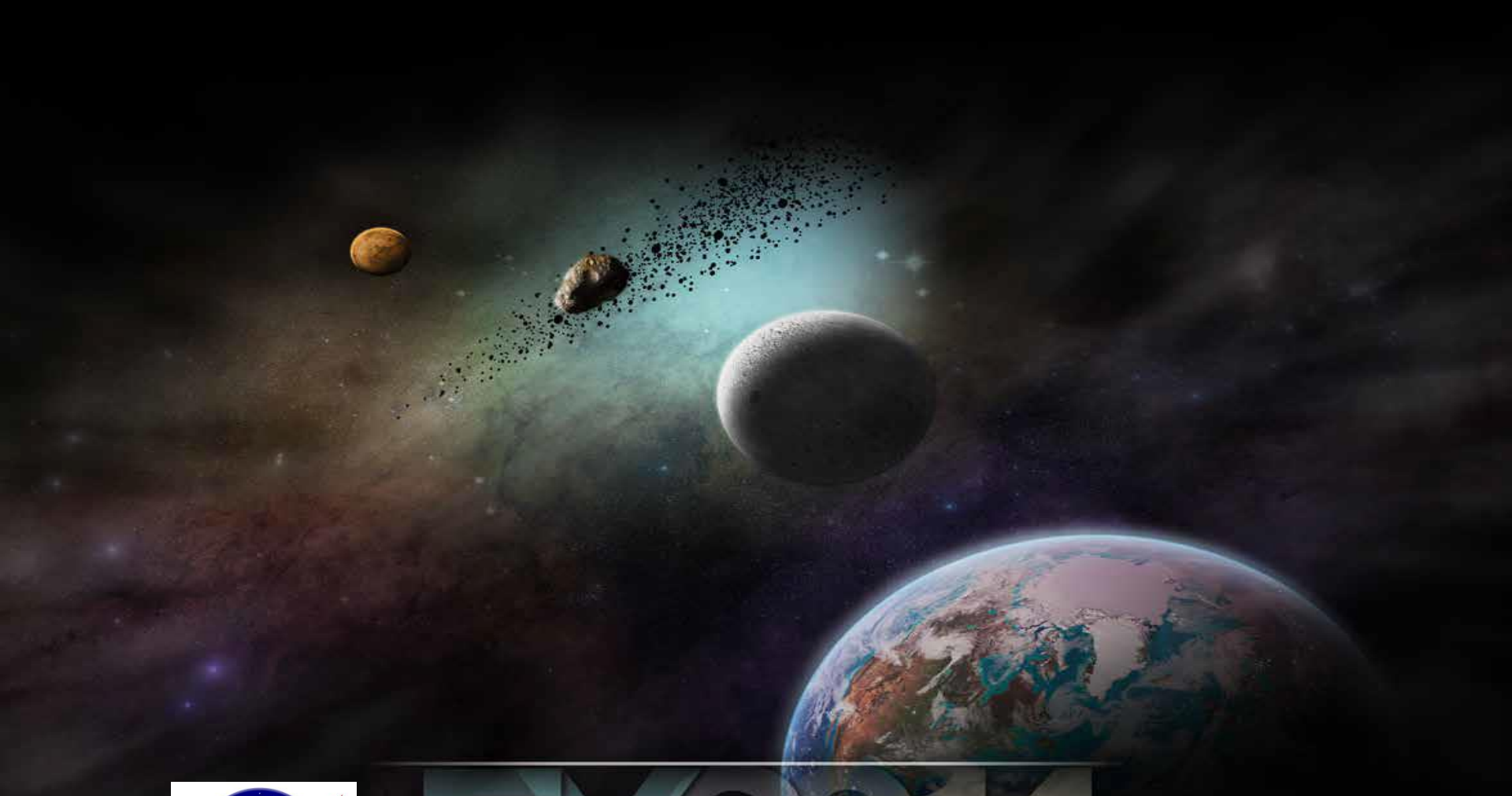


FY2014

BUDGET ESTIMATES

Public Benefits of the FY14 NASA Budget

Advances U.S. leadership in space exploration and scientific discovery

Improves life on Earth and protects our planet

Strengthens U.S. economy through science and technology investments

Overview

- The Budget ensures that the United States remains the world's leader in space exploration and scientific discovery, while positioning America to out-innovate our competitors and inspire the next generation of technology leaders.

- It keeps us on track to launch American astronauts from U.S. soil in 2017 and expands the use of the International Space Station to improve life on Earth and help make the next great leaps in scientific discovery and exploration.

- The plan invests in American ingenuity, drives innovation and helps create new transportation systems to reach low-Earth orbit and end our reliance on foreign launch providers.

- It supports development of the Space Launch System and Orion crew vehicle for deep space human exploration to an asteroid and Mars.

Overview *(continued)*

- The budget continues critical investments in the cutting-edge technologies needed to execute the nation's exploration and discovery goals, providing spinoff benefits to the U.S. space industry, other government space activities, and Americans in their everyday lives.
- It advances both aviation and space technologies to expand the nation's capabilities in the skies and in space, fuel economic growth, create new jobs and expand opportunities for a skilled workforce.
- The plan continues to build on our nation's record of breathtaking and compelling scientific discoveries and achievements in space, with science missions that will reach farther into our solar system, reveal unknown aspects of our universe and provide critical knowledge about our home planet.

Overview *(continued)*

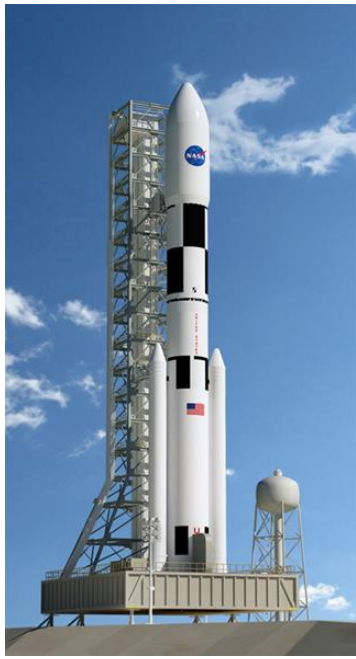
- The budget advances technologies to carry out the first-ever mission to identify, capture and redirect an asteroid, meeting the President's challenge to send astronauts to an asteroid by 2025.

- This innovative work will continue to inspire the next generation of scientists, technologists, engineers and astronauts.

2014 Highlights

- ✓ Fully funds the Space Launch System (SLS) heavy-lift rocket and Orion Multi-Purpose Crew Vehicle, (Orion MPCV) to carry astronauts to deep space, and the systems needed to assemble, test and launch the new vehicles. Funding enables an uncrewed flight test of Orion in 2014 and the SLS in 2017.

- ✓ Fully funds the Commercial Crew Program -- our plan to restore America's human space launch capability -- at a necessary level to ensure we're flying missions by 2017 and that our astronauts are launching from U.S. soil on spacecraft built by American companies. The Commercial Cargo Program is funded to keep already successful operations on track.

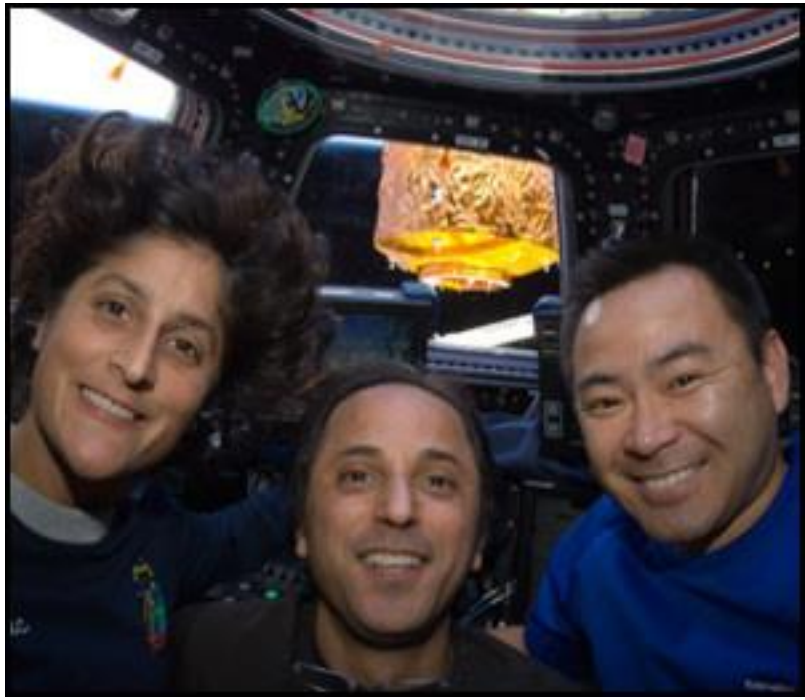


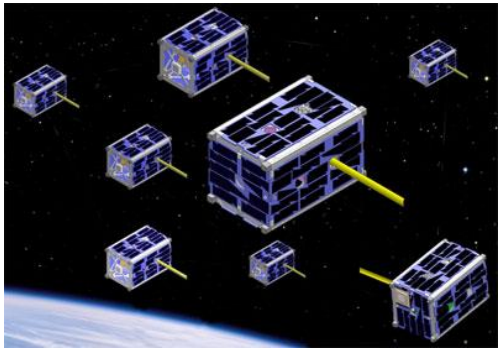
2014 Highlights (cont.)

- ✓ Sustains the operations and vital research astronauts perform each day aboard our unique orbiting national laboratory, the International Space Station (ISS), that are helping us understand how to live and work in space for the long term, demonstrate technologies and undertake scientific research not possible on Earth.

- ✓ Enhances investment in crucial and cutting edge space technologies, such as advanced in-space propulsion and space propellant storage, which will increase what we can do in space, bring the cost of exploration down, and pave the way for other government and commercial space activities.

- ✓ Strengthens NASA's important role in increasing efficiency and safety of air travel and pushing the boundaries of aeronautics technology, including a new initiative to make lighter composite materials more easily usable in aviation.

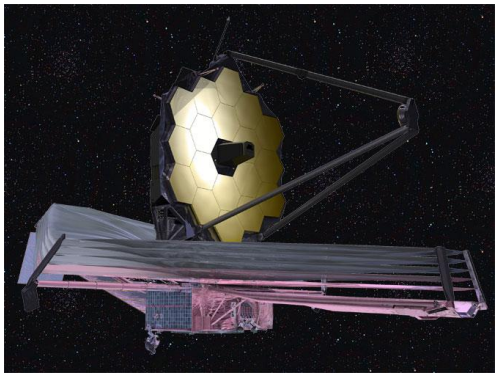




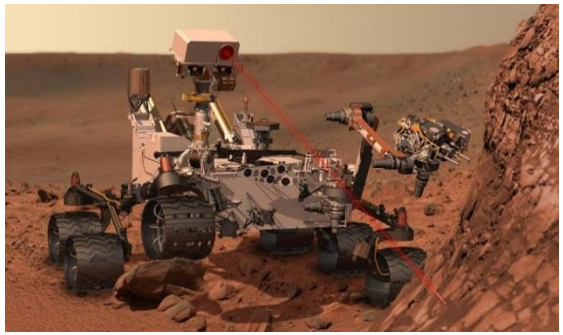
2014 Highlights (cont.)

- ✓ Funds crucial Earth Science land imaging capabilities beyond the recently launched Landsat Data Continuity Mission, development of climate sensors previously planned for launch on the Joint Polar Satellite System, and numerous other satellite and research efforts to help us understand the Earth's systems and climate.

- ✓ Continues construction of our next Great Observatory, the James Webb Space Telescope, keeping it on track to probe deeper into the universe than ever before when deployed in 2018.

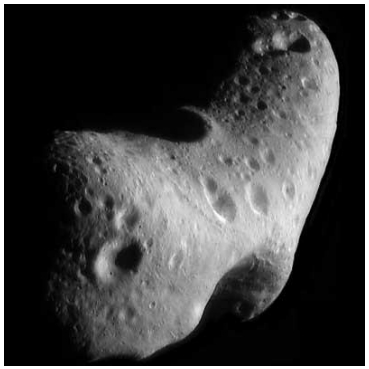


- ✓ Following Curiosity's daring landing on Mars, provides for a new Mars rover mission to launch in 2020, continued operations of rovers and orbiters already at Mars, and launch of MAVEN in November to study the Martian atmosphere.



2014 Highlights (cont.)

- To protect our planet, advance exploration capabilities and technologies for human space flight, and learn how to best utilize space resources, the FY14 budget aligns relevant portions of NASA's science, space technology, and human exploration capabilities to meet the President's challenge to send astronauts to an asteroid by 2025 and to Mars in the 2030s.



- In support of the Administration's FY 2014 Science, Technology, Engineering, and Mathematics (STEM) Education plan, the Agency's education efforts will be fundamentally restructured into a consolidated education program funded through the Office of Education, which will use competitive processes to fund the best education and public outreach programs within NASA and will coordinate closely with the Department of Education, the National Science Foundation, and the Smithsonian Institution to broaden the reach of NASA's capability to inspire and educate.

Considerations

- **Sequestration.** The President believes we should replace sequestration with balanced deficit reduction.
- **Out-year Funding Assumptions.** In this time of national fiscal austerity, NASA has accepted the challenge to manage to a flat out-year top-line budget. Funding lines beyond FY 2014 should be considered notional. In general, NASA accounts are held at their FY 2014 request level with adjustments.
- **Campaign to Promote Efficient and Effective Spending.** This budget continues NASA's efforts to improve operational efficiency and maintains reduced spending for service contracting, travel, supplies and materials, printing and reproduction, and IT services.
- **Aligning the NASA Workforce.**
  - ✓ Aligns human capital with the priority requirements of the Agency
  - ✓ Reduces the rate of re-hiring in FY2014 consistent with budget limitations
- **Presentation in full-cost,** where all project costs are allocated to the project, including labor funding for the Agency's civil service workforce.
- **Comparisons to FY 2013.** Due to the timing of budget development, FY 2013 comparisons are to the full-year CR level in effect in the February time period.

FY 2014 Budget Request

	FY 2012 Actual	FY 2013 Annualized CR	FY2014	Notional FY2015	Notional FY2016	Notional FY2017	Notional FY2018
NASA FY 2014	**$17,770.0**	**$17,893.4**	**$17,715.4**	**$17,715.4**	**$17,715.4**	**$17,715.4**	**$17,715.4**
Science	**$5,073.7**	**$5,115.9**	**$5,017.8**	**$5,017.8**	**$5,017.8**	**$5,017.8**	**$5,017.8**
Earth Science	$1,760.5	-	$1,846.1	$1,854.6	$1,848.9	$1,836.9	$1,838.1
Planetary Science	$1,501.4	-	$1,217.5	$1,214.8	$1,225.3	$1,254.5	$1,253.0
Astrophysics	$648.4	-	$642.3	$670.0	$686.8	$692.7	$727.1
James Webb Space Telescope	$518.6	-	$658.2	$645.4	$620.0	$569.4	$534.9
Heliophysics	$644.8	-	$653.7	$633.1	$636.8	$664.3	$664.6
Aeronautics Research	**$569.4**	**$572.9**	**$565.7**	**$565.7**	**$565.7**	**$565.7**	**$565.7**
Space Technology	**$573.7**	**$578.5**	**$742.6**	**$742.6**	**$742.6**	**$742.6**	**$742.6**
Exploration	**$3,707.3**	**$3,790.1**	**$3,915.5**	**$3,952.0**	**$3,970.7**	**$3,799.0**	**$3,589.3**
Exploration Systems Development	$3,001.6	-	$2,730.0	$2,789.8	$2,801.5	$2,818.3	$2,819.5
Commercial Spaceflight	$406.0	-	$821.4	$821.4	$821.4	$590.0	$371.0
Exploration Research and Development	$299.7	-	$364.2	$340.8	$347.8	$390.7	$398.7
Space Operations	**$4,184.0**	**$4,247.8**	**$3,882.9**	**$4,014.9**	**$3,996.2**	**$4,167.9**	**$4,377.6**
Space Shuttle	$596.2	-	$0.0	$0.0	$0.0	$0.0	$0.0
International Space Station	$2,789.9	-	$3,049.1	$3,169.8	$3,182.4	$3,389.6	$3,598.3
Space and Flight Support (SFS)	$797.9	-	$833.8	$845.1	$813.8	$778.3	$779.3
Education	**$136.1**	**$136.9**	**$94.2**	**$94.2**	**$94.2**	**$94.2**	**$94.2**
Cross Agency Support	**$2,993.9**	**$3,012.2**	**$2,850.3**	**$2,850.3**	**$2,850.3**	**$2,850.3**	**$2,850.3**
Center Management and Operations	$2,204.1	-	$2,089.7	$2,089.7	$2,089.7	$2,089.7	$2,089.7
Agency Management and Operations	$789.8	-	$760.6	$760.6	$760.6	$760.6	$760.6
Construction & Envrmtl Compl Restoration	**$494.5**	**$401.9**	**$609.4**	**$440.9**	**$440.9**	**$440.9**	**$440.9**
Inspector General	**$38.3**	**$38.2**	**$37.0**	**$37.0**	**$37.0**	**$37.0**	**$37.0**
NASA FY 2014	**$17,770.0**	**$17,893.4**	**$17,715.4**	**$17,715.4**	**$17,715.4**	**$17,715.4**	**$17,715.4**

Notes:
-- FY 2012 is consistent with submitted operating plans however, for comparability purposes, values for Space Technology reflect the funding for Space Technology related activities executed in Exploration, Space Operations, and Cross Agency Support.
-- FY 2012 Estimates include rescission of prior year unobligated balances, pursuant to section 528(f) of P.L. 112-55, Division B, Commerce, Justice, Science, and Related Agencies Appropriations Act, 2012
-- The FY 2013 appropriation for NASA was not enacted at the time that the FY 2014 Request was prepared; therefore, NASA is operating under a Continuing Resolution (CR) (P.L. 112-175). Amounts in the "FY 2013 annualized CR" column reflect the annualized level provided by the CR. Rescission of remaining unobligated balances of American Recovery and Reinvestment Act funds in the Office of Inspector General account pursuant to section 1306 of the Dodd-Frank Wall Street Reform and Consumer Protection Act (P.L. 111-203)
-- Funds associated with out-year estimates for programmatic construction remain in programmatic accounts.

NASA Mission Launches
(Fiscal Years 2013 – 2020)

- NASA Mission on US ELV
- Reimbursable for NOAA
- Joint NASA-NOAA- USAF Mission
- Joint NASA-International Partner Mission
- International Mission with NASA science instrument or contribution
- Mission of Opportunity
- Commercial Crew Services
- Commercial Crew Development Test
- Exploration Systems Development Mission
- Commercial Orbital Transportation Services Missions
- ISS Commercial Resupply Services
- Future ISS Cargo Delivery Demand

* Mission successfully launched

• SLS 1st flight (EM-1) in CY2017.

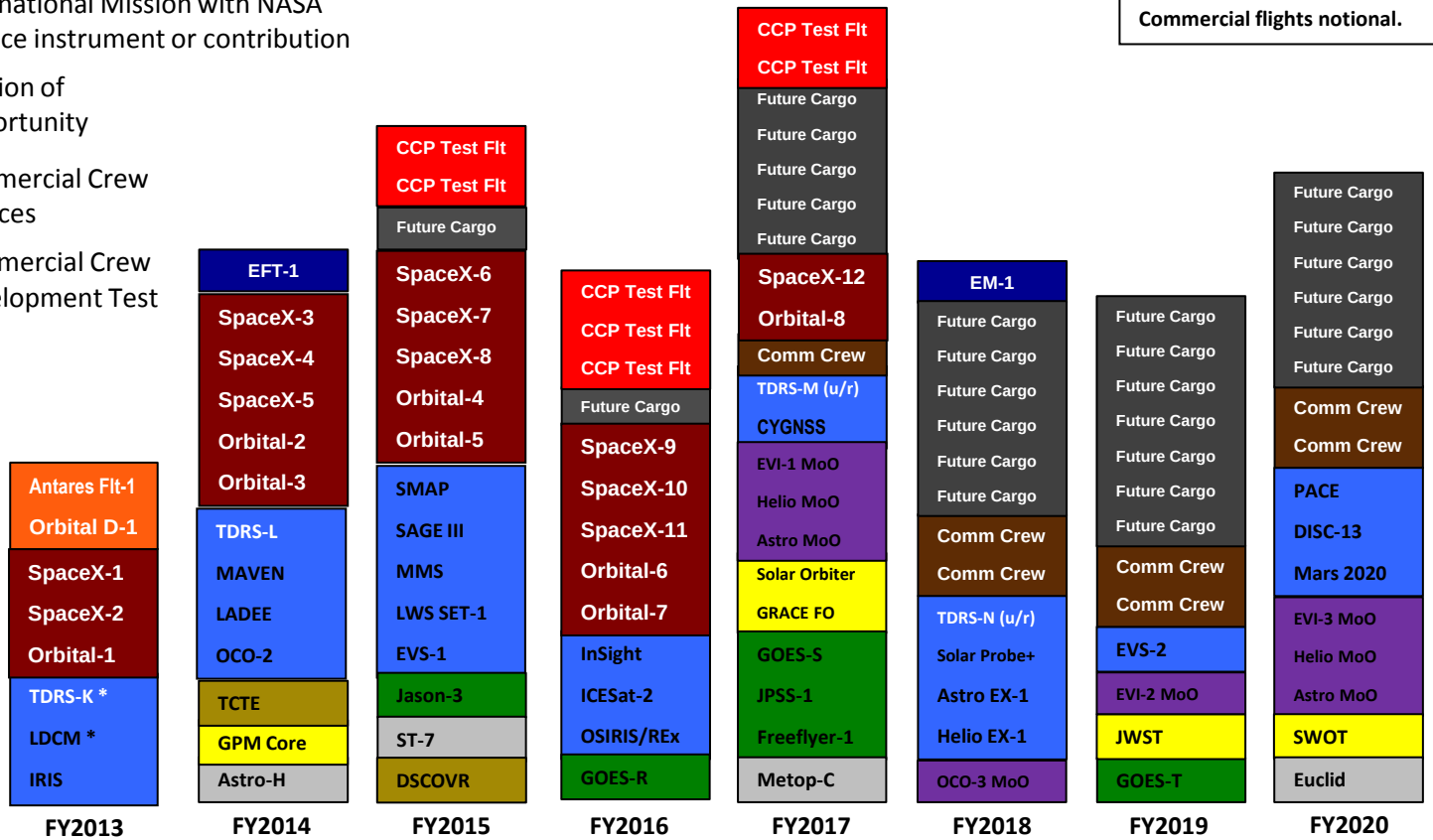
\# Non-confirmed; not in FY14 request

HEO missions denoted in white text.

SMD missions denoted in black text.

International launches not shown.

Commercial flights notional.



Earth Science

Outyears are notional

($M)	2014	2015	2016	2017	2018
Earth Science	$1,846	$1,855	$1,849	$1,837	$1,838

- Launches OCO-2 and the Global Precipitation Measurement Mission (GPM).
- Formulates and develops SMAP, Stratospheric Aerosol and Gas Experiment III (SAGE III), ICESat-2, GRACE-Follow on, a sustained Land Imaging capability following LDCM, and OCO-3 instrument.
- Maintains weather and climate change modeling capabilities to enhance forecast accuracy. Continues working with NOAA and OSTP to address approaches for providing sustained space-borne Earth observations.
- Operates over 15 Earth-observing spacecraft.
- Maintains robust R&A, airborne science (including IceBridge), and technology development.

Planetary Science

Outyears are notional

($M)	2014	2015	2016	2017	2018
Planetary Science	$1,218	$1,215	$1,225	$1,255	$1,253

- Enhances asteroid detection capabilities through a doubling of NASA's efforts to identify and characterize potentially hazardous near-Earth objects (NEOs).
- Funds development of OSIRIS-REx for launch in 2016 to encounter and return a sample from an asteroid, providing critical information on asteroid mitigation strategies.

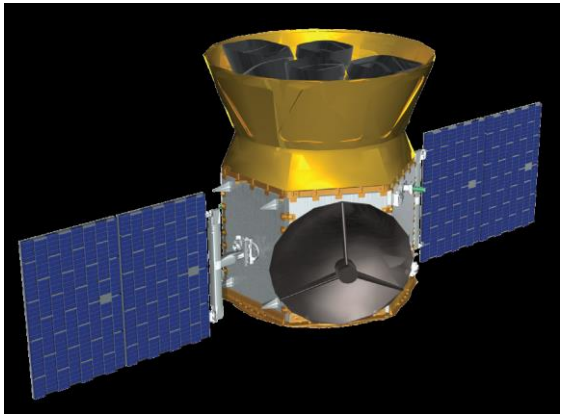
- Includes a robotic Mars science rover for launch in 2020, building on the success of Curiosity's landing.
- Funds the launch of MAVEN, to enter Mars orbit in September 2014.
- Funds a NASA partnership with DOE to produce plutonium-238, including NASA funding of DOE's infrastructure.
- Operates nearly 15 Planetary missions, including Juno and MSL.

Astrophysics

Outyears are notional

($M)	2014	2015	2016	2017	2018
Astrophysics	$642	$670	$687	$693	$727

- Supports all operating missions: Hubble, Kepler, SOFIA, Chandra, Fermi, Spitzer, Herschel, Planck, XMM-Newton, NuSTAR, Swift, Suzaku.
- Supports recently-selected Explorer missions.
- Continues to work toward demonstration of SOFIA full operational capability.
- Pursues confirmation of the nature of Kepler exoplanet candidates and exploration of the nature of planets circling other stars.
- Continues a robust competed astrophysics research program.
- Supports three long duration balloon flights from Antarctica to measure the cosmic rays that fill the Milky Way.



James Webb Space Telescope

Outyears are notional

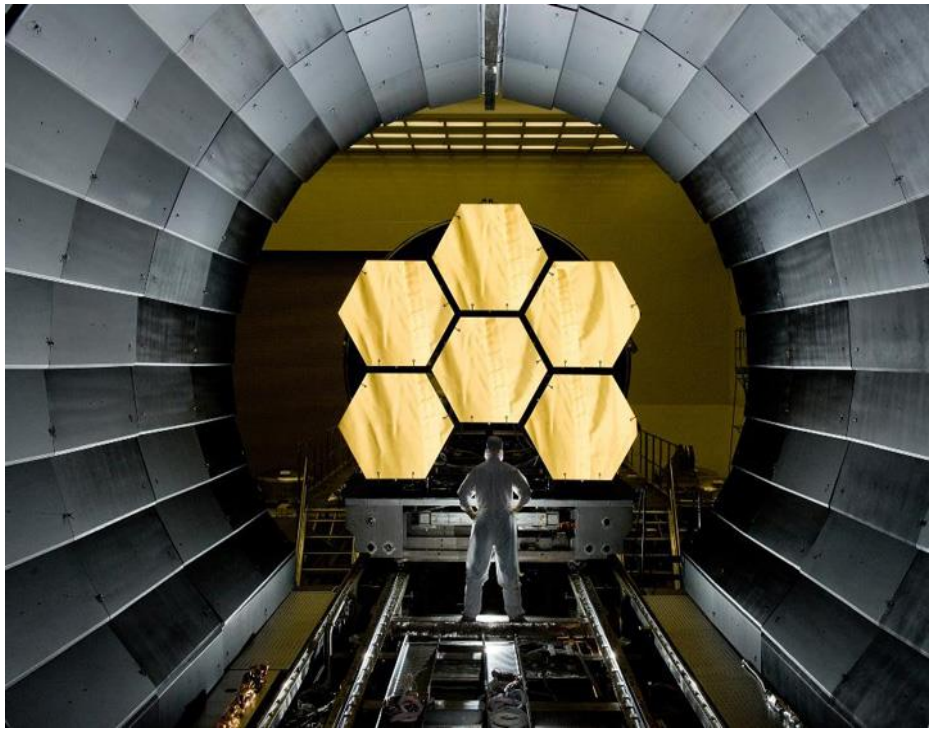
($M)	2014	2015	2016	2017	2018
JWST	$658	$645	$620	$569	$534

- Supports the commitment of an October 2018 launch date.

- Completes the science instruments and begins their testing as an integrated science payload.

- Completes the critical design review of the spacecraft bus.

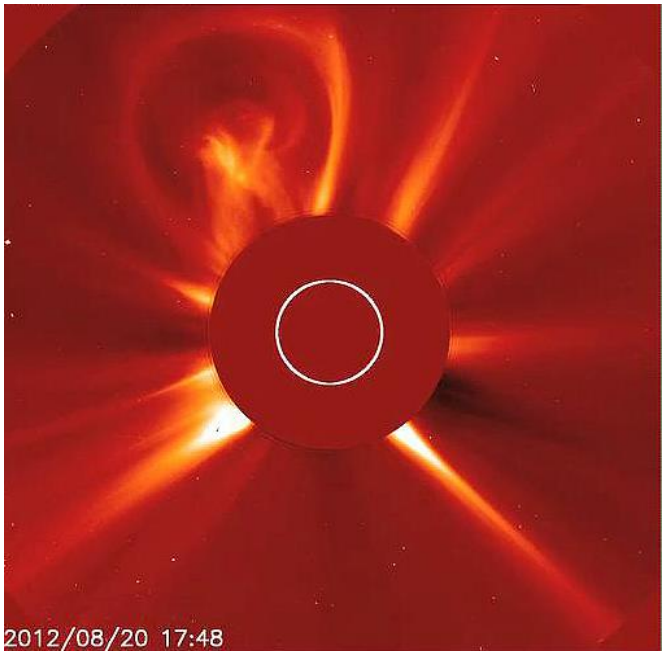
- Completes the telescope primary mirror assemblies, and begins integration of the pathfinder secondary mirror support structure.



Heliophysics

Outyears are notional

($M)	2014	2015	2016	2017	2018
Heliophysics	$654	$633	$637	$664	$665



- Works toward launch of IRIS in June 2013 and the strategic MMS mission in 2015.
- Continues development of Solar Orbiter Collaboration mission with the European Space Agency (ESA), including the Solar-Heliospheric Imager and the Heavy Ion Sensor science instruments.
- Continues formulation of the highest priority “large” Heliophysics mission, Solar Probe Plus.
- Enables selection of multiple low-cost ($1-2M or less) CubeSat investigations in FY14
- Supports up to 24 sounding rocket flights.
- Operates over 15 Heliophysics missions.

Joint Agency Satellite Programs

In FY 2010, NASA established the Joint Agency Satellite Division (JASD) within the Science Mission Directorate to manage satellite development work for other agencies on a fully-reimbursable basis. JASD applies standard NASA project management processes to ensure mission success for our partners with a focus on efficiently managing operational satellite acquisitions.

During FY 2014, NASA expects to continue developing the following reimbursable missions for NOAA:

- Joint Polar Satellite System (JPSS): JPSS-1, JPSS-2, and Freeflyer-1 missions, and the JPSS ground system
- Geostationary Operational Environmental Satellite–R (GOES-R) series: GOES-R, -S, -T, and –U missions
- Jason-3: instruments and launch vehicle
- Deep Space Climate Observatory (DSCOVR): spacecraft refurbishment and development of ground system

Aeronautics

Outyears are notional

	2014	2015	2016	2017	2018
Aeronautics	$566M	$566M	$566M	$566M	$566M

- NASA's Aeronautics research is focused in these key areas:
  - Safe, efficient growth in global aircraft operations
  - Ultra-efficient commercial transports
  - Transition to low-carbon propulsion
  - Real-time system-wide safety assurance
  - Integration of Unmanned Aerial Vehicles into the National Airspace System
  - Innovative composites research

- This research will lead to increases in economic growth and high quality jobs, and advances in mobility and long-term sustainability within the aviation industry.
- Among other research activities NASA will pursue new aircraft engine technologies that dramatically reduce fuel burn, noise and emissions such as the Ultra High Bypass engine.
- This budget provides funding for new research into reducing the timeline for development and certification of innovative composite materials and structures. In FY 2014, NASA will also explore options for the future of its rotary wing research, in coordination with federal agency partners.

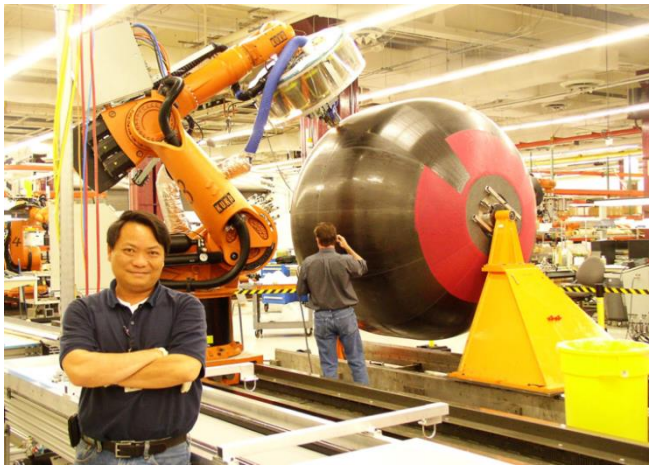
Space Technology

Outyears are notional

	2014	2015	2016	2017	2018
Space Technology	$743	$743	$743	$743	$743

Delivers innovative solutions that dramatically improve technological capabilities for NASA and the Nation including:

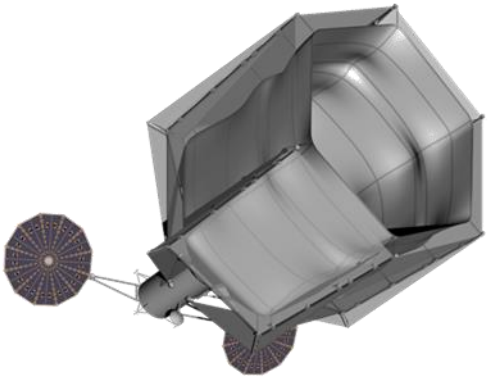
- Accelerated development of a high-powered solar electric propulsion capability to enable infusion of this capability into multiple applications, and make it available to be used to power the robotic segment of the proposed asteroid retrieval mission.
- Developing, testing and flying a portfolio of enabling and breakthrough technologies across six major areas including fabrication of a 5.5 meter composite cryogenic propellant tank, launch of a cluster of small spacecraft to measure space radiation, demonstration of advanced robotics on the International Space Station, and development of the largest Solar Sail ever operated in space.
- Continuing a steady cadence of new technology starts to be conducted by the NASA workforce, academia, small businesses, and the aerospace enterprise, to ensure a steady pipeline of innovation to NASA's missions.
- Chief Technologist's efforts in transferring and commercializing technology to a wide range of users to ensure the full economic value and societal benefit of these innovations is realized.



Asteroid Mission Overview

Proposed mission would leverage and align existing activities:

- Asteroid observing efforts to identify target asteroids (in Science);
- Demonstration of new propulsion technologies to power the mission to reposition the asteroid (in Space Technology);
- Development of SLS rocket and Orion vehicle to launch humans to rendezvous with and sample the asteroid (in Exploration Systems); and
- Development of new technologies to encounter and sample the asteroid (in Exploration R&D).



The Budget provides $105M to support identification and general mitigation strategies for asteroids, as well as to initiate planning and early development of the asteroid mission to enable human rendezvous with an asteroid before 2025. Formulation of this mission is still in the early stages, and NASA is committed to pursuing an affordable and feasible mission.

Exploration Systems Development

Outyears are notional

($M)	2014	2015	2016	2017	2018
ESD	$2,730	$2,790	$2,802	$2,818	$2,820

- Begins planning and early development for an asteroid capture mission.
- Provides steady funding for SLS and Orion MPCV along with associated Exploration Ground Systems (EGS).
- Continues modifications to the Kennedy Space Center's Launch Complex 39, Vehicle Assembly Building and Launch Control Center to support 2017 launch.
- Maintains the Orion MPCV on track for early uncrewed test flights in 2014 and 2017 and a first crewed flight in 2021.
- Note: Exploration Systems Development (ESD) construction funding of $142M million is requested in the Construction and Environmental Remediation account.

Commercial Spaceflight

Outyears are notional

($M)	2014	2015	2016	2017	2018
Commercial Spaceflight	$821	$821	$821	$590	$371

- Facilitates development of affordable U.S. commercial crew space transportation capability with a goal of achieving safe, reliable, and cost effective access to and from low Earth orbit and the International Space Station.
- Reduces our dependence on Russian spaceflight capabilities for crew exchange.
- Builds on successful progress in the development of commercial cargo capabilities and the Commercial Crew Development (CCDev) activities.
- Ensures contracted services meet the Agency's crew transportation system certification requirements.

Exploration Research and Development

Outyears are notional

($M)	2014	2015	2016	2017	2018
Exploration R&D	$364	$341	$348	$391	$399

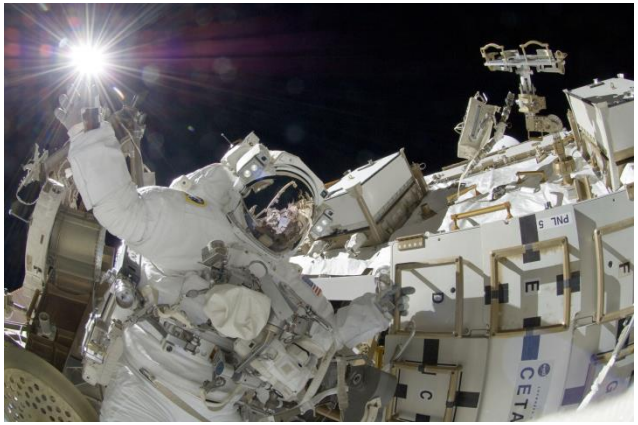
- Increases investment in asteroid capture, retrieval, and redirection technologies, and concepts for astronaut extravehicular technologies.
- Expands fundamental knowledge and develops advanced human spaceflight capabilities required to explore space in a more sustainable and affordable way.
- Comprises of the Human Research Program (HRP) and the Advanced Exploration Systems (AES) Program.
  - HRP researches the human system to provide countermeasures, knowledge, technologies, and tools to enable safe, reliable, and productive human spaceflight missions.
  - AES pioneers new approaches for rapidly developing prototype systems, demonstrates key capabilities, and validates operational concepts for future human missions beyond Earth orbit, such as the asteroid retrieval and sample mission.
  - AES maintains critical competencies at the NASA centers and is seeking to increase the use of that expertise in public-private partnerships to work in collaboration with the outside entities. AES also supports robotic missions of opportunity in collaboration with the Science Mission Directorate.

International Space Station

Outyears are notional

($M)	2014	2015	2016	2017	2018
ISS	$3,049	$3,170	$3,182	$3,390	$3,598

- Continues international partnerships to maintain a continuous crew of six capability and research essential to sustaining long-term habitation in space.
- Supports:
  - ISS activities, including EVA and visiting vehicles.
  - As needed anomaly resolution and failure investigation.
  - Development of hardware that supports research.
  - Utilization of new hardware to perform plant research and investigate gravity effects on physiology and biology.
  - Reuse of hardware to launch the ISS-RapidScat to measure ocean-surface wind speed and direction.
  - Cargo resupply of the ISS.



Space and Flight Support

Outyears are notional

($M)	2014	2015	2016	2017	2018
SFS	$834	$845	$814	$778	$779

- Supports continued modernization for a 21st Century Space Launch Complex to improve capabilities and infrastructure for a low-cost multi-user space transportation infrastructure at KSC in conjunction with Exploration Ground System efforts for SLS and Orion MPCV. (Note: SFS construction funding of $26M million is requested in the Construction and Environmental Remediation account).
- Provides space communication and navigation capabilities to all missions through numerous networks.
- Ensures crew health and expertise for current and future missions by maintaining the U.S. astronaut corps with appropriate skills and experience.
- Provides safe, reliable, and cost effective launch services for NASA, Commercial and NASA-sponsored payloads using ELVs.
  - LSP will manage 3 launches in FY 2014 - MAVEN, TDRS-L, and OCO-2, and will provide advisory support to GPM Core.
- Supports government and commercial rocket propulsion testing at NASA test facilities.

Education

Outyears are notional

($M)	2014	2015	2016	2017	2018
Education	$94	$94	$94	$94	$94

- Restructures STEM education efforts within the Agency to support the Administration's STEM reorganization and aligns education investments with the federal strategic plans of the CoSTEM.

- Creates a consolidated education program funded through the Office of Education that would use competitive processes to fund the best education and public outreach programs within NASA and would coordinate closely with the Department of Education, the National Science Foundation, and the Smithsonian Institution to broaden the reach of NASA's capability to inspire and educate.
- Maintains the Agency's investment in the Space Grant, EPSCoR, MUREP and GLOBE programs. Also, maintains a focus on Minority Serving Institutions and community colleges, which generally serve a high proportion of minority students and prepare them for study at a four-year institution.

Cross-Agency Support and Construction

Outyears are notional

($M)	2014	2015	2016	2017	2018
Cross-Agency	$2,850	$2,850	$2,850	$2,850	$2,850
Construction & ECR	$609	$441	$441	$441	$441

- Cross-Agency Support
  - Funds ongoing management, operations and maintenance of Headquarters, nine field centers and associated component facilities
  - Provides management and oversight of Agency missions and mission support activities
  - Conducts safety and reliability activities to assure safety and mission success
  - Works to identify institutional efficiencies to drive down operational costs including workforce sizing and the realignment of workforce skills and capabilities
- Construction and Environmental Compliance and Restoration
  - Supports numerous initiatives to help NASA facilities operate in a more efficient and sustainable manner
  - Constructs new or modified facilities to conduct NASA's program missions, and manages NASA's environmental clean-up responsibilities

Questions?

Acronyms

- CRS: cargo resupply Services
- ELV: Expendable Launch Vehicle
- EPSCoR: Experimental Program to Stimulate Competitive Research
- ESA: European Space Agency
- GOES: Geostationary Operational Environmental Satellite
- GPM: Global Precipitation Mission
- GRACE: Gravity Recovery and Climate Experiment
- ICESat: Ice Cloud and Land Elevation Satellite
- IRIS: Interface Region Imaging Spectrograph
- ISS: International Space Station
- JPSS: Joint Polar Satellite System
- JUNO: Jupiter Uranus Neptune Outreach
- LADEE: Lunar Atmosphere Dust Environment Explorer
- LDCM: Landsat Data Continuity Mission
- MAVEN: Mars Atmosphere and Volatile Evolution
- MMS: Magnetospheric Multiscale Mission
- MSL: Mars Science Laboratory
- MPCV: Multi-Purpose Crew Vehicle
- MUREP: Minority University research and Education Program
- NOAA: National Oceanographic and Atmospheric Administration
- NPP: NPOESS Preparatory Project
- OCO: Orbiting Carbon Observatory
- OSIRIS-Rex: Origins Spectral Interpretation Resource Identification Security Regolith Explorer
- POES: Polar Operational Environmental Satellite
- SAGE: Stratospheric Aerosol and Gas Experiment
- SLS: Space Launch System
- SMAP: Soil Moisture Active-Passive Mission
- STEM: Science, Technology, Engineering and Mathematics
- USGS: U.S. Geological Survey