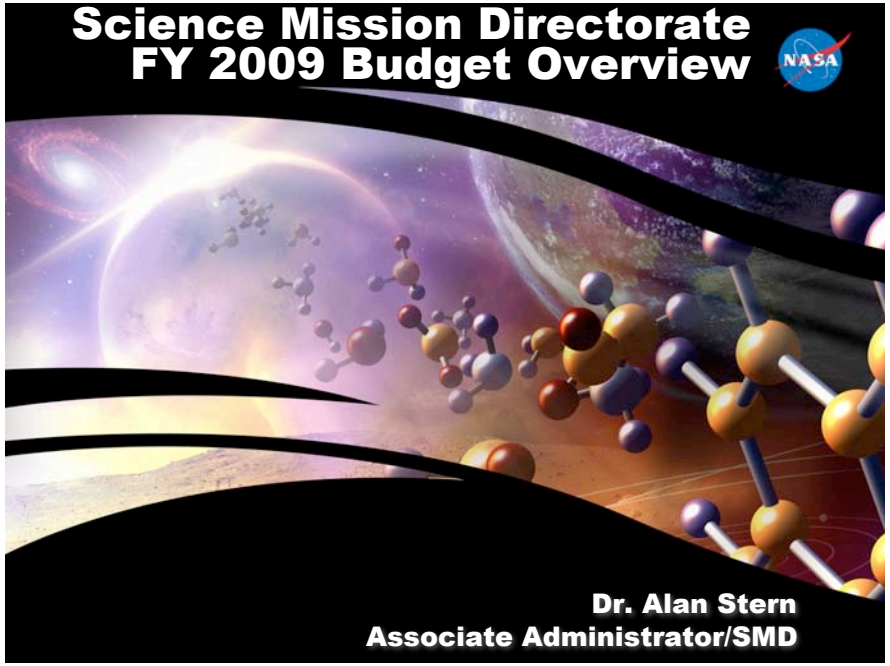
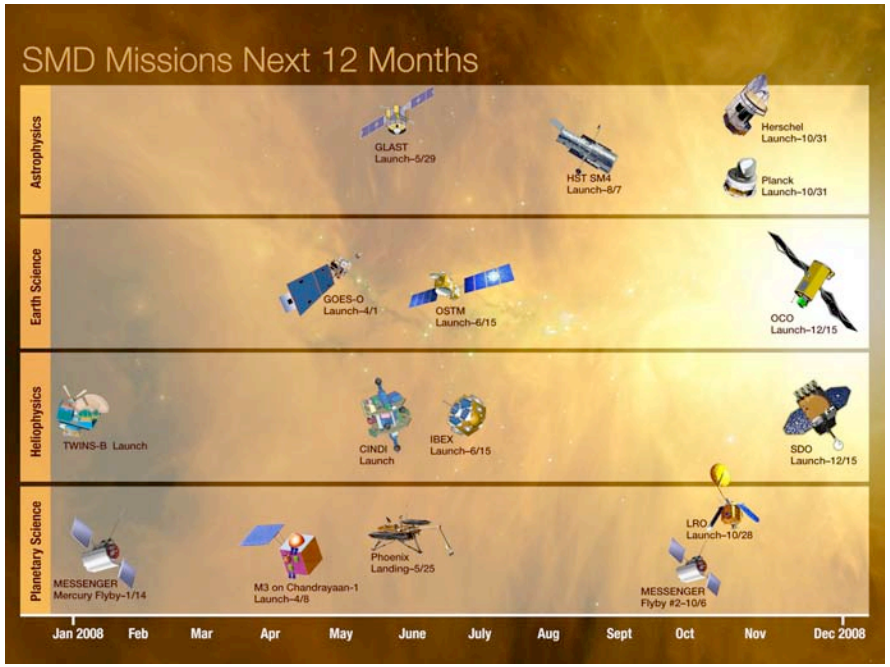
# Science Mission Directorate FY 2009 Budget Overview



Dr. Alan Stern
Associate Administrator/SMD

## SMD'S SCIENCE PROGRAM LEADS THE WORLD

- $4.5B/YEAR BUDGET.
- LARGE EARTH SCIENCE, HELIOPHYSICS, PLANETARY SCIENCE, & ASTROPHYSICS PROGRAMS.
- 55 FLIGHT MISSIONS IN OPERATION AS OF DEC '07.
- 30 FLIGHT MISSIONS IN DEVELOPMENT AS OF DEC '07.
- 3000+ OPERATING R&A GRANTS.
- THESE NUMBERS EXCEED THE COMBINED EFFORTS OF ALL THE OTHER EARTH & SPACE SCIENCE PROGRAMS OF THE WORLD.


## SMD MANAGEMENT OBJECTIVES

- We will get more science done within our budget.
- We will help ensure that U.S. Space Exploration Policy succeeds.
- We will promote U.S. leadership across all of SMD's science disciplines.
- We will improve SMD's actual and perceived impact on, and relevance to, the public.
- We will create a better workplace.

# SELECTED MAJOR ACCOMPLISHMENTS IN 2007

## Earth Science Division

- We launched NOAA-N (POES) for NOAA.
- We completed concept studies for all 15 Earth Science Decadal Survey missions, and held community workshops for the 4 highest priority.
- We conducted a comprehensive Senior Review involving operational agency as well as science input, resulting in the approval of extensions to 11 Earth observing missions.
- We continued the development of 7 new Earth science and applications missions for launch between 2008 and 2013.
- We advanced OSTM, GOES-O and OCO toward their 2008 launch dates.

# SELECTED MAJOR ACCOMPLISHMENTS IN 2007

## Astrophysics Division

- The SOFIA airborne infrared observatory reached first flight milestone in April 2007. The date for first science flights was accelerated to 2009.
- The James Webb Space Telescope flagship mission completed its technology non-advocate review (TNAR) in 2007 and is now preparing for its Preliminary Design Review (PDR) to proceed into the development phase in spring 2008.
- We completed instrument deliveries to our European partners for the Herschel and Planck missions to be launched in late 2008.
- We completed integration and testing of the Gamma-ray Large Area Space Telescope (GLAST) and are proceeding with satellite level thermal-vacuum testing in preparation for launch in late spring 2008.
- We continued preparing for the shuttle mission to service the Hubble Space Telescope in late summer 2008.
- We restarted the NuSTAR small Explorer black hole finder mission toward launch in 2011.
- We expanded suborbital programs and revitalized the Explorer mission queue.
- We solicited proposals for large and medium class Astrophysics Strategic Mission Concept Studies to help provide technical inputs to the upcoming Astronomy & Astrophysics Decadal Survey and received 42 proposals.

# SELECTED MAJOR ACCOMPLISHMENTS IN 2007

## Heliophysics Division

- We successfully launched five missions (comprising ten spacecraft): Hinode (by Japan, 1), STEREO (2), ST-6 (1), THEMIS (5), and AIM (1).
- We selected BARREL as our Geospace Mission of Opportunity.
- We initiated the Explorer SMEX and MoO AO; Phase A down-select is planned for May 2009; three new Heliophysics/Astrophysics missions are to fly beginning in 2012.
- We continued development of the next solar physics mission– the Solar Dynamics Observatory (SDO)-- toward launch in late 2008.
- We restructured the long-awaited Solar Probe mission to be a higher value, lower cost, non-nuclear mission in the medium cost category ("Solar Probe Plus").

# SELECTED MAJOR ACCOMPLISHMENTS IN 2007

## Planetary Division

- We launched the Phoenix Mars lander to a landing in May 2008 and the Dawn asteroid orbiter to reach Vesta in 2011 and Ceres in 2015.
- We conducted the New Horizons Jupiter flyby on the way to Pluto (arrival in 2015).
- We completed the MSL Mars rover CDR, in prep for launch in 2009.
- We selected two Mars Scout mission for Phase A; down-select will occur in late 2008.
- We selected the EPOXI (using Deep Impact) and NExT (using Stardust) comet missions for 2010 and 2011 flybys.
- We selected GRAIL as the next Discovery mission, to be launched in 2010/2011.

# IN TOTAL WE MADE FIVE MISSION NEW STARTS IN 2007

- **Astrophysics**: NuSTAR Small Explorer.
- **Heliophysics**: BARREL Mission of Opportunity.
- **Planetary**: GRAIL Discovery mission, and two Missions of Opportunity: the NExT and EPOXI comet flyby (using the operational Stardust and Deep Impact spacecraft).

# SMD'S CROSS-CUTTING FY09 BUDGET OBJECTIVES

- Accelerate the Earth Science Decadal Survey mission queue.
- Increase space science R&A/MO&DA to get better value from our flight missions.
- Increase space science suborbital research programs to foster PI on-ramps, technology demonstration, and accomplish more science.
- Increase the number of planned missions in all four of SMD's science theme areas.
- Support NRC Decadal Survey priorities.
- Initiate an SMD lunar robotic science program.

# MAJOR FY09 BUDGET CHANGES

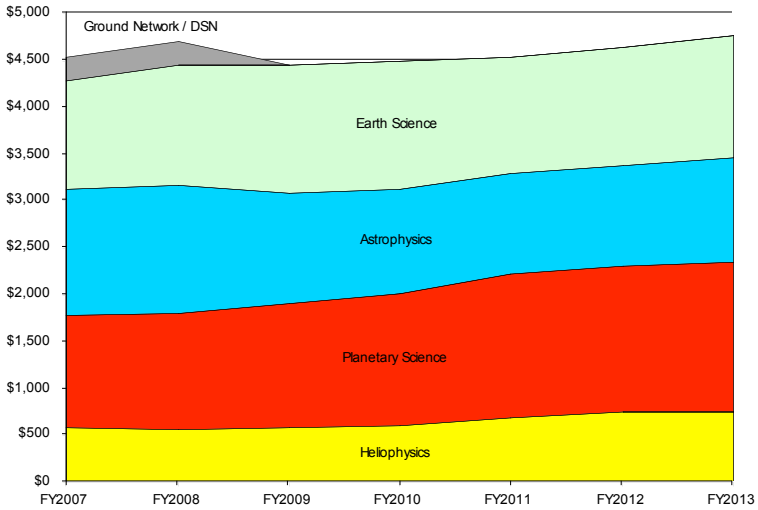
- Increased commitment to Earth Science over 5 years.
- Initiated seven new FY09 mission starts: more than in the past four budgets combined; at least one per SMD science area:
  - Earth Science: SMAP and IceSat II (2012, 2015 launches)
  - Astrophysics: JDEM (launch in 2014/2015)
  - Heliophysics: Solar Probe Plus (launch in 2015)
  - Planetary: Outer Planets Flagship (launch by 2017) small lunar science orbiter (launch by 2011), and lunar mini-landers (launch by 2014).
- Substantial increases in astrophysics, heliophysics, and planetary science R&A/MO&DA.
- Increased budgets for suborbital rockets and balloons.
- Funding for new starts and R&A increases came from internal transfers, efficiencies, out-year mission ops savings, and re-phasings for MMS and Scout.

# NASA AND SMD PRESIDENT'S BUDGETS: FY09-FY13

| | *FY2007 | *FY2008 | FY2009 | FY2010 | FY2011 | FY2012 | FY2013 |
|---|---|---|---|---|---|---|---|
| Total NASA | $16,231.0 | $17,300.5 | $17,610.7 | $18,022.9 | $18,457.0 | $18,901.6 | $19,355.4 |
| Science | $4,609.9 | $4,706.2 | $4,441.5 | $4,482.0 | $4,534.9 | $4,643.4 | $4,761.6 |
| Earth Science | $1,198.5 | $1,280.3 | $1,367.5 | $1,350.7 | $1,250.9 | $1,264.4 | $1,290.3 |
| Planetary Science | $1,215.6 | $1,247.5 | $1,334.2 | $1,410.1 | $1,537.5 | $1,570.0 | $1,608.7 |
| Astrophysics | $1,365.0 | $1,337.5 | $1,164.5 | $1,122.4 | $1,057.1 | $1,067.7 | $1,116.0 |
| Heliophysics | $583.7 | $590.9 | $575.3 | $598.9 | $689.4 | $741.2 | $746.6 |
| DSN/Ground Network | $247.2 | $250.0 | | | | | |
| Aeronautics Research | $593.8 | $511.7 | $446.5 | $447.5 | $452.4 | $456.7 | $467.7 |
| Education | $114.1 | $137.9 | $112.1 | $122.7 | $120.4 | $120.4 | $120.4 |
| Exploration Systems | $2,837.6 | $3,143.0 | $3,500.5 | $3,737.7 | $7,048.2 | $7,116.8 | $7,666.8 |
| Constellation Systems | $2,114.7 | $2,471.9 | $3,048.2 | $3,252.8 | $6,479.5 | $6,521.3 | $7,080.5 |
| Advanced Capabilities | $722.9 | $671.1 | $452.3 | $484.9 | $568.7 | $595.5 | $586.3 |
| Space Operations | $5,093.5 | $5,526.2 | $5,774.7 | $5,872.7 | $2,900.1 | $3,089.9 | $2,788.5 |
| Space Shuttle | $3,295.3 | $3,266.7 | $2,981.7 | $2,983.6 | $95.7 | | |
| International Space Station | $1,469.0 | $1,813.2 | $2,060.2 | $2,277.0 | $2,176.4 | $2,448.2 | $2,143.1 |
| Space and Flight Support (SFS) | $329.2 | $446.3 | $732.8 | $612.1 | $628.0 | $641.7 | $645.4 |
| Cross-Agency Support | $2,949.9 | $3,242.9 | $3,299.9 | $3,323.9 | $3,363.7 | $3,436.1 | $3,511.2 |
| Agency Management and Operations | $971.2 | $830.2 | $945.6 | $945.5 | $939.8 | $950.5 | $961.3 |
| Institutional Investments | $223.8 | $319.7 | $308.7 | $331.7 | $335.9 | $330.4 | $338.3 |
| Congressionally Directed Items | | $80.0 | | | | | |
| Center Management and Operations | $1,754.9 | $2,013.0 | $2,045.6 | $2,046.7 | $2,088.0 | $2,155.2 | $2,211.6 |
| Inspector General | $32.2 | $32.6 | $35.5 | $36.4 | $37.3 | $38.3 | $39.2 |

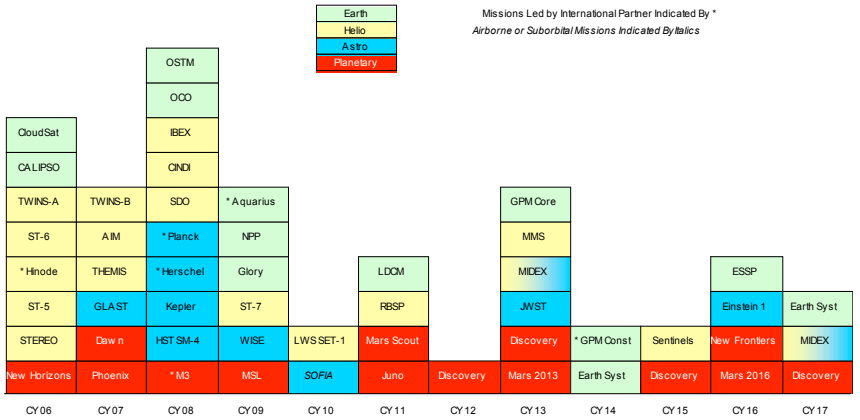
* FY07-08 are consistent with IBPD, and exclude latest Operating Plans. Subsequent charts INCLUDE Operating Plans.

# SMD BUDGET BY SCIENCE THEME



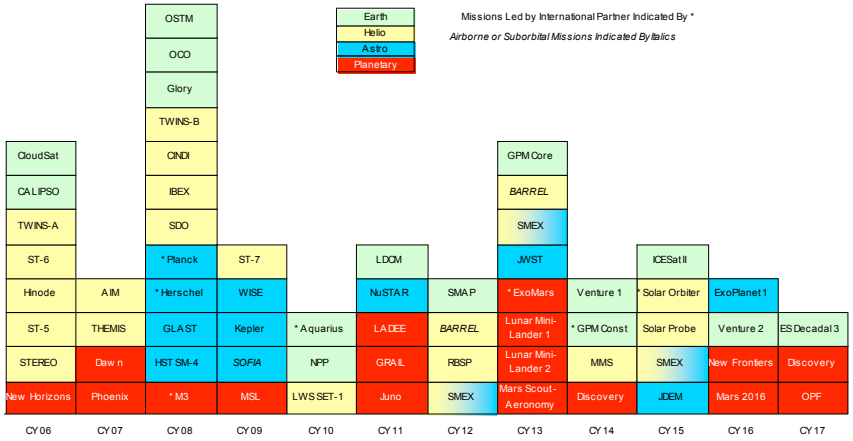

# SMD'S FLIGHT PROGRAM: JANUARY 2007

Launches by Calendar Year



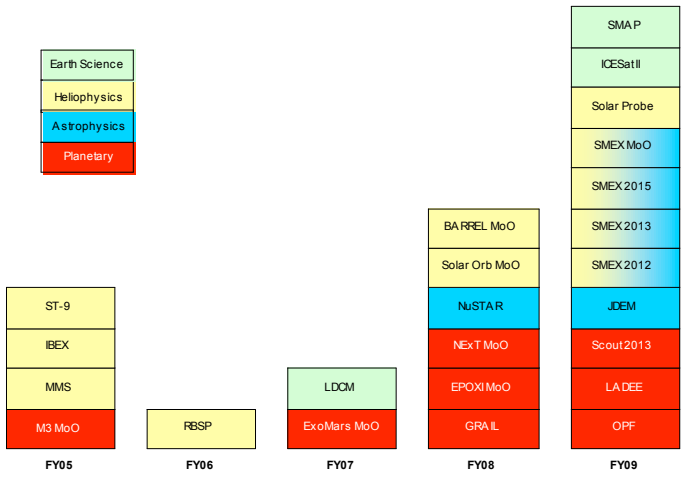

# SMD'S FLIGHT PROGRAM: JANUARY 2008

Launches by Calendar Year




# NEWLY STARTED MISSIONS

New Starts Defined as a Phase A Start Year or Final Downselect Year, Whichever is Later.



# Earth Science Program Content

| | * FY07 | * FY08 | FY09 | FY10 | FY11 | FY12 | FY13 |
|---|---|---|---|---|---|---|---|
| FY09 President's Budget * | 1,152.3 | 1,284.2 | 1,367.5 | 1,350.7 | 1,250.9 | 1,264.4 | 1,290.3 |
| | | | | | | | |
| Earth Systematic Missions | 396.2 | 548.3 | 677.9 | 661.5 | 583.2 | 563.6 | 569.6 |
| GPM | 23.8 | 74.4 | 125.8 | 161.7 | 129.8 | 140.0 | 113.3 |
| Glory | 91.3 | 47.8 | 29.7 | 9.1 | 9.8 | 2.7 | |
| LDCM | 33.9 | 133.0 | 139.4 | 127.1 | 96.0 | 11.3 | 2.7 |
| NPP | 35.7 | 58.8 | 94.4 | 52.2 | 8.6 | 8.9 | 9.2 |
| OSTM | 42.6 | 28.7 | 8.0 | 7.8 | 7.7 | 7.3 | 7.3 |
| Decadal Survey Missions | 0.6 | 33.0 | 103.2 | 116.2 | 150.0 | 250.2 | 290.7 |
| Other Missions and Data Analysis | 168.2 | 172.7 | 177.4 | 187.5 | 181.2 | 143.1 | 146.3 |
| | | | | | | | |
| Earth System Science Pathfinder (ESSP) | 156.9 | 105.6 | 88.6 | 58.8 | 37.4 | 50.0 | 54.9 |
| OCO | 76.1 | 47.3 | 25.4 | 9.0 | 1.4 | | |
| Aquarius | 60.9 | 30.7 | 33.8 | 27.9 | 5.1 | 4.0 | 2.9 |
| Other Missions and Data Analysis | 19.9 | 27.7 | 29.4 | 21.9 | 30.8 | 46.0 | 52.0 |
| | | | | | | | |
| Earth Science Multi-Mission Operations | 168.0 | 156.0 | 140.5 | 159.1 | 157.9 | 166.5 | 170.9 |
| | | | | | | | |
| Earth Science Research | 348.6 | 380.4 | 380.6 | 388.2 | 390.6 | 400.7 | 409.3 |
| Research and Analysis | 231.6 | 242.5 | 245.7 | 254.0 | 255.5 | 260.3 | 266.5 |
| Computing and Management | 91.3 | 103.4 | 104.9 | 104.7 | 107.3 | 110.1 | 111.8 |
| Airborne Science | 25.6 | 31.1 | 26.3 | 25.7 | 24.0 | 26.4 | 27.0 |
| Near Earth Object Observations | | 3.4 | 3.7 | 3.8 | 3.8 | 3.9 | 4.0 |
| | | | | | | | |
| Applied Sciences | 24.4 | 45.9 | 33.8 | 33.8 | 31.3 | 32.1 | 32.8 |
| Earth Science Technology | 58.3 | 48.0 | 46.1 | 49.2 | 50.6 | 51.6 | 52.8 |

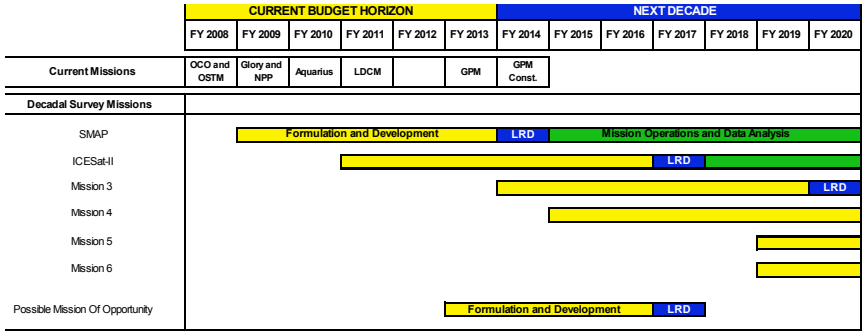
* FY07 and FY08 reflect latest Operating Plan, in FY09 structure

# SELECTED FY09 BUDGET HIGHLIGHTS: EARTH SCIENCE

- **Increased budget by $90M for each of FY09-11, then $150M for each of FY12 and FY13.**
- **Fund the development of two new Decadal Survey missions (SMAP and ICESAT II) and 5 total new mission starts over the next 5 years; first Decadal Survey launch now moved up to 2012.**
- **Continue to implement 7 already started precursor missions (OSTM, OCO, Glory, Aquarius, NPP, LDCM, GPM) for launch between 2008 and 2013.**
- **Fund operations and data production for 14 NASA on-orbit missions in prime and extended phases.**
- **With NOAA, fund and re-manifest key climate time series measurements (OMPS-Limb, CERES, TSIS).**

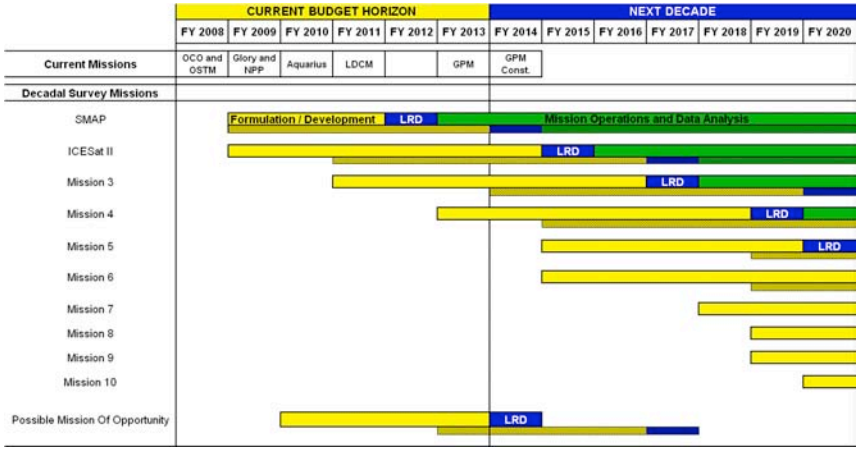
# Earth Science New Initiative

## • PREVIOUS MISSION PROFILE




# Earth Science New Initiative

## NEW vs. PREVIOUS (hatched) MISSION PROFILE



# Earth Science Budget Changes

| | FY07 | FY08 | FY09 | FY10 | FY11 | FY12 | 07-12 Total |
|---|---|---|---|---|---|---|---|
| Content Changes from FY08 | -78.6 | 45.9 | 85.1 | 86.9 | 77.3 | 138.0 | 354.6 |
| Future Missions | 2.6 | 33.0 | 84.4 | 9.3 | -16.8 | 141.4 | 253.9 |
| NPP | -30.8 | -15.4 | 17.8 | 29.7 | 3.0 | 2.6 | 6.9 |
| LDCM | -60.2 | 2.3 | -18.3 | | 64.2 | 8.0 | -4.0 |
| OCO | 8.1 | 11.6 | 13.7 | 3.0 | 1.4 | | 37.8 |
| Operating Missions / Sr. Review | 19.7 | -5.7 | 12.2 | 18.6 | 27.0 | 0.7 | 72.5 |
| All other | -18.1 | 20.2 | -24.7 | 26.3 | -1.5 | -14.7 | -12.5 |

# Astrophysics Program Content

| | * FY07 | * FY08 | FY09 | FY10 | FY11 | FY12 | FY13 |
|---|---|---|---|---|---|---|---|
| FY09 President's Budget * | 1,356.8 | 1,363.4 | 1,164.5 | 1,122.4 | 1,057.1 | 1,067.7 | 1,116.0 |
| Physics of the Cosmos | 196.5 | 157.2 | 157.0 | 219.8 | 249.0 | 271.1 | 326.0 |
| GLAST | 84.4 | 41.9 | 23.2 | 23.3 | 24.1 | 24.9 | 24.9 |
| Herschel | 11.5 | 14.9 | 27.2 | 17.4 | 17.6 | 17.5 | 16.4 |
| Planck | 6.7 | 8.8 | 9.4 | 8.9 | 6.6 | 6.5 | 6.5 |
| JDEM | | 3.7 | 8.5 | 63.0 | 83.0 | 109.0 | 125.0 |
| LISA | 6.5 | 5.7 | 5.7 | 15.9 | 18.7 | 26.7 | 35.0 |
| Constellation-X | 8.3 | 8.1 | 8.3 | 12.0 | 16.8 | 15.9 | 42.0 |
| Other Missions and Data Analysis | 79.1 | 74.1 | 74.9 | 79.3 | 82.1 | 70.6 | 76.2 |
| Exoplanet Exploration | 184.6 | 159.5 | 48.1 | 67.7 | 68.4 | 96.4 | 126.2 |
| SIM | 30.4 | 24.3 | | | | | |
| Kepler | 121.8 | 79.5 | 25.2 | 14.9 | 13.9 | 12.6 | 8.8 |
| Future Exoplanet Missions | 1.0 | 23.8 | 6.6 | 41.7 | 44.0 | 72.0 | 107.5 |
| Other Missions and Data Analysis | 31.3 | 31.9 | 16.3 | 11.2 | 10.5 | 11.7 | 9.9 |
| Cosmic Origins | 788.9 | 816.9 | 674.4 | 571.1 | 515.4 | 485.6 | 458.5 |
| James Webb Space Telescope | 398.6 | 447.4 | 371.9 | 311.1 | 265.1 | 236.1 | 194.9 |
| Hubble Space Telescope | 277.5 | 230.2 | 154.9 | 125.6 | 114.7 | 94.8 | 93.9 |
| SOFIA | 38.9 | 64.0 | 72.8 | 72.8 | 57.0 | 58.8 | 60.6 |
| Spitzer | 73.8 | 75.4 | 71.7 | 15.9 | 10.3 | 3.2 | 3.3 |
| Astrophysics Future Missions | | | 3.0 | 45.8 | 68.3 | 92.7 | 105.8 |
| Astrophysics Explorer | 88.0 | 117.2 | 132.6 | 93.3 | 43.3 | 11.7 | 6.4 |
| WISE | 52.9 | 72.7 | 65.2 | 13.0 | 5.2 | 1.6 | |
| NuSTAR | | 16.7 | 43.5 | 57.8 | 31.0 | 6.8 | 6.4 |
| Operating Explorers | 35.1 | 27.8 | 23.9 | 22.5 | 7.1 | 3.2 | |
| Astrophysics Research | 98.8 | 112.6 | 152.3 | 170.4 | 181.0 | 203.0 | 198.9 |
| Research and Analysis | 52.2 | 56.6 | 61.4 | 65.4 | 69.3 | 72.6 | 77.5 |
| Balloons | 22.2 | 24.0 | 24.6 | 26.7 | 28.8 | 32.4 | 33.2 |
| Other Missions and Data Analysis | 24.5 | 32.0 | 66.3 | 78.4 | 82.9 | 97.9 | 88.2 |

*** FY07 and FY08 reflect latest Operating Plan, in FY09 structure**

# Astrophysics Budget Restructure Crosswalk

**Current Structure**

**New Structure**

- Navigator, Discovery (Kepler) → **Exoplanet Exploration** — "Are we Alone?"
- JWST, HST, SOFIA, Spitzer → **Cosmic Origins** — "How did we get here?"
- Beyond Einstein, GLAST, ISSC, Chandra → **Physics of the Cosmos** — "How does the Universe Work?"
- Astro. Explorers → **Astrophysics Explorer** (Adds operating missions)
- Astro. Research → **Astrophysics Research** (Subtracts operating missions)

# SELECTED FY09 BUDGET HIGHLIGHTS: ASTROPHYSICS

- ❑**Fund a new start for JDEM (Dark Energy Mission) in FY09; continue LISA, Con-X, and Einstein Probe technology investments.**
- ❑**Refocus Navigator/SIM into a new medium class Exoplanet initiative.**
- ❑**Accelerate SOFIA research capability in order to begin in 2009.**
- ❑**Fund a revitalized balloon and suborbital rocket program.**
- ❑**Augment astrophysics R&A 26% in FY09, 46% by FY12.**

# Astrophysics Budget Changes

| | FY07 | FY08 | FY09 | FY10 | FY11 | FY12 | 07-12 Total |
|---|---|---|---|---|---|---|---|
| Content Changes from FY08 | 26.5 | 40.3 | -4.4 | -36.6 | -72.9 | -143.7 | -190.8 |
| JDEM | | 3.7 | 8.5 | 63.0 | 83.0 | 109.0 | 267.2 |
| LISA | -3.3 | 0.7 | 0.5 | 11.0 | 14.0 | 23.0 | 45.8 |
| Constellation-X | 3.3 | 3.0 | 3.0 | 7.0 | 12.0 | 12.0 | 40.3 |
| Physics of the Cosmos Future | -0.2 | -14.2 | -30.8 | -108.1 | -125.8 | -164.4 | -443.5 |
| SIM | -63.8 | 4.1 | -20.7 | -22.0 | -22.3 | -22.6 | -147.3 |
| Future/Other Exoplanet Missions | 1.5 | 20.4 | 0.1 | 32.2 | 32.6 | 60.1 | 146.9 |
| SOFIA | 38.9 | 0.9 | -0.1 | -0.1 | -17.1 | -17.1 | 5.4 |
| Balloons | 2.4 | 2.0 | 0.5 | 2.8 | 5.0 | 7.3 | 20.0 |
| Research and Analysis | 2.1 | 9.0 | 12.5 | 19.2 | 21.2 | 22.8 | 86.8 |
| Hubble Space Telescope | -7.0 | 3.6 | 19.7 | | -10.0 | -30.0 | -23.7 |
| Spitzer / Chandra | -5.0 | | | -33.0 | -34.0 | -60.0 | -132.0 |
| Herschel | -0.2 | 0.4 | | -10.0 | -10.0 | -10.0 | -29.8 |
| Kepler | 32.6 | | 3.8 | 1.5 | 0.5 | -1.8 | 36.6 |
| GLAST | 9.2 | 7.5 | | | | | 16.7 |
| Astrophysics Future | | | 2.8 | 3.1 | -9.8 | -71.9 | -75.8 |
| All other | 16.0 | -0.8 | -4.2 | -3.2 | -12.2 | -0.1 | -4.5 |

# Heliophysics Program Content

| | * FY07 | * FY08 | FY09 | FY10 | FY11 | FY12 | FY13 |
|---|---|---|---|---|---|---|---|
| FY09 President's Budget * | 573.3 | 560.9 | 575.3 | 598.9 | 689.4 | 741.2 | 746.6 |
| Living with a Star | 188.6 | 224.3 | 223.8 | 212.0 | 216.6 | 232.8 | 237.5 |
| SDO | 144.0 | 108.2 | 24.1 | 14.8 | 14.6 | 15.5 | 14.7 |
| Geospace RBSP | 12.9 | 67.9 | 154.4 | 154.7 | 113.4 | 57.9 | 15.8 |
| BARREL | | 0.8 | 0.9 | 3.9 | 2.4 | 2.0 | 2.1 |
| Solar Probe | | 13.9 | | 3.4 | 40.1 | 74.2 | 106.3 |
| Other Missions and Data Analysis | 31.7 | 33.6 | 44.4 | 35.2 | 46.2 | 83.2 | 98.6 |
| Solar Terrestrial Probes | 61.8 | 74.9 | 123.1 | 137.5 | 171.4 | 172.6 | 161.5 |
| MMS | 21.1 | 43.1 | 94.6 | 116.0 | 149.3 | 148.8 | 137.5 |
| Other Missions and Data Analysis | 40.7 | 31.8 | 28.5 | 21.5 | 22.0 | 23.9 | 24.1 |
| Heliophysics Explorers | 74.4 | 57.1 | 41.3 | 66.8 | 125.1 | 156.0 | 160.1 |
| IBEX | 45.1 | 25.8 | 9.5 | 6.9 | 1.0 | | |
| Future Missions | 1.5 | 6.0 | 16.5 | 40.9 | 105.8 | 135.7 | 139.2 |
| Other Missions and Data Analysis | 27.8 | 25.3 | 15.3 | 19.1 | 18.4 | 20.3 | 20.9 |
| Heliophysics Research | 208.0 | 189.6 | 184.8 | 180.3 | 175.3 | 179.8 | 187.5 |
| Research and Analysis | 32.5 | 33.1 | 33.9 | 35.9 | 38.9 | 39.6 | 40.5 |
| Sounding Rockets | 31.9 | 33.6 | 45.1 | 47.3 | 48.9 | 49.7 | 51.8 |
| GSFC Building Support | 30.0 | 20.0 | 12.0 | 12.0 | | | |
| Operating Missions / Data / Modeling | 113.6 | 102.9 | 93.8 | 85.1 | 87.6 | 90.5 | 95.2 |
| New Millenium | 40.5 | 15.0 | 2.3 | 2.2 | 1.1 | | |

* FY07 and FY08 reflect latest Operating Plan, in FY09 structure

# SELECTED FY09 BUDGET HIGHLIGHTS: HELIOPHYSICS

- ❑Fund a new start for Solar Probe Plus.
- ❑Fund ESA Solar Orbiter US participation.
- ❑Fund new Explorer SMEX missions and a major MoO initiative for Heliophysics and Astrophysics.
- ❑Fund a revitalized suborbital rocket and balloon program.
- ❑Augment heliophysics R&A 10% in FY09, ramping to 29% by FY12.

# Heliophysics Budget Changes

| | FY07 | FY08 | FY09 | FY10 | FY11 | FY12 | 07-12 Total |
|---|---|---|---|---|---|---|---|
| Content Changes from FY08 | -52.7 | -44.1 | 15.3 | 28.5 | -33.1 | -55.5 | -141.6 |
| LWS Solar Probe | | 13.9 | | 3.4 | 40.1 | 74.2 | 131.6 |
| LWS Solar Orbiter Collaboration | | 1.0 | 4.6 | 8.7 | 19.6 | 55.7 | 89.6 |
| LWS Sentinels | 0.1 | -4.8 | -10.7 | -21.9 | -66.6 | -139.9 | -243.8 |
| New Millenium | -41.6 | -43.3 | -27.1 | -28.6 | -75.8 | -80.7 | -297.1 |
| R&A | 2.2 | 3.0 | 3.0 | 6.0 | 9.0 | 9.0 | 32.2 |
| Sounding Rockets / Res Range | -3.5 | 8.0 | 21.0 | 26.7 | 29.0 | 29.9 | 111.1 |
| MMS | -16.3 | -25.9 | 20.0 | 33.0 | 4.0 | 7.0 | 21.8 |
| All Other | 6.4 | 4.0 | 4.5 | 1.2 | 7.6 | -10.7 | 13.0 |

# Planetary Program Content

| | * FY07 | * FY08 | FY09 | FY10 | FY11 | FY12 | FY13 |
|---|---|---|---|---|---|---|---|
| FY09 President's Budget * | 1,200.4 | 1,246.5 | 1,334.2 | 1,410.1 | 1,537.5 | 1,570.0 | 1,608.7 |
| | | | | | | | |
| Discovery | 119.4 | 147.6 | 247.0 | 258.3 | 256.0 | 326.1 | 140.5 |
| Discovery Future | 4.4 | 35.2 | 50.4 | 49.1 | 65.4 | 239.8 | 90.7 |
| GRAIL | | 35.1 | 122.4 | 122.8 | 113.1 | 24.9 | 5.7 |
| M3 | 6.6 | 3.9 | 2.7 | 2.6 | 0.5 | | |
| Discovery Research | 11.9 | 15.7 | 18.8 | 16.5 | 15.7 | 16.9 | 17.3 |
| Operating Missions and Data Analysis | 96.5 | 57.7 | 52.6 | 67.3 | 61.3 | 44.6 | 26.8 |
| | | | | | | | |
| New Frontiers | 106.3 | 132.2 | 263.9 | 250.3 | 232.3 | 227.7 | 236.9 |
| Juno | 87.8 | 110.1 | 245.0 | 225.2 | 168.0 | 14.4 | 17.8 |
| Other Missions and Data Analysis | 18.5 | 22.2 | 19.0 | 25.1 | 64.3 | 213.3 | 219.1 |
| | | | | | | | |
| Technology | 84.2 | 68.7 | 64.9 | 69.3 | 69.6 | 71.3 | 73.0 |
| | | | | | | | |
| Planetary Science Research | 178.1 | 273.2 | 270.8 | 315.8 | 355.6 | 373.2 | 382.6 |
| Research & Analysis | 111.7 | 137.4 | 142.4 | 145.1 | 150.4 | 155.2 | 159.0 |
| Outer Planet Mission Studies | | 4.2 | | | | | |
| Lunar Science Research | | 42.0 | 105.0 | 122.0 | 140.0 | 150.0 | 151.9 |
| Operating Missions and Analysis | 20.4 | 18.6 | 19.5 | 21.4 | 22.2 | 22.3 | 22.7 |
| Education and Directorate Management | 46.0 | 71.0 | 3.9 | 27.4 | 43.1 | 45.7 | 49.0 |
| | | | | | | | |
| Mars Exploration | 634.1 | 541.8 | 386.5 | 299.6 | 344.5 | 341.1 | 413.8 |
| MSL 2009 | 416.8 | 355.0 | 223.3 | 69.0 | 54.6 | 37.6 | |
| Scout 2013 | 5.3 | 2.3 | 6.7 | 68.5 | 152.5 | 170.7 | 121.8 |
| JPL Building Support | 26.8 | 14.2 | | | | | |
| Mars R&A | 14.2 | 23.3 | 24.9 | 25.9 | 26.7 | 27.1 | 27.5 |
| Operating Missions and Data Analysis | 171.0 | 147.0 | 131.6 | 126.2 | 90.5 | 69.9 | 69.3 |
| Mars Next Decade | | | | 10.0 | 20.2 | 35.8 | 195.2 |
| | | | | | | | |
| Outer Planets | 78.3 | 82.9 | 101.1 | 216.7 | 279.4 | 230.6 | 362.0 |
| Cassini | 78.3 | 82.9 | 81.8 | 81.5 | 75.3 | 10.0 | 10.0 |
| Outer Planets Flagship | | | 19.3 | 135.2 | 204.1 | 220.6 | 352.0 |

*** FY07 and FY08 reflect latest Operating Plan, in FY09 structure**

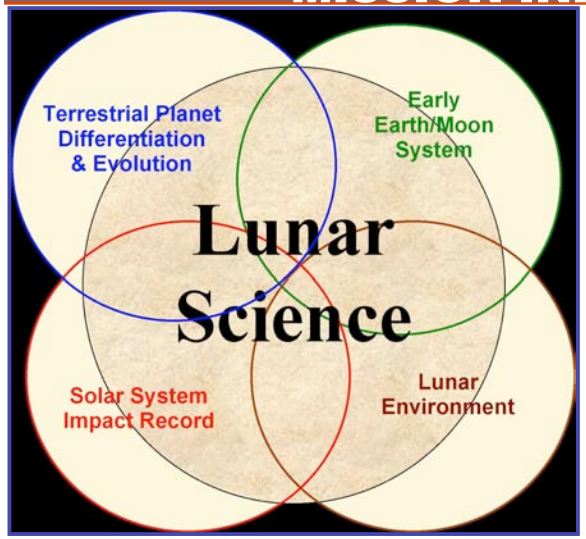
# SELECTED FY09 BUDGET HIGHLIGHTS: PLANETARY

- **Fund a new start for the outer planets flagship mission (LRD 2016/2017); fund Cassini through 2011.**
- **Initiate a new lunar robotic science flight mission line, with first launch (small orbiter) by 2011, second launch (landers) by 2014.**
- **Continue all existing Mars missions; launches in 2009, 2013, 2016; also US ExoMars participation for 2013 launch; initiate sample return studies leading to 2018 and 2020 missions; augment Mars DA and R&A.**
- **Fully fund Juno (2011 launch) and New Frontiers 3 (2016 launch), as well as GRAIL (launch by 2011) and the next Discovery launch in 2014.**
- **Augment planetary R&A 30% in FY09.**

# Planetary Budget Changes

| | FY07 | FY08 | FY09 | FY10 | FY11 | FY12 | 07-12 Total |
|---|---|---|---|---|---|---|---|
| Content Changes from FY08 | -75.9 | 6.6 | -108.3 | -90.4 | 22.5 | 54.8 | -190.7 |
| Outer Planets Flagship | | | 11.2 | 130.3 | 204.1 | 220.6 | 566.2 |
| Lunar Science Research | | 20.0 | 60.0 | 60.0 | 60.0 | 70.0 | 270.0 |
| Planetary / Mars R&A | 16.3 | 28.0 | 27.5 | 36.8 | 40.7 | 41.3 | 190.6 |
| GRAIL | | 35.1 | 122.4 | 122.8 | 113.1 | 24.9 | 418.3 |
| Discovery Future | -43.5 | -68.1 | -163.3 | -204.0 | -173.3 | 10.8 | -641.4 |
| In-Space Propulsion / RPS | -0.6 | -17.6 | -18.6 | -16.4 | -15.2 | -15.5 | -83.9 |
| MSL | 74.3 | 44.0 | 9.3 | 0.1 | 0.0 | 0.0 | 127.8 |
| Mars Scout 2011 slip to 2013 | | -58.7 | -138.3 | -91.5 | 38.5 | 134.7 | -115.3 |
| ExoMars | | | 13.2 | 23.3 | 18.4 | 6.5 | 61.4 |
| Other Mars | -73.7 | 0.9 | -40.7 | -182.4 | -292.2 | -417.4 | -1,005.6 |
| All Other | -48.7 | 23.0 | 9.0 | 30.6 | 28.4 | -21.0 | 21.3 |

# LUNAR SCIENCE ROBOTIC MISSION INITIATIVE




***"It is the unanimous consensus of the (NRC) committee that the Moon offers profound scientific value*****.....A vigorous near term robotic exploration program providing global access is central to the next phase of scientific exploration of the Moon and is necessary both to prepare for the efficient utilization of human presence and to maintain scientific momentum as this major national program moves forward."**

**-NRC Report, 2007.**

# LUNAR SCIENCE ROBOTIC MISSION INITIATIVE

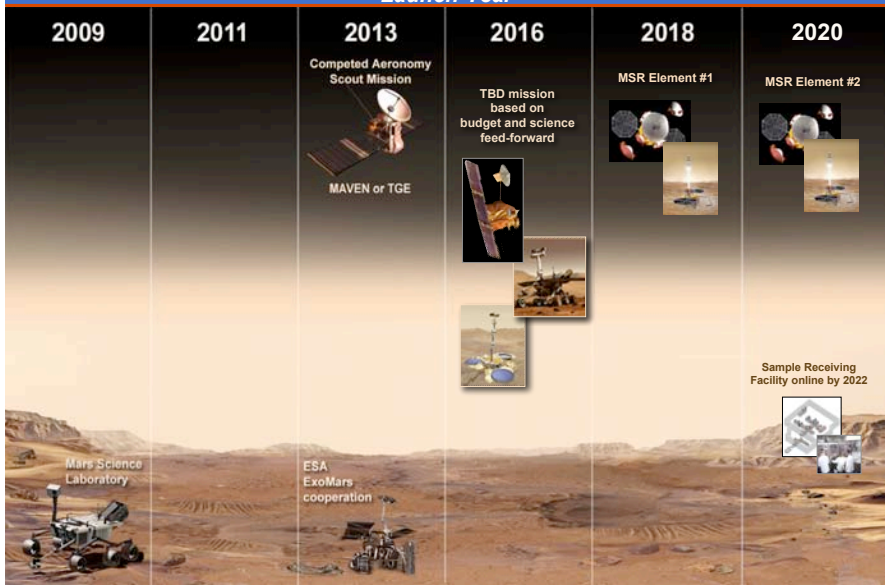
- Funded at $60M per year FY09-11, then $70M/year.
- Strategic SMD missions with science teams and instruments selected competitively.
- First mission: small science orbiter, to be launched by 2011.
- Follow-on missions: Surface geophysical network mini-lander nodes launched in pairs; first pair to be launched by 2014.

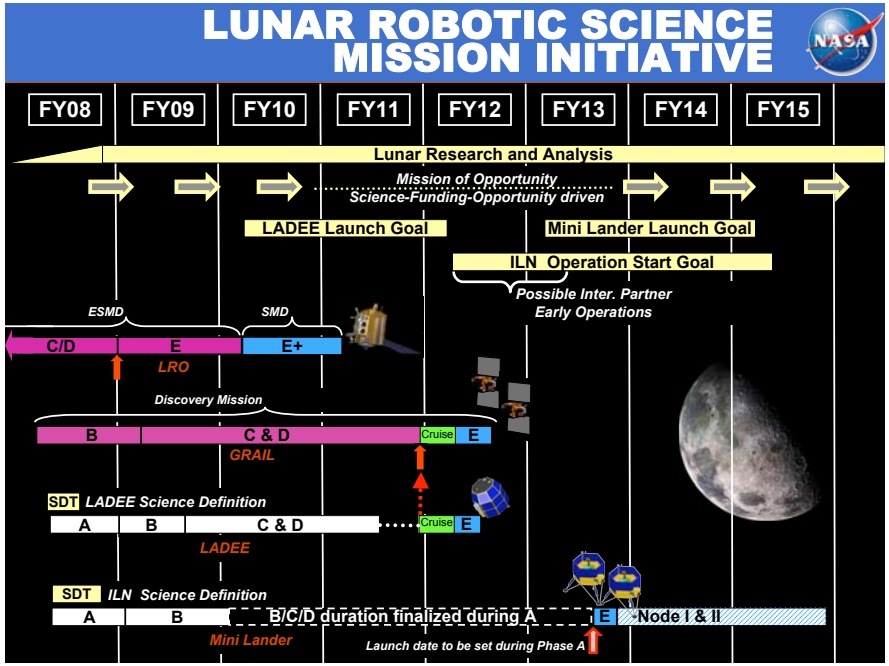
# LUNAR SCIENCE ROBOTIC MISSION INITIATIVE

- With this initiative, the US in total plans to launch 7 robotic spacecraft to the Moon between 2008 and 2014:
  - LRO and LCROSS in 2008.
  - GRAIL (two spacecraft) and a small science orbiter by 2011.
  - Two small landers as anchor nodes in a geophysical network, to be launched by 2014.
- This is the most extensive lunar robotic exploration program of any nation.

Backup

# Mars Program - Next Decade




LUNAR ROBOTIC SCIENCE MISSION INITIATIVE
FY08
FY09
FY10
FY11
FY12
FY13
FY14
FY15
Lunar Research and Analysis
Mission of Opportunity
Science-Funding-Opportunity driven
LADEE Launch Goal
Mini Lander Launch Goal
ILN Operation Start Goal
Possible Inter. Partner Early Operations
ESMD
SMD
C/D
E
E+
LRO
Discovery Mission
B
C & D
Cruise
E
GRAIL
SDT
LADEE Science Definition
A
B
C & D
Cruise
E
LADEE
SDT
ILN Science Definition
A
B
B/C/D duration finalized during A
E
Node I & II
Mini Lander
Launch date to be set during Phase A