

National Aeronautics and Space Administration

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HIGHLIGHTS

- The President's Budget Request for NASA in FY 2014 is \$17.7 billion, \$1.3 billion above the estimated FY 2013 level and \$84 million below the enacted FY 2012 level.
- NASA's FY 2013 appropriations suffered two across-the-board reductions, a 1.877% rescission in the FY 2013 Continuing Appropriations, P.L. 113-6, and the forced 5% sequester required by the Budget Control Act of 2011. The President's Budget Request for FY 2014 does not account for the expected sequester required by the Budget Control Act of 2011 on FY 2014 appropriations.
- The Orion Multi-Purpose Crew Vehicle and Space Launch System, scheduled for their first combined test launch in 2018, with a target crew launch in 2021, are slightly reduced in funding the President's FY 2014 Budget Request.
- As of May 25, 2012, with Space Exploration Technologies Corporation (SpaceX) having successfully completing its resupply mission to the ISS, commercial cargo has officially begun operations. SpaceX again resupplied the ISS on March 3, 2013. On April 22, 2013, Orbital Sciences Corporation successfully launched its Antares rocket from NASA's Wallops Launch Facility on the coast of Virginia, another important milestone in creating a commercial market for cargo to the ISS. Orbital anticipates launching both the Antares rocket and the Cygnus capsule in the fall of 2013, and SpaceX, The Boeing Company, Sierra Nevada Corporation, and unfunded Blue Origin are working toward commercial crew missions to the ISS, with launches to begin in 2017. Funding for

commercial crew was one of the very few programs in the entire FY 2013 federal budget to see an increase after the implementation of the sequester, according to AAAS estimates at the time of this writing.

- The Curiosity Mars Science Laboratory landed successfully on Mars on August 6, 2012, through the use of a unique and complicated “sky-crane” platform. The largest vehicle to date on the surface of the planet and the size of a sport utility vehicle, the newest rover is designed to take samples of the Martian surface to determine if life could have existed on the planet. However, Curiosity is not the only rover active on Mars. Continuing into its ninth year, Opportunity is still at work – eight years after its mission was scheduled to end. The President’s FY 2014 budget request provides continued funding for both rovers and the next generation of Mars exploration vehicles expected to start launching in 2016.
- The President’s FY 2014 budget request proposes a robotic mission to capture and return a near-Earth asteroid to orbit in cislunar space. Upon successful placement in orbit, a crewed mission to the asteroid would land and retrieve a sample. The FY 2014 budget request designates this project as the first mission beyond LEO for the Orion Multi-Purpose Crew Vehicle and the Space Launch System. This mission would span multiple programs within NASA, including Human Exploration and Operations, Science, and Space Technology. The program’s feasibility and plan will be developed in the coming year.
- The President’s FY 2014 Budget Request combines Exploration and Space Operations under a new directorate dubbed Human Exploration and Operations.

INTRODUCTION

Congress established the National Aeronautics and Space Administration (NASA) through the National Aeronautics and Space Act of 1958 to provide for all civil aeronautical and space activities of the United States.¹ Over 50 years later, NASA continues to uphold its mission to “pioneer the future in space exploration, scientific discovery, and aeronautics research.”²

1 <http://history.nasa.gov/spaceact.html>

2 <http://www.nasa.gov>

Proponents of a robust aeronautics program and scientific research capability at NASA continue to express concern at the shift in emphasis for the Agency. In 2006, at the direction of Congress, NASA released its *National Vision for Aeronautics Research* to provide a roadmap for NASA's priorities. This roadmap was followed in December 2007 with NASA's release of the *National Plan for Aeronautics Research and Development and Related Infrastructure* offering specific strategies to address national aerospace challenges and capabilities.

NASA continues to focus on cutting-edge fundamental aeronautical research in the following key areas: foundational and multidisciplinary research to enable air-breathing access to space and entry into planetary atmospheres; stewardship of NASA's aeronautics research and test facilities; development of technologies that will enable the transition to the Next Generation Air Transportation System (NextGen); and technical advancements in the civilian application of unmanned aerial vehicles in the national airspace.

On June 28, 2010, President Obama released the National Space Policy of the United States. The policy stipulated six key goals in moving America's space programs forward: energize competitive domestic industries; expand international cooperation; strengthen stability in space; increase assurance and resilience of mission-essential functions; pursue human and robotic initiatives; and improve space-based Earth and solar observation. President Obama stated: "Fifty years after the creation of NASA, our goal is no longer just a destination to reach. Our goal is the capacity for people to work and learn and operate and live safely beyond the Earth for extended periods of time, ultimately in ways that are more sustainable and even indefinite. And in fulfilling this task, we will not only extend humanity's reach in space – we will strengthen America's leadership here on Earth."³

On October 11, 2010, President Obama signed into law the National Aeronautics and Astronautics Act of 2010, authorizing NASA for three years with continually increasing funding levels, a Space Launch System (SLS) that will operate for missions past low Earth orbit (LEO) and serve as a back-up access to the International Space Station (ISS), a multi-

3 http://www.whitehouse.gov/sites/default/files/national_space_policy_6-28-10.pdf

purpose crew capsule that incorporates the Orion capsule already in development, funding for the ISS until 2020, guidelines for commercial crew operations, expansion of commercial cargo activity, and increased aeronautics program funding.

After 30 years and 135 missions, the Space Shuttle was retired in 2011 after completion of the International Space Station, leaving a gap in U.S. human space flight capability for the next several years, and placing immediate reliance on the Russian Soyuz for crew and supply launches to the ISS. However, with the recent success in delivery of cargo to ISS by commercial ventures, the gap is within years of closing.

NASA generally has enjoyed strong congressional support through recent appropriations cycles. However, it continues to appear likely that budgetary pressures, including the impending 2014 sequestration required under the Budget Control Act of 2011, will continue to force Congress to make tough decisions regarding NASA's appropriations accounts. Pressure from stakeholders outside of the exploration portfolio is mounting, and Congress must decide at what level to fund each of NASA's mission directorates. Within this context, NASA has repeatedly asserted that it is implementing the priorities of the President and Congress within the resources provided. The discontinuation of the Constellation Program and its subsequent replacement, and an emphasis on commercial cargo and crew carriers, continue to cause concern within Congress on the direction the Administration is taking in regard to NASA human space exploration. Further, complications continue to arise from the retirement of the Space Shuttle and the immediate dependence on foreign countries, including rocket mishaps and rising fees to maintain access to the ISS. Additionally, NASA funding over the past three cycles has not met the authorized levels stipulated in the NASA Reauthorization Act of 2010. This dilemma was demonstrated in the FY 2013 enacted appropriations: NASA accounts of concern to Congress and the President, such as commercial crew, were funded above normal levels to absorb the mandated sequestration, while other accounts were funded below previous years to offset the increases and stay within total funding levels. FY 2014 is expected to be no less complicated than FY 2013.

NASA authorization is scheduled for the first session of the 113th Congress. Unlike in 2010, the NASA authorization process now faces a split between political parties, chambers, and agendas. Proposals submitted

in the House of Representatives include mission direction, new terms for the Administrator with a new appointment process, new procurement processes, and a new budget request process. NASA authorization language is expected in the summer of 2013.

BUDGET HIGHLIGHTS

At the time of this writing, final spending NASA plans are not yet available. Thus, all FY 2013 figures referenced below refer to preliminary AAAS estimates of FY 2013 post-sequestration funding. Additionally, FY 2012 figures below refer to the enacted spending levels, rather than the actual spending levels that appear in table II-12.

The President's FY 2014 Budget Request for NASA is \$17.7 billion, \$1.3 billion above the FY 2013 level and \$84 million below the enacted FY 2012 level.

Human Exploration and Operations Mission Directorate: The Human Exploration and Operations (HEO) Mission Directorate is funded through two budget programs, Exploration and Space Operations. Total funding for the HEO Mission Directorate for FY 2014 is \$7.8 billion, \$490 million above FY 2013 and \$346 million below FY 2012.

Space Operations, as stated in the President's FY 2014 request, is responsible for enabling "access to low Earth orbit, provides critical communication capabilities, and creates pathways for discovery and human exploration of space." Space Operations is requesting \$3.9 billion for FY 2014, an increase of \$198 million above FY 2013 and level with FY 2012.

The International Space Station assembly has been completed and the ISS is "a fully functional and permanently crewed research laboratory and technology test bed providing a critical stepping stone for exploration and future international cooperation." Due to the retirement of the Space Shuttle in FY 2011, private contractors have sought to provide alternatives, including SpaceX, which has begun resupply flights to the ISS, and Orbital, which has successfully reached orbit and plans to start re-supplying the ISS in late 2013. Crew transport will rely on the Russian Soyuz vehicle until such time as a domestic commercial contractor is able to provide crew transportation services. At \$3 billion, the ISS would receive an increase of \$292 million above FY 2013 estimates and \$ 259 million above FY 2012 enacted.

The Space and Flight Support Program is requesting \$834 million for FY 2014, a decrease from the FY 2013 estimated level of \$862 million but an increase of \$29 million above FY 2012. The 21st Century Space Launch Complex, funded within the Space and Flight Program, a program that promises to enhance NASA's current and future activities as well as those of non-NASA users of the range, is proposed at \$40 million, an increase of \$2 million above FY 2013 estimates.

The Exploration program "develops the systems and capabilities required for human exploration of space beyond low Earth orbit (LEO) and for U.S. crew access to the International Space Station (ISS) after retirement of the Space Shuttle." The FY 2014 budget request for NASA includes \$3.9 billion, a \$293 million increase above FY 2013 estimates and \$205 million above FY 2012 enacted. Exploration includes three themes: Exploration Systems and Development, Commercial Spaceflight, and Exploration Research and Development.

The Exploration Systems and Development Theme is requesting \$2.7 billion in the President's FY 2014 budget, which is \$117 million below FY 2013 and \$272 million below FY 2012 enacted. The theme is comprised of three programs. Multiple-Purpose Crew Vehicle, which will design and incorporate parts of the Orion capsule in order to extend humans beyond low Earth orbit and is expected to launch with crew in 2021, is requesting \$1 billion, a decrease of \$89 million below FY 2013. Space Launch Systems, a program tasked with developing a heavy-lift vehicle to extend human flight beyond low Earth orbit (including the Moon, Mars, Asteroids, etc.), which is expected to launch with an un-crewed system in 2017, is proposed at \$1.4 billion, a decrease of \$29 million below FY 2013. Lastly, and Exploration Ground Systems requests \$318 million, an increase of \$70 above FY 2013 estimates.

The Commercial Spaceflight Theme is proposed at \$821 million, \$332 million above FY 2013 and \$415 million above FY 2012. The theme is tasked to advance investment and partnerships in the emerging commercial space sector while encouraging those markets to develop in the areas of cargo and crew vehicles. Blue Origin, Boeing, Sierra Nevada, and SpaceX have partnered with NASA in developing crew capability.

The Exploration Research and Development Theme is requesting \$364 million, an increase of \$77 million above FY 2013 and \$61 million above

FY 2012 enacted. The theme is comprised of two programs: the Human Research Program and Advanced Exploration Systems. The Human Research Program, whose focus is on investigating and mitigating the risks to human health in human space exploration, is proposed at \$165 million. Advanced Exploration Systems, which works to develop and implement life support systems, habitat research, and other human life supporting activities in support of future NASA human space exploration beyond LEO, is proposed at \$199 million.

Science Mission Directorate: The Science Mission Directorate (SMD) oversees and directs “the development of innovative satellite missions and instruments to enable scientists to conduct research to understand Earth, the Sun, and planetary bodies in the solar system, and to unravel the mysteries of the universe,” as stated in the President’s FY 2014 request. The total request for the SMD is \$5.0 billion, an increase of \$223 million above FY 2013 estimates and \$72 million below the enacted FY 2012. Within the SMD are five themes representing the key areas of research the directorate focuses on: Earth Science, Heliophysics, Planetary Science, Astrophysics, and the James Webb Space Telescope. The SMD seeks to explore issues relating to these themes by engaging the science community, by sponsoring scientific research, and through the use of satellites.

The Earth Science Theme (EST) request for FY 2014 is \$182 million above FY 2013 estimates at \$1.8 billion and \$80 million below FY 2012. The EST’s mission is “advancing knowledge of the integrated Earth systems.” The budget specifically focuses on NASA’s climate-related activities in research, applied sciences, and technology. The FY 2014 budget request includes funds for six programs within the theme: Earth Science Research at \$443 million, an increase of \$39 million above FY 2013; Applied Sciences, which “leverages NASA Earth Science satellite measurements and new scientific knowledge to enable innovative and practical uses by public and private sector organizations,” at \$35 million, an increase of \$3 million above FY 2013; Earth System Multi-Mission Operations, charged with acquiring, preserving, and distributing “observational data to support Earth Science focus areas (climate variability and change, atmospheric composition, Earth surface and interior) in conformance with national science objectives,” at \$172 million, an increase of \$21 million above FY 2013; Earth Systematic Missions, which includes Ice, Cloud, and Land Elevation Satellite (ICESat-II), with an expected launch in May 2017, Global Precipitation Measurement (GPM), with an expected

launch in June 2014, Soil Moisture Active and Passive (SMAP), with an expected launch in March 2015, LandSat Data Continuity Mission (LDCM), which launched successfully on February 11, 2013, and GRACE Follow-On, with a targeted launch of August 2017, and a suite of other missions, would be funded at \$788 million, \$38 million below FY 2013; Earth System Science Pathfinder, including Venture Class Missions, Aquarius, which was launched in June 2011, Cloudsat, which launched in 2006 and was instrumental in monitoring Hurricane Sandy's growth and strength, and the Orbiting Carbon Observatory-2, with an anticipated launch in February 2015, would be funded at \$354 million, an increase of \$149 million above FY 2013; and Earth Science Technology, focusing on developing new remote-sensing and information technologies, would be funded at \$55 million, an increase of \$9 million above FY 2013.

The Heliophysics Theme requests an increase of \$51 million above FY 2013 estimates, for a total of \$654 million, \$9 million below the enacted FY 2012 budget. Heliophysics is charged with developing, monitoring, and collecting research on how the environment of the Sun, the heliosphere, and planetary environments interact. The FY 2014 budget request includes funds for five programs within the theme: Heliophysics Research at \$196 million, \$31 million above FY 2013; Living with a Star, which includes the Solar Dynamics Observatory, which was launched in February of 2010, at \$216 million, \$4 million above FY 2013; Solar Terrestrial Probes, which include STEREO, Hinode, and continues the implementation of the Magnetospheric Multi-scale Mission (MMS), expected to launch in March 2015, at \$147 million, a decrease of \$29 million below FY 2013; and Heliophysics Explorer Program, including the IBEX, CINDI, TWINS, AIM, and THEMIS, at \$95 million, an increase of \$45 million above FY 2013.

The Planetary Science Theme proposes a decrease of \$101 million below FY 2013 estimates, and \$284 million below FY 2012 enacted, to \$1.2 billion. Planetary Science seeks to advance scientific knowledge of the nature, origin, and history of the solar system, including the history of life and whether it evolved beyond Earth. The theme also looks into hazards and resources in the solar system that would affect human presence into space. The FY 2014 budget request includes funds for seven programs: Mars Exploration, including the continuation of the rover Opportunity, which has been operating for over nine years, the Mars Science Laboratory (Curiosity), which landed successfully on August 6, 2012, and the Mars

Atmosphere and Volatile Evolution (MAVEN), expected to launch in November 2013, at a proposed budget level of \$234 million, a decrease of \$186 million below FY 2013; Discovery, which includes MESSENGER, currently in orbit around Mercury, GRAIL, currently in orbit around the Moon, and Dawn, currently in on its way to dwarf planet Ceres with an expected arrival date in 2015, at \$258 million, an increase of \$31 million over FY 2013; New Frontiers, which includes the continuation of operations of the New Horizons spacecraft heading to Pluto and its moons, the Juno spacecraft on a mission to Jupiter, Origins-Spectral Interpretation-Resource Identification-Security-Regolith Explorer (OSIRIS-REx), expected to launch in September 2016, Interior Exploration using Seismic Investigations, Geodesy and Heat Transport (InSIGHT) in a Mars lander mission expected to launch in spring 2016, at a proposed budget of \$258 million, an increase of \$95 million above FY 2013; Technology at \$151 million, an increase of \$23 million above FY 2013; Planetary Science Research, at \$221 million, an increase of \$42 million above FY 2013; Outer Planets, which continues the Cassini mission, at \$79 million, a decrease of \$69 million below FY 2013; and Lunar Quest Program, which includes the Lunar Atmosphere and Dust Environment Explorer (LADEE), expected to launch in November 2013, at \$18 million, a significant decrease of \$39 million below FY 2013. The FY 2014 request notes that the Lunar Quest Program will be closed out as separate program in the FY 2015 budget. The FY 2014 budget request includes \$40.5 million, doubling FY 2013 funding, for Near Earth Object Observations (NEOO), which is charged with tracking and detecting at least 90% of near Earth objects, asteroids, and comets. Additionally, pursuant to the FY 2014 request, in order “to support planetary missions in the 2020s and beyond,” NASA will partner with the Department of Energy to produce an estimated 1.5 to 20 kilograms of plutonium-238 per year by 2018, and thus requests \$50 million for the radioisotope power system development and infrastructure.

The Astrophysics Theme’s proposed budget is \$642 million, an increase of \$18 million above the FY 2013 estimated level of \$624 million and \$6 million below FY 2012. The Astrophysics Theme is dedicated to the goal of discovering how the universe works, how it began, how it developed, and whether there could be life elsewhere. To meet this goal, the FY 2014 budget includes funds for five programs: Astrophysics Research, continuing the Balloon Project to develop a super-pressure balloon that could carry large scientific loads to the edge of space for 100 days or more, at \$148 million, a decrease of \$12 million from the FY 2013 level; Cosmic

Origins, which operates the Hubble Space Telescope, the Stratosphere Observatory for Infrared Astronomy (SOFIA), the Spitzer Space Telescope, and the Herschel Space Observatory, at a proposed budget of \$228 million, a decrease of \$4 million below FY 2013; Physics of the Cosmos, which includes continued operations for Planck, Fermi Gamma-ray Space Telescope, XMM-Newton, and Chandra, at a proposed \$110 million, an increase of \$7 million above FY 2013; Exoplanet Exploration, which supports the Kepler Program and the Wide-Field InfraRed Survey Telescope (WFIRST), at \$55 million, an increase of \$4 million above FY 2013; and Astrophysics Explorer, including the High Resolution Soft X-Ray Spectrometer (SXS), and the Nuclear Spectroscopic Telescope Array (NuSTAR) launched on June 13, 2012, at a proposed \$101 million, a major increase of \$34 million above FY 2013.

Finally, the James Webb Space Telescope is proposed at \$658 million, a significant increase of \$73 million above FY 2013 and \$140 million above FY 2012. The telescope is anticipated to launch in October 2018.

Aeronautics Research Mission Directorate: The goal of the Aeronautics Research Mission Directorate (ARMD), as stated in the President’s FY 2014 budget, is to conduct research bringing “transformational advances in the safety, capacity, and efficiency of the air transportation system while minimizing negative impacts on the environment.” The Aeronautics Research budget request for FY 2014 is \$566 million, an increase of \$35 million above FY 2013 estimates and \$4 million below FY 2012.

Programs included within the directorate include: Aviation Safety, proposed at \$80 million; Airspace Systems Program, proposed at \$92 million; Fundamental Aeronautics Program, proposed at \$168 million; Aeronautics Test Program, proposed at \$77 million; Integrated Research Systems Program, which include the development of technologies that would enable routine civil operations of unmanned aircraft systems (UAS) in the national airspace and advancements in environmental technologies in aviation, proposed at \$127 million; and Aeronautics Strategy and Management Program, proposed at \$23 million.

Space Technology Mission Directorate: The Space Technology Mission Directorate (STMD) will, as stated in the President’s FY 2014 request, draw “on talent from the NASA workforce, academia, small businesses and the broader space enterprise to deliver innovative solutions that

dramatically improve technological capabilities for NASA and the Nation.” The Space Technology Directorate is provided \$743 million in the FY 2014 budget request, a significant increase of \$145 million over FY 2013 estimates and \$169 million above FY 2012 enacted. The Directorate is composed of a single theme, Space Technology, which includes four programs: Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR), proposed at \$186 million; Partnership Development and Strategic Integration, proposed at \$34 million; Crosscutting Space Technology Development, proposed at \$278; and Exploration Technology Development, proposed at \$245 million.

Cross-Agency Support: Cross-Agency Support funding provides a focus for managing technical capability and agency mission support functions. This budget area consists of two themes: Center Management and Operations, with a request at \$2.1 billion, and Agency Management and Operations, with a request of \$761 million. Cross-Agency Support is not directly identified or aligned to a specific program or project requirement, but is necessary to ensure the efficient and effective operation and administration of NASA. The FY 2014 request is \$2.9 billion, an increase of \$218 million above the FY 2013 level and \$145 million less than FY 2012.

Education: Education funding continues to focus on achieving NASA’s vision through the development of a qualified workforce of the future. Therefore, NASA continues to encourage students to pursue the “STEM” disciplines of science, technology, engineering, and mathematics. These programs provide opportunities for students to be involved in NASA research and certain NASA programs. The request for the Education Directorate for FY 2014 is \$94 million, a significant decrease of \$23 million below FY 2013 and \$42 million below FY 2012, and looks to consolidate the agency’s education programs through the Office of Education, which will work in partnership with “other federal agencies in pursuit of the Administration’s STEM education goals.”