Kelly Johnson
Secretary: Leslie Allen
Program Support Specialist: Sheila Gorham

Asst Dir for Innovation & Technology: Michael Moore (acting)
PE for Tech & Ops Missions: William (Billy) Lightsey *
Asst Dir for Policy & Planning: Vacant

Communications
Division E/PO POC: Hashima Hasan (Lead)
Division PAO POC: Ilana Harrus *
Information Manager: Lisa Wainio *

Astrophysics Research

Program Manager: Linda Sparke
Program Support: Tina Swindell *
Astrophysics Data Analysis: Doug Hudgins
Astrophysics Theory: Linda Sparke
Origins of Solar Systems: Mario Perez *
APRA lead: Ilana Harrus *
Cosmic Rays, Fundamental Physics: Vernon Jones
Gamma Ray/X-ray: Ilana Harrus *, Wilt Sanders *
Lou Kaluzienski
Optical/Ultraviolet: Mario Perez *
Hashima Hasan
IR/Submillimeter/Radio: Chris Davis *, Doug Hudgins
Glenn Wahlgren *, Bill Danchi *
Lab Astro: Glenn Wahlgren *
ADCAR:Archives/High End computing: Hashima Hasan
Astrophysics POC for Sounding rockets: Wilt Sanders *
Balloons Program: Vernon Jones (PS), Mark Sistilli (PE)

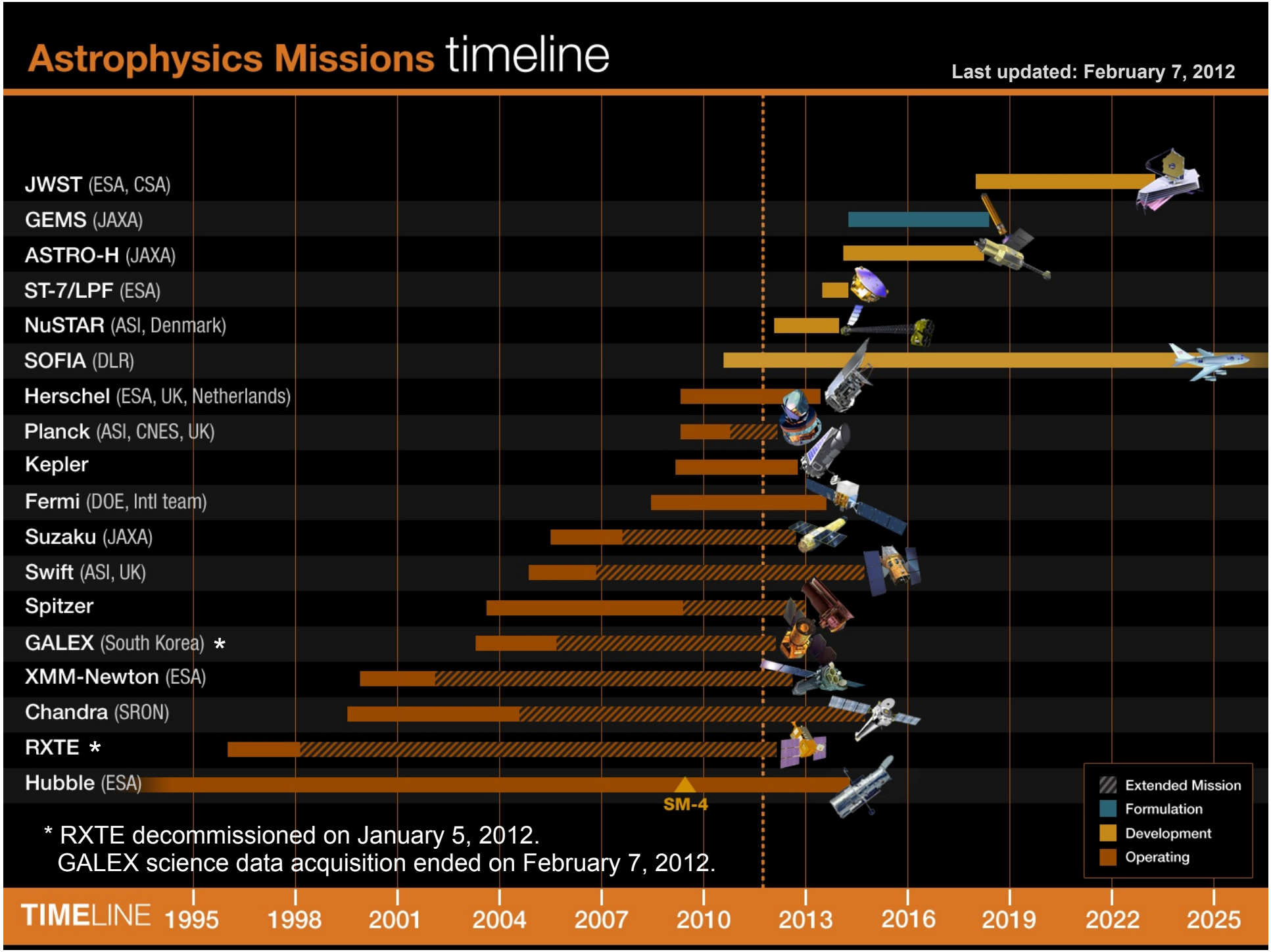
Programs / Missions

	Program Scientist	*Program Executive*
Exoplanet Exploration (EXEP)		
LEADS	**Doug Hudgins**	**Lia LaPiana**
Keck	Mario Perez *	Mario Perez *
Kepler	Doug Hudgins	Jaya Bajpayee *
LBTI	Mario Perez *	Michael Moore
NExScI	Mario Perez *	Lia LaPiana
Cosmic Origins (COR)		
LEADS	**Mario Perez ***	**Michael Moore**
Herschel	Bill Danchi *	Jaya Bajpayee *
HST Ops	Richard Griffiths *	John Gagosian
JWST	Hashima Hasan	N/A
SOFIA	Chris Davis *	John Gagosian
Spitzer	Bill Danchi *	Jaya Bajpayee *
Physics of the Cosmos (PCOS)		
LEADS	**Rita Sambruna**	**Jaya Bajpayee ***
Chandra	Wilt Sanders *	Jaya Bajpayee *
Fermi	Ilana Harrus *	Jaya Bajpayee *
Planck	Bill Danchi *	Jaya Bajpayee *
ST-7/LPF	Wilt Sanders *	Anne-Marie Novo-Gradac
XMM-Newton	Lou Kaluzienski	Jaya Bajpayee *
Astrophysics Explorers (APEX)		
LEADS	**Wilt Sanders ***	**Anne-Marie Novo-Gradac**
Astro-H	Lou Kaluzienski	Anne-Marie Novo-Gradac
GALEX	Mario Perez *	Jaya Bajpayee *
GEMS	Richard Griffiths *	Lia LaPiana
NuSTAR	Lou Kaluzienski	Mark Sistilli
RXTE	Ilana Harrus *	Jaya Bajpayee *
Suzaku	Lou Kaluzienski	Jaya Bajpayee *
Swift	Ilana Harrus *	Jaya Bajpayee *
WISE	Bill Danchi *	Jaya Bajpayee *
WMAP	Bill Danchi *	Jaya Bajpayee *

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

Astrophysics Missions timeline

Last updated: February 7, 2012



* RXTE decommissioned on January 5, 2012.
GALEX science data acquisition ended on February 7, 2012.

Astrophysics Mission Events

CY2011 | 2012 | 2013 | 2014 | 2015

Mission Launches etc.

- Mar14 **NuSTAR**
- Spring **Explorer** Downselect
- TBD 2014 **LPF/ST-7**
- Apr/Aug **Astro-H**
- Nov **GEMS**

Suborbital
Rocket Program.

- Jan FIRE
- Oct PICTURE 1
- Oct XQC 4
- Dec EXOS 2
- Feb CIBER 1-3
- Apr FORTIS 1
- May IMAGER 1
- Oct SLICE
- Oct ACCESS 1
- Oct MicroX
- Nov XACT 1
- Dec DXL 1
- Feb ACCESS 2
- Jun XACT 2
- Sep ACCESS 3
- TBD XQC 5
- TBD EXOS 3
- TBD FORTIS 2
- TBD EXOS 4

Balloon Campaigns

- Antarctica: D/J (***CREAM VI, BLAST, SPB Test***) D/J (***STO, CREST***) D/J D/J
- Sweden: M/J (No astrophysics flights) M/J (Superpressure)
- Ft. Sumner (spr): A/M J/J
- Palestine: Jul (CULIT)
- Ft. Sumner (fall): A/S (***GRAPE, COFE, WASP***) A/S (PROTOEXIST, WASP) A/S
- Australia: M/A (***HERO***) M/A M/A

Opportunities

- July 8 **SOFIA Instr AO**
- TBD **SMEX or MoO AO**

Future AOs will depend upon availability of resources.

Last Updated: February 8, 2012

Astrophysics - Missions in Formulation & Implementation

Project	Overall previous months				This Month					Comments
	-4	-3	-2	-1	O	T	C	S	P	
Physics of the Cosmos	G	G	G	G	G	G	G	G	G	
ST-7 (NET Apr 2014)	G	G	G	G	G	G	G	G	G	ESA preparing spacecraft for 1-year storage period.
Explorer Program										
NuSTAR (Mar 14, 2012)	Y	Y	Y	Y	Y	G	G	Y	G	LRD 3-14-2012.
Astro-H (Aug 2014)	Y	Y	Y	Y	Y	Y	Y	Y	G	Mission CDR Feb 2012.
GEMS (Nov 2014)	Y	Y	Y	R	Y	Y	Y	Y	Y	Mission PDR February 2012. Confirmation Review April 2012.
FINESSE, TESS, NICER, GUSSTO					G	G	G	G	G	Phase A reports due Sep 21, 2012.
Cosmic Origins	G	G	G	G	G	G	G	G	G	
SOFIA (ongoing)	G	G	G	G	G	G	G	G	G/ Y	Began Major System Upgrades. Instrument selection Spring 2012. Flights to resume in the 3rd quarter of CY 2012.
Exoplanet Exploration	G	G	G	G	G	G	G	G	G	
Balloon Prog (ongoing)	G	G	G	G	G	Y	G	G	G	Antarctica campaign completed with two Astrophysics science payloads.

O: Overall, C: Cost, S: Schedule, T: Technical, P: Programmatic

On plan, adequate margin

Problems, working to resolve within planned margin

Problems, not enough margin to recover

Accomplishments & Significant Events

Engineering model mirror fit check at JAXA

Astro-H

- Japanese government has approved Astro-H budget for the new fiscal year.
- The engineering model Calorimeter Spectrometer Insert (detector) has completed all pre-ship activities and is now packed and ready for shipment to Japan.
- Build-up of the engineering model Aperture Assembly has begun.

NuSTAR Observatory

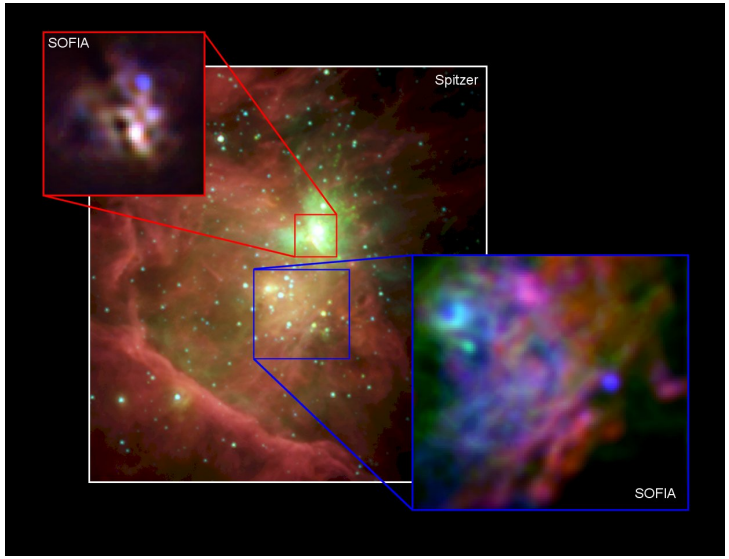
NuSTAR

- March 14 launch readiness date approved at Jan 6 SMD/ DPMC.
- Successfully completed NuSTAR Observatory Integration and Test.
- NuSTAR Observatory was shipped from OSC (VA) to Vandenberg Air Force Base (VAFB) January 24-27. Integration of the spacecraft and booster occurs at Vandenberg.
- NuSTAR Observatory/Pegasus launch vehicle will be shipped from VAFB to Kwajalein Island in early March 2012.

Accomplishments & Significant Events (cont.)

SOFIA

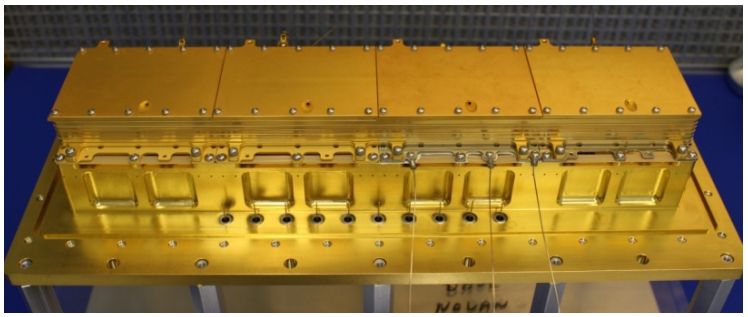
- Completed Segment 2 Development and 45 early science and telescope characterization flights.
- Started Major Observatory Upgrades (aircraft avionics upgrades, new platform wiring installation, telescope pre-cooling system).
- Selected 13 teams of Airborne Astronomy Ambassadors (26 educators from 14 states) for Cycle 1 Science Flights in 2012-13.
- Proposals received for second generation instruments. Selection anticipated Spring 2012.
- Approximately 130 Cycle 1 GO proposals received.



SOFIA Looks at the Heart of the Orion Nebula.

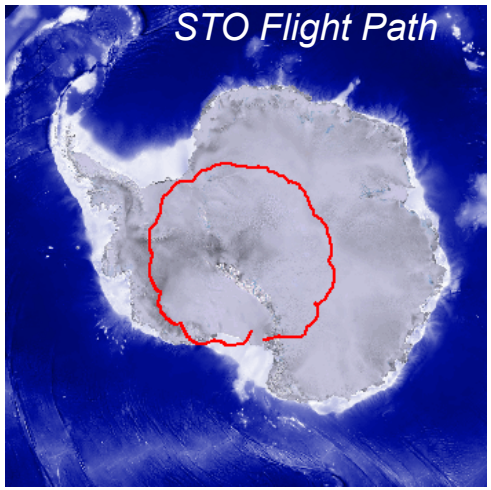
GEMS

- Polarimeter instrument completed TRL-6 activities Oct 2011. Flight requirements met.
- SMD/DPMC held Jan 13, 2012. Project given permission to continue to Confirmation Review in April 2012.
- Instrument and Mission PDR's planned for February 2012, Confirmation Review (KDP-C) planned for April 2012.



Interior of GEMS Engineering Test Unit Polarimeter

Accomplishments & Significant Events



Balloon Program

- STO (Stratospheric Terahertz Observatory) Astrophysics payload was launched from McMurdo, Antarctica on January 14, 2012.
  - STO will provide 3-dimensional maps of the structure, dynamics, and thermodynamics of our galaxy's interstellar medium and star formation rate.
  - The STO PI is Chris Walker from the University of Arizona.
  - STO made one complete revolution around the continent in ~13 days.
  - Five days of cold data obtained due to leak in cryostat; warm data mission after. Minimum science requirements were achieved.
- STO and CREST payloads recovered.

Astrophysics – Operating Missions

Mission	Launch	End Date	Phase	-4	-3	-2	-1	Jan 2012	Comments
Hubble	1990-04-24	2014-05-31	Prime	G	G	G	G	G	COS FUV detector sensitivity decline is being monitored.
RXTE	1995-12-30	2012-01-05	Ext	G	G	G	G		Sci Ops ended Jan 3, spacecraft decommissioned on Jan 5 after 16 years of operations.
Chandra	1999-07-23	2014-09-30	Ext	G	G	G	G	G	
XMM-Newton	1999-12-10	2012-09-30	Ext	G	G	G	G	G	
GALEX	2003-04-28	2012-03-31	Ext	G	G	G	G	G	NASA Sci Ops ended on Feb 7, after 8 years of operations.
Spitzer	2003-08-25	2012-12-31	Ext	G	G	G	G	G	
Swift	2004-11-20	2014-09-30	Ext	G	G	G	G	G	
Suzaku	2005-07-10	2012-09-30	Ext	G	G	G	G	G	
Fermi	2008-06-11	2013-08-18	Prime	G	G	G	G	G	
Kepler	2009-03-07	2012-11-07	Prime	G	G	G	G	G	Successfully completed Quarter 11 spacecraft roll and science data collection activity. Data released early.
Herschel	2009-05-14	2013-05-14	Prime	G	G	G	G	G	GO awards U.S.-based PI's 49%.
Planck	2009-05-14	2012-02-14	Ext	G	G	G	G	G	As anticipated, the High Frequency Instrument ran out of coolant on Jan 14. The LFI instrument will continue surveying the sky for ~1 more year.

On plan, adequate margin

Problems, working to resolve within planned margin

Problems, not enough margin to recover

2012 Senior Review of Operating Missions

Invited Missions	
Planck	Hubble
Chandra	Fermi
Warm Spitzer	Kepler
Swift	
XMM-Newton	
Suzaku	

2012 Senior Review Schedule	
Draft Call for proposals	Jul 1, 2011
Call for Proposals	Aug 10, 2011
EPO SR Proposals Due	Dec 15, 2011
SR Proposals Due	Jan 18, 2012
EPO Section Review	Jan 23 - 25, 2012
SRC Meets	Feb 28 - Mar 2, 2012
Final Report	Mar 30, 2012

Changes to the 2012 Senior Review

- Expanded Senior Review invitation list to cover all astrophysics missions in or entering extended operations.
- EPO review part of 2012 Senior Review.
  - In 2010, the EPO review was performed separately, after the Senior Review.

New Projects in the Senior Review

- Kepler and Fermi were invited to participate in the 2012 Senior Review - completed Level 1 requirements review.
- In 2009, the Astrophysics Subcommittee recommended that Hubble be invited to the 2012 Senior Review.

http://science.nasa.gov/astrophysics/2012-senior-review/

X-Ray & Gravitational Wave Concept Studies

Important Dates

X-Ray Concept Study	
RFI Release	Sept 13, 2011
Responses Due	Oct 28, 2011
CST solicitation release (thru Dear Colleague Ltr)	Oct 3, 2011
CST responses due	Oct 19, 2011
Community Workshop	Dec 2011
Mission Design Activity	Feb-Apr 2012
Draft Report Release	Early June, 2012
Final Report Release	Late June 2012
CAA Presentation	TBD

GW Concept Study	
RFI Release	Sep 27, 2011
Responses Due	Oct 28, 2011
CST solicitation release (thru Dear Colleague Ltr)	Oct 7, 2011
CST responses due	Oct 25, 2011
Community Workshop	Dec 2011
Mission Design Activity	Feb-Apr 2012
Draft Report Release	Early June 2012
Final Report Release	Late June 2012
CAA Presentation	TBD

- Concept Study activity will conclude with presentations to the CAA.
- The study team, including the Community Science Team (CST) will then be disbanded.
- Concept studies being considered for Exoplanet and UV/Optical science.

http://pcos.gsfc.nasa.gov/studies/

X-ray Concept Study Status

- 29 RFI responses were received in late October, 2011.
  - 16 mission concepts; 13 enabling technology
- Open workshop was held Dec 14-15, 2011.
- Three notional missions selected by Community Science Team for further study
  - Calorimeter mission (5000 cm^2 at 1 keV; 2000 cm^2 at 6 keV; DE<3 keV)
  - Gratings mission (500 cm^2 0.2-1.5 keV; R>3000)
  - Wide field imaging mission (5000 cm^2 at 1 keV; FoV>30 arcmin)
- GSFC design lab runs planned for notional missions.
  - “Delta” studies will investigate cost scaling with mission size
- Draft outline for study report has been developed.

Gravitational Wave Mission Concept Study

- 17 Responses to RFI
  - 12 Mission Concepts
  - 3 Instrument Concepts
  - 2 Technology
- At the Workshop (Dec 20-21), Community Science Team recommended Team-X mission studies of:
  - 1 LISA-like concept
  - 1 Geocentric, ultra low-cost concept
  - Possibly 1 non-drag-free concept, pending further analysis

ESA Cosmic Vision Status
Astrophysics

M-Class Missions (M1 and M2)

- ✓ October 2011, the Science Programme Committee (SPC) met and approved the SSAC decision on two missions, Euclid and Solar Orbiter, for the release of the industrial 'Invitation to Tender'.
- June 2012, following 'consolidation' of member-state partnerships and agreements, the Science Programme Committee will consider 'adoption' of missions (Cost-at-Completion and Payload Formal Agreement).
- June 2012, Euclid enters Implementation Phase immediately after adoption by the SPC for launch in 2019.

M-Class Mission M3

- ✓ EChO, LOFT, MarcoPolo-R and STE-QUEST selected for Assessment Phase and further downselect for launch in 2022. (PLATO may be included if the mission re-proposes per AWG recommendation.)

Timeline for selection of M-Class missions from: http://sci.esa.int/science-e/www/object/index.cfm?fobjectid=42370

ESA Cosmic Vision Status
Astrophysics

L-Class Missions (L1)

- ✓ October 2007: EJSM-Laplace, IXO & LISA selected for study, with NASA in a key role in all three.
- ✓ February 2011: Assessment phase completed, but Astro2010 and NASA budget preclude proceeding.
- ✓ April 2011: ESA defined new approach – European-led teams to define affordable European-led missions with limited international participation for launch in early 2020s.
- ✓ ATHENA (Advanced Telescope for High ENergy Astrophysics, replacing IXO), NGO (New Gravitational wave Observatory, replacing LISA), and JUICE (Jupiter Icy Moons Explorer, replacing EJSM-Laplace) studies are underway.
  - ✓ Technical studies completed in November 2011.
  - – Review by ESA advisory bodies in December 2011 – February 2012.
- February 2012 SPC to consider mission funding and management schemes.
- April 2012: SSAC recommendation to SPC for one mission to enter phase A/B1.
- L1 target launch date ~2022.

ESA's Euclid

- ✓ On September 19, 2011, ESA sent its recommendations to the Science Programme Committee (SPC).
  - ✓ ESA recommended that Solar Orbiter and Euclid be selected as M1 and M2, respectively, and will propose that PLATO continue in the competitive process for the M3 mission.
  - – ESA has asked for a longer definition phase for Euclid than previously planned and ESA will propose that the SPC adopt the mission in June 2012 instead of February 2012. The launch would be in Q4 2019.
- ✓ October 2011, SPC decision on two missions for ITT release.
- • June 2012, SPC adoption of missions (Cost-at-Completion and Payload Formal Agreement).
- • June 2012, missions enter Implementation Phase.

National Academies Report on Euclid

- ✓ The National Research Council organized an ad hoc study to assess if a proposed NASA plan for a U.S. hardware contribution to the European Space Agency Euclid mission, in exchange for U.S. membership on the Euclid Science Team and science data access, is a viable part of an overall strategy to pursue dark energy, exoplanet detection, and infrared survey science goals articulated in the Astro2010 decadal survey report.

From the Feb 2012 National Academies Report on NASA Participation in Euclid

- While WFIRST dark energy measurements are expected to be superior to Euclid's, U.S. participation in Euclid will have clear scientific, technical, and programmatic benefits to the U.S. community as WFIRST and Euclid go forward.
- NASA should make a hardware contribution of approximately $20 million to the Euclid mission to enable U.S. participation. This investment should be made in the context of a strong U.S. commitment to move forward with the full implementation of WFIRST in order to fully realize the decadal science priorities of the 2010 Decadal report.
- In exchange for this small, but crucial contribution, NASA should secure through negotiation with the European Space Agency both a U.S. position on the Euclid Science Team and the inclusion of a team of U.S. scientists in the Euclid Consortium with full data access that would be selected by a peer-reviewed process.

WFIRST (Wide-Field Infrared Survey Telescope)

- Science Definition Team has delivered its interim report in July 2011.
  - Copy of the report can be found at: *http://wfirst.gsfc.nasa.gov/science/WFIRST_Interim_Report.pdf*
  - The Interim Design Reference Mission (IDRM) is a proof of concept that a mission can be constructed that is compliant with the Astro2010 recommendation for groundbreaking observations in Dark Energy, Exoplanet and NIR sky surveys.
- Updated guidance given to Science Definition Team Dec 8, 2011.
  - Accounts for updated events since initial kickoff meeting.
  - Second Design Reference Mission being studied.
  - Second DRM will not duplicate capabilities of Euclid, LSST, and JWST in advancing science objectives of WFIRST.
- Science Definition Team met Feb 2-3, 2012. Next meeting March 1-2, 2012.
- Final report due June 2012.

Theory and Computational Networks

- Astro2010 recommended a new competed program with coordinated interagency support to enable the large-scale theoretical and computational investigations identified as science priorities by Astro2010.
- NASA and NSF have discussed the possible creation of such a joint program that should
  1. Advance both theoretical and computational astrophysics;
  2. Be explicitly multi-disciplinary; and
  3. Address workforce development in new research techniques.
- NSF and NASA have requested the assistance of the AAAC to better define the scope of such a program. (Discussion follows later today.)
- Based on the report of the AAAC in mid-2012, the Agencies will consider the opportunity to issue a joint solicitation in late 2012, with the first network selections in 2013.

Size of Kepler Planet Candidates

Kepler Exoplanets = 61