

**Statement of
The Honorable Charles F. Bolden, Jr.
Administrator
National Aeronautics and Space Administration**

before the

**Committee on Commerce, Science, and Transportation
U.S. Senate**

Mr. Chairman and Members of the Committee, today it is my privilege to discuss the President's FY 2013 budget request for NASA. Our requested budget of \$17.7 billion will enable NASA to execute the balanced program of science, space exploration, technology, and aeronautics agreed to by the President and a bipartisan majority of Congress.

Despite the constrained fiscal environment facing the Nation, this request supports a robust civil space program that puts us on a path to achieving a truly exciting set of goals. We are working to send humans to an asteroid and ultimately to Mars, to peer deep into space to observe the first galaxies form, and to broaden human activity in low-Earth orbit (LEO). We have completed assembling and outfitting of the U.S. segment of the International Space Station (ISS), allowing us to focus on full utilization of the Station's research capabilities. NASA is making air travel safer and more efficient, learning to live and work in space, and operating a fleet of spacecraft to investigate the Earth, the Solar system and the Universe.

The FY 2013 request supports the implementation of key priorities for NASA.

First, since the historic construction of the International Space Station (ISS) was completed in 2011, and now that all the international partners have agreed to its extension to at least 2020, we must enhance its utilization to insure the success of this national laboratory. For over eleven years, international crews of space explorers have been living on orbit, both building the International Space Station and conducting a diverse research program continuously. NASA is committed to making this National resource available to the broader scientific and commercial research community. Key to its sustainment is the availability of a U.S. commercial crew and cargo delivery capability as soon as possible. NASA is working with American companies to establish the next generation of safe and efficient vehicles for access to LEO and the ISS. In calendar year 2012, we will see the first commercial cargo flights to the ISS, demonstrating the innovation and capabilities of our industry partners and providing a path forward to ease our sole reliance on Russian transport of astronauts. We will continue to work with our industry partners to develop end-to-end systems for transporting crew and cargo to orbit. I am committed to ensuring that American companies, launching from U.S. soil, are providing the cargo and crew transportation services that we need to keep the ISS functioning. We are making steady progress on these launch services. Later this spring and summer, we expect that both of our private company partners, SpaceX and Orbital Sciences, will complete demonstration flights of their cargo vehicles to Station and actually berth with the ISS, marking a major milestone in our goal to establish commercial space capabilities for low-Earth orbit travel. Some modification of the Iran, North Korea, Syria Non-proliferation Act (INKSNA) provisions will likely be required for the continued operation of ISS and other space programs after 2016. The

Administration plans to propose appropriate provisions and looks forward to working with the Congress on their enactment.

Second, with the FY 2013 budget request, NASA is moving out on plans to develop a flexible launch system that will ultimately be the most capable in history. The Space Launch System (SLS) rocket and the Orion Multi-Purpose Crew Vehicle (Orion MPCV) will carry American astronauts beyond low-Earth orbit and into deep space within the next decade. Following a thorough analysis of alternatives, NASA has established architecture for SLS and the Orion MPCV. In recent months we have continued to push forward with contracting and design efforts to make this system a reality. At the same time, we are moving forward on a critical effort to develop the technologies and capabilities required to support our ambitious exploration goals. Our FY 2013 budget request supports our plans for an uncrewed SLS test flight in 2017 and a crewed test mission by 2021.

Third, we plan to continue progress toward the launch of the world's most advanced telescope in 2018. The James Webb Space Telescope (JWST) will operate deep in space to orbit the sun nearly one million miles from Earth. From that vantage point, JWST will look out into space and back in time almost as far as it is possible to look. Over the past year, NASA has engaged in a thorough review of JWST, made important adjustments to management, and put the project on a sound financial footing. Since we completed this new plan, the project has met 19 of 20 FY 2011 milestones (with one deferred without impact), and has met all FY 2012 milestones to date on or ahead of schedule. NASA is confident that the FY 2013 request supports a 2018 launch of JWST.

Fourth, The FY 2013 budget request supports continued advances in new technologies. The National Research Council (NRC) has determined that future U.S. leadership in space requires a foundation of sustained technology advances, but that the U.S. space program is now living on the innovation funded in the past. Our focus on new space technologies is absolutely essential to enable NASA to achieve its ambitious goals. At the same time, NASA technology research seeds innovation, supports economic vitality and helps to create new jobs and expanded opportunities for a skilled workforce. Space technology investments address long-term Agency technology priorities and technology gaps identified by NASA Mission Directorates and within the Agency's draft space technology roadmaps. On February 1, 2012, the NRC released its final review of NASA's Draft Space Technology Roadmaps. The report, which notes that NASA's technology base is largely depleted and identifies sixteen top-priority technologies necessary for NASA's future missions, which also could benefit American aerospace industries and the nation. This NRC assessment will help guide NASA's technology priorities in the years to come.

NASA's budget request supports a portfolio of innovative science missions that will explore the diverse planetary bodies of our solar system, unravel the mysteries of our universe and provide critical data about our home planet. Currently operating missions continue to return a stream of data from orbits around the Sun, Mercury, the Moon, the asteroid Vesta, Mars, and Saturn. We now have missions on the way to Jupiter, Pluto and Mars. Sixteen Earth Science missions in orbit study the Earth as an integrated system. The Hubble, Spitzer, Chandra, and Fermi space telescopes continue to make groundbreaking discoveries on an almost daily basis. In calendar year 2011, the MESSENGER spacecraft entered orbit around Mercury, Ebb and Flow began mapping the gravity field of the Moon, and Juno launched on its way to Jupiter. Also in 2011, Aquarius produced the first global view of ocean surface salinity and the Suomi National Polar-orbiting Partnership satellite began making observations of Earth's weather and climate. In 2012, we will launch the Nuclear Spectroscopic Telescope Array to study massive black holes, supernovae and other high-energy sources in the universe, and will launch the Radiation Belt Storm Probes into Earth's Van Allen belts. In 2013, we will launch the next land observing mission (the Landsat Data Continuity Mission) and complete environmental testing of the Global Precipitation

Measurement mission, the Lunar Atmosphere and Dust Environment Explorer (LADEE) and the Mars Atmosphere and Volatile Evolution (MAVEN) mission.

In view of these key priorities for NASA and of our constrained fiscal environment, we will not be moving forward with the 2016 and 2018 ExoMars missions we had been studying with the European Space Agency. Instead, NASA is developing a new, integrated strategy for Mars missions to ensure that the next steps for Mars exploration will support science and human exploration goals and take advantage of advanced space technology developments. NASA will complete this integrated plan, including the framework for a mission to take advantage of the 2018 or 2020 launch opportunities, no later than this summer and, hopefully, in time to support the FY 2013 appropriations process. The FY 2013 request supports this approach, and this process will be informed by coordination with the science community and our international partners. The FY 2013 budget request continues to support robust Mars exploration including two spacecraft orbiting Mars, the Opportunity rover on the surface, a multi-year exploration of Mars by the Curiosity Mars Science Laboratory, and the MAVEN mission to explore the Mars upper atmosphere. The August landing of Curiosity will be among the most difficult technical challenges that NASA has ever attempted and Curiosity's mission of exploration will far eclipse anything humanity has attempted on the surface of Mars in the past. We look forward to receiving a treasure trove of data from the surface of Mars to help answer questions about its past and present habitability.

With the 2013 request, NASA will conduct aeronautics research to enable the realization of the nation's Next Generation Air Transportation System (NextGen), and the safer, more fuel efficient, quieter, and environmentally responsible aircraft that will operate within NextGen. Through the aeronautics research we conduct and sponsor with universities and industry, NASA helps to develop the technology that enables continuous innovation in aviation. As a result, U.S. companies are well positioned to build on discoveries and knowledge resulting from NASA research, turning them into commercial products that benefit the quality of life for our citizens, provide new high-quality engineering and manufacturing job opportunities, and enables the United States to remain competitive in the global economy.

The request also continues NASA's dedicated efforts to inspire the next generation of explorers. NASA can provide hands-on experience and inspiration as few other agencies can. To foster the development of the U.S. workforce, NASA's education programs will focus on demonstrable results and capitalize on the Agency's ability to inspire students and educators through unique missions and the big challenges that help today's young people envision their future in science, technology, engineering and mathematics (STEM). NASA Education is one of many Federal government programs that support STEM education. NASA Education is working with other agencies through the National Science and Technology Council's Committee on STEM Education to fund coordinated and effective student and teacher opportunities. NASA will focus its resources on demonstrated areas of strength in its unique role in STEM education, freeing resources for other Agency priorities. NASA brings many assets, beyond funding, to support the Administration's emphasis on STEM education. Our people, platforms like the International Space Station, and our facilities across the Nation all contribute to strengthening STEM education.

NASA is grateful to the American people, and their representatives here on the Committee for the continued support for NASA despite the difficult resource challenges facing our Nation. A more detailed description of NASA's balanced program of science, space exploration, technology development, and aeronautics is provided below.

Science

NASA's Science Mission Directorate develops and operates innovative spacecraft missions and instruments that help researchers deliver new discoveries of the Earth, the Sun, the planetary bodies in our solar system, and the universe beyond. The FY 2013 budget request for Science is \$4,911.2 million.

NASA's **Earth Science** Program advances knowledge of the integrated Earth system--the global atmosphere, oceans, land surfaces, ice sheets, ecosystems and interactions among them. The FY 2013 budget request for Science includes \$1,784.8 million for Earth Science. In 2011, NASA successfully launched Aquarius/SAC-D, a cooperative ocean surface salinity mission conducted with the Argentine Space Agency, and with our partner the National Oceanic and Atmospheric Administration (NOAA) and the Suomi National Polar-orbiting Partnership (SNPP). SNPP is the first step in developing the Nation's next-generation climate and weather monitoring missions. During calendar year 2012 NASA will select the first small satellite mission under the Earth Venture program as recommended in the National Research Council's decadal survey for Earth science. The FY 2013 budget will fund all three components of the Earth Venture program: this new small mission, the on-going EV-1 airborne science campaigns, and the first EV-I instrument of opportunity. FY 2013 will see the launch of the Landsat Data Continuity Mission and the completion of environmental testing for the Global Precipitation Measurement mission. The FY 2013 budget will also fund continued development of the first two Tier 1 decadal survey missions, Soil Moisture Active Passive mission and ICESat-2. Finally, the FY 2013 budget will fund continued development of three key missions to assure delivery of sustained Earth observations (GRACE-Follow on, OCO-2, and the SAGE-III instrument that will fly on the ISS) and fund the continued operation of 16 missions currently in orbit as well as research using the resultant data. The FY 2013 budget request for Earth Science sustains support for focused research, applications, and technology development activities that redeem the investment in our ongoing missions, while positioning us to accomplish essential new missions in the future. NASA's Earth Science program leads to improved prediction services by other agencies, providing direct tangible benefits to communities, businesses, and citizens.

NASA's **Planetary Science** Program explores the content origin and evolution of the solar system and the potential for life beyond Earth. The FY 2013 budget request for Science includes \$1,192.3 million for Planetary Science. In the second half of 2011, NASA launched Juno on its way to Jupiter, GRAIL to the Moon, and the Mars Science Laboratory to the Red Planet. GRAIL's "Ebb" and "Flow" spacecraft will conduct their mission to map the Moon's gravity field and interior structure during the first half of 2012. The Mars Science Laboratory rover Curiosity will land in Gale Crater on Mars on August 6th. The FY 2013 budget request funds the operation of Curiosity on Mars. The FY2013 budget will also fund the beginning of development of the next Discovery mission that will be selected from among three candidates completing their studies in 2012. In FY2013, NASA will be completing development of the LADEE mission to the Moon and the MAVEN mission to Mars for launch in late calendar year 2013/early FY2014. Also in FY 2013, NASA will continue the development of the OSIRIS-REx mission to return samples from an asteroid, and will continue operation of the Dawn (the asteroid Vesta), Juno (Jupiter), Cassini (Saturn), New Horizon (Pluto), and MESSENGER (Mercury) missions. However, the resources available over the budget horizon are insufficient to enable either a future Mars or Outer Planets flagship mission as identified by last year's Planetary Science decadal survey.

NASA remains committed to a vigorous program of Mars exploration and continuing America's leadership role in Mars exploration within the available budget. As stated above, NASA is discontinuing its effort on instruments for the joint (NASA/European Space Agency) 2016 ExoMars Trace Gas Orbiter mission and the 2018 mission that NASA had been exploring with the European Space Agency (ESA). Instead, NASA will develop an integrated strategy to ensure that the next steps for Mars exploration will support science as well as long-term human exploration goals. This process will be informed by

coordination with the science community and international community. NASA is developing a plan for a reformulated medium-class robotic science Mars mission, within available resources, to take advantage of the favorable location of Mars and Earth in 2018 or 2020. NASA's plan is to work with potential international partners including ESA and the science community to lay out an initial framework for this mission over the next several months and produce a mission architecture by this summer. To keep this effort moving forward in FY 2012, resources, totaling approximately \$30 million, are proposed for work towards a revised mission. The budget request includes \$62 million in FY 2013 for this mission.

NASA's **Astrophysics** Program seeks to discover how the universe works, explore how the universe began and evolved and search for Earth-like planets. The FY 2013 budget request for Science includes \$659.4 million for Astrophysics. NASA will continue to conduct science operations flights of the SOFIA aircraft in 2012 and 2013 as we upgrade its science instruments, and will continue parallel development of efforts leading to achievement of a full operational capability in 2014. The FY 2013 budget will fund the early stages of development of the next Astrophysics small Explorer mission to be selected early in calendar year 2013. Also in 2013 NASA will complete development of its instrument contributions to Japan's Astro-H mission for launch in FY 2014. The FY2013 budget enables NASA to continue development of the GEMS Explorer mission toward a launch in 2015. Finally, the FY 2013 budget will fund the operation of eleven Astrophysics missions currently in operation, including the Hubble, Spitzer, Chandra, and Fermi space telescopes.

The **James Webb Space Telescope** (JWST) is an infrared telescope designed to study and answer fundamental astrophysical questions ranging from the formation and structure of the universe to the origin of planetary systems and the origins of life. The FY 2013 budget request for Science includes \$627.6 million for JWST. A scientific successor to the Hubble Space Telescope (HST) and the Spitzer Space Telescope, JWST will be used by international teams of astronomers to conduct imaging and spectroscopic observations. The Observatory will be located in an orbit near the second Sun-Earth Lagrange point (L2), approximately 1.5 million km from Earth. The telescope and instruments will be operated at a temperature of forty degrees above absolute zero (40 Kelvin) shielded from the heat of the Sun by a large sunshield, to enable the Observatory to achieve unprecedented sensitivity over its entire wavelength range. NASA completed a new baseline cost and schedule for JWST at the end of calendar year 2011, and is now implementing that new baseline. All 18 JWST primary mirror segments have been completed. NASA expects to take delivery of all four JWST instruments in FY2012-2013. In FY 2013, NASA will begin sunshield fabrication and continue development of the Integrated Science Instrument Module and the ground segment.

NASA's **Heliophysics** Program seeks an understanding of the Sun, and the complex interaction of the coupled system comprising the Sun, Earth, other planetary systems, the vast space within the solar system, and the interface with interstellar space. The FY 2013 budget request for Science includes \$647.0 million for Heliophysics. Later this year, NASA will launch the Radiation Belt Storm Probes mission, and the FY 2013 budget will fund completion of its checkout and its early operations. The FY 2013 budget will fund completion and launch of the IRIS small Explorer mission as well as beginning of the development of the next small Explorer to be selected in early in calendar year 2013. FY 2013 will be a peak year in the development of the Magnetospheric Multiscale (MMS) mission to be launched in 2015. The FY 2013 budget will also fund the continued formulation of the Solar Probe Plus mission and development of the Solar Orbiter Collaboration with ESA. NASA expects to receive the new NRC Heliophysics decadal survey this spring, and will use it to shape the FY 2014 budget request in this area.

Also during FY 2013, NASA will continue development of environmental operational satellites for NOAA on a reimbursable basis. These include the Joint Polar Satellite System, Geostationary Operational Environmental Satellites (GOES-R series), Jason 3, and the Deep Space Climate Observatory. Funding for these programs is in the Department of Commerce budget request for NOAA.

In addition to the space missions emphasized above, the FY 2013 budget funds NASA's Science Mission Directorate to continue to sponsor competitively-selected research by universities, industry, and government laboratories across the nation. Using data from these missions, the nation's scientific community pursues answers to profound scientific questions of interest to all humanity as well as questions that enhance our national capability to predict environmental change including severe storms, droughts, and space weather events, and thereby enhance our economic and environmental security.

Aeronautics Research

NASA aeronautics research will enable the realization of the nation's Next Generation Air Transportation System (NextGen), and the safer, more fuel efficient, quieter, and environmentally responsible aircraft that will operate within NextGen. Through the research we conduct and research we sponsor with universities and industry, we help to develop the technology that enables continuous innovation in aviation. American companies are well positioned to build on discoveries and knowledge resulting from NASA research, turning them into commercial products, benefiting the quality of life for our citizens, providing new high-quality engineering and manufacturing job opportunities, and enabling the United States to remain competitive in the global economy. NASA's FY 2013 budget request for aeronautics is \$551.5 million to continue our tradition of developing new concepts for aeronautics applications.

The FY 2013 request for Aeronautics Research includes \$168.7 million for the **Fundamental Aeronautics** Program which seeks to continually improve technology that can be infused into today's state-of-the-art aircraft, while enabling game-changing new concepts such as Hybrid Wing Body airframes, tilt-rotor aircraft, low-boom supersonic aircraft, and sustained hypersonic flight. In FY 2010 and 2011 we conducted emissions measurements for alternative non-petroleum fuels derived from coal and biomass that showed dramatic reductions in particulate emissions in the vicinity of airports. In FY 2013 the Program will perform emissions measurements behind aircraft operating at relevant altitudes and cruise speeds to provide the first-ever data on the impact of alternative fuels on contrail formation, an important factor in aviation climate impact. In FY 2013 the Program will also increase its research on composite materials to enable airframe weight reductions beyond those achieved with current materials and structural design concepts.

NASA is combining hypersonic and supersonic research into a single project to focus on fundamental research for high-speed flight. Research into hypersonic flight is also relevant to the Department of Defense and NASA will retain critical core competencies and national asset testing capabilities to continue productive collaborations with DoD. Responsibility for fundamental research on entry, descent, and landing technologies will be transferred to Space Technology to increase synergy with the Agency's exploration and science missions. NASA will continue to work with DOD to maximize the efficiencies of current assets and investments and increase partnership to accomplish common goals. These realignments will enable NASA to focus on higher-priority research to improve the safety and minimize the environmental impacts of current and future aircraft and air traffic management systems. The FY 2013 request for Aeronautics Research includes \$104.0 million for the **Integrated Systems Research Program**. This program evaluates and selects the most promising environmentally friendly engine and airframe concepts emerging from the fundamental research programs for further development, integration, and evaluation in relevant environments. Last year, the Program completed a major study by three aircraft manufactures to identify the critical technologies needed to simultaneously reduce emissions, fuel burn, and noise in aircraft entering service in 2025. In FY 2013, the Program will start a 3-year focused research effort on these technologies to advance their technology readiness. The Program is also addressing the emerging desire to integrate Unmanned Aircraft Systems (UAS) into the National Airspace System. Current Federal Aviation Administration (FAA) regulations are built upon the

condition of a pilot being on-board the aircraft. The Program will therefore generate data for FAA use in rule-making through development, testing, and evaluation of UAS technologies in operationally relevant scenarios.

Reductions in environmental impact will be achieved not only through new aircraft, engines, and fuels, but also through improved air traffic management procedures, which is the focus of the **Airspace Systems Program** with \$93.3 million requested for FY 2013. Last year the Program advised the FAA on new air traffic management concepts for more efficient routing of flights during their cruise phase. We also completed evaluations of concepts for new fuel-efficient arrival procedures and will deliver requirements for those concepts to the FAA this year. In FY 2013 the Program will begin demonstrations to verify that several new procedures for air traffic management during arrival and taxiing to the gate that are enabled by NextGen Automatic Dependent Surveillance-Broadcast (ADS-B) technology can work together seamlessly. This effort will demonstrate near-term and mid-term ADS-B application benefits and provide airlines with data to support their strategic decisions related to the significant investments they need to make to equip their aircraft with ADS-B capability.

The **Aviation Safety Program**, with \$81.1 million requested for FY 2013, conducts research to ensure that current and new aircraft and operational procedures maintain the high level of safety which the American public has come to expect. In FY 2011, the Program advanced data mining methods that permit the discovery of flight operations and aircraft maintenance issues through automated analysis of the vast amounts of data generated during flight operations and by sensors onboard aircraft. These methods have enabled the development of new software for aircraft central maintenance computers on both business jet and large commercial aircraft that can identify the early stages of hardware faults 30 to 50 flights earlier than previously possible. This allows airline maintenance personnel to address equipment issues before they cause a disruptive maintenance delay at the airport gate. The Program also focuses on mitigating environmental hazards to aviation and in FY 2013 will conduct a flight campaign to characterize ice water content at high altitudes in tropical regions as a first step to understanding the causes of severe loss of power due to engine icing that has occurred on a number of occasions.

U.S. leadership in aerospace depends on ready access to technologically advanced, efficient, and affordable aeronautics test capabilities. NASA's **Aeronautics Test Program**, with \$78.1M requested for FY 2013, makes strategic investments to ensure the availability of these ground test facilities and flight test assets to researchers in Government, industry, and academia. In addition to this strategic management activity, the Program will continue developing new test instrumentation and test technologies. Last year the Program completed nearly \$50 million worth of upgrades to major facilities funded through the American Recovery and Reinvestment Act. These upgrades provide improved research capabilities at Glenn and Ames Research Centers for aircraft and engine icing research, and tilt-rotor designs for a new generation of rotorcraft. New capabilities were also added to the Langley 14x22 Subsonic Wind Tunnel that will enable researchers to measure noise signatures from novel aircraft designs at a fraction of the cost of noise measurement acquired by flying real aircraft over airport microphone arrays. NASA's Aeronautics Test program enables and sustains U.S. leadership in aerospace yielding high quality jobs and ultimately a productive Aerospace sector.

The **Aeronautics Strategy and Management Program** provides for research and programmatic support that benefits each of the other five Programs, and has a requested budget of \$26.4 million for FY 2013. The Program manages Directorate functions including Innovative Concepts for Aviation, Education and Outreach, and Cross Program Operations.

NASA is making meaningful contributions to the aerospace community, but we cannot do all these good things alone. Therefore, our partnerships with industry, academia, and other Federal agencies are critical to our ability to expand the boundaries of aeronautical knowledge for the benefit of the Nation. These

partnerships foster a collaborative research environment in which ideas and knowledge are exchanged across all communities and help ensure the future competitiveness of the nation's aviation industry. They also directly connect students with NASA researchers and our industrial partners and help to inspire students to choose a career in the aerospace industry.

Human Exploration and Operations

In 2011, NASA combined the Exploration Systems and Space Operations Mission Directorates to create the Human Exploration and Operations (HEO) Mission Directorate. HEO encompasses everything from the ISS and the commercial cargo and crew vehicles that will support it, to NASA's new exploration vehicles, which will take astronauts beyond LEO. HEO also includes research and technology development efforts that will enable deep space exploration, as well as critical infrastructure and operational capabilities that ensure NASA's ability to conduct testing, launch science missions, and communicate with its spacecraft across the solar system. As NASA reformulates its Mars exploration plans, we will ensure that the next steps for Mars exploration will take into account long-term human exploration as well as science goals.

The FY 2013 budget request includes \$2,769.4 million for **Human Exploration Capabilities**, which the Agency proposes to rename **Exploration Systems Development**. This program includes development of the Orion MPCV, SLS heavy-lift launch vehicle, and the supporting ground infrastructure required for NASA's future crewed missions of exploration beyond LEO and into deep space. The amounts requested align with the plan developed and supported by an independent cost analysis performed last summer.

NASA's Orion MPCV will carry astronauts to, and support operations at, a variety of destinations in our solar system for periods of up to 21 days. NASA has recently completed a number of tests on Orion MPCV, including a test of the main parachute, and a series of water drop tests on the 18,000-pound Orion MPCV Boiler Plate Test Article. The Orion ground test article will undergo and complete acoustic, modal, and vibration environment compatibility testing at Lockheed Martin Denver during fiscal year 2012. The results of these tests will help improve the design for the actual flight vehicle. In May, the Orion Crew Module primary structure will be moved to Kennedy Space Center in Florida for the start of Assembly, Integration, and Production. NASA plans to conduct an uncrewed high-energy-atmospheric entry test mission of the Orion MPCV in FY 2014. Designated Exploration Flight Test-1 (EFT-1), this flight test will provide critical data to influence key design decisions. EFT-1 will also validate innovative new approaches to space systems development and operations to reduce the cost of exploration missions. For EFT-1, an early production variant of the Orion MPCV spacecraft will be integrated on a Lockheed Martin-procured, heavy class launch vehicle. The flight test will provide an opportunity to significantly inform critical design elements by operating the integrated spacecraft hardware and software in flight environments that cannot be duplicated by ground testing.

On September 14, 2011, NASA announced the design of the SLS, which will initially be capable of lifting 70-100 metric tons before evolving to a lift capacity of 130 metric tons for more demanding missions. NASA has worked diligently to accomplish the contracting and design work necessary to support a 2017 initial flight mission for the SLS. In FY 2013, SLS will continue detailed preliminary design and development and undergo a preliminary design review to evaluate the completeness/consistency of the program's preliminary design in meeting all requirements with appropriate margins, with acceptable risk, and within cost and schedule constraints. This comprehensive review will determine the program's readiness to proceed with the detailed critical design phase of the project.

The SLS will use a liquid hydrogen and liquid oxygen propulsion system, building upon the investment made by the Nation over the last forty years. The vehicle's core stage will utilize existing Space Shuttle Main Engines (SSME RS-25D) for the initial capability. NASA's use of the SSME inventory will reduce initial design costs and take advantage of an existing human-rated system. NASA plans to modify and use the existing SSME contract with Pratt & Whitney Rocketdyne to acquire RS-25D engine servicing and testing for the initial launch system.

The upper stage of the SLS needed for the full-up SLS capability will also use a liquid hydrogen and liquid oxygen propulsion system that includes the J-2X, a new upper stage engine previously planned for use in the Ares-I vehicle. NASA is negotiating a modification to the Ares I Upper Stage contract with Boeing to develop the SLS core stage and upper stage, including avionics. SLS will also utilize the existing J-2X contract with Pratt & Whitney Rocketdyne to continue developing the upper stage engine. NASA has been running J-2X components through a series of tests. In November and December 2011, the Agency conducted three J-2X engine tests, firing the motor for a total of 680 seconds. These were the last of ten engine test firings completed in 2011. In January and February of 2012, NASA also conducted a series of J-2X Power Pack Assembly tests. These tests are part of a series of over 100 power-pack and integrated engine tests that NASA has planned to complete the engine design and certify the J-2X for use in the SLS Upper Stage.

NASA plans to use five-segment solid rocket boosters for the initial capability test flights of the SLS. We will conduct a competition to develop the follow-on boosters based on performance requirements. In support of this effort, on February 9, 2012, the Agency released a NASA Research Announcement (NRA) for Advanced Booster Engineering Demonstration and Risk Reduction. Proposals are due in April and contract awards are expected in October 2012.

On February 1, 2012, NASA also released a draft for an NRA, for advanced development of key technologies in propulsion, avionics, structures and materials, and other areas. The final release is planned for March, with proposals due in May and contract award in October 2012.

Exploration Ground Systems (EGS) will develop the necessary ground systems infrastructure at the Kennedy Space Center and operational plans and procedures to prepare, assemble, test, launch and recover the Exploration architecture elements for long-term beyond-Earth orbit exploration. EGS will focus on the life cycle of a launch complex as an integrated system (from development, activation, operations, maintenance of capabilities to manufacture, assemble, test, checkout, launch, and recover flight hardware) to enable more efficient and cost-effective ground processing, launch and recovery operations.

The FY 2013 budget request includes \$829.7 million for the **Commercial Spaceflight** theme. This effort will support commercial providers to develop and operate safe, reliable, and affordable commercial systems to transport crew and cargo to and from the ISS and LEO.

As part of the Commercial Orbital Transportation Services (COTS) program – NASA's commercial cargo effort – NASA has partnerships with Space Exploration Technologies, Inc. (SpaceX) and Orbital Sciences Corporation (Orbital) using funded Space Act Agreements. These agreements include a schedule of fixed payment performance milestones culminating in a demonstration mission to the ISS that includes vehicle launch, spacecraft rendezvous, ISS berthing, and re-entry for disposal or return to Earth. Both COTS partners continue to make progress in developing and demonstrating their systems. Based on the success of their first COTS demo flight in December 2010, SpaceX plans to fully develop and assemble their next vehicle with the capabilities and equipment necessary to complete rendezvous and berthing demonstration to the ISS, thus potentially combining milestones that had been planned for separate flights. If successful, this will accelerate the completion of the COTS Space Act Agreement and

enable delivery of cargo under the Commercial Resupply Services (CRS) contract. This mission is tentatively planned for April 2012. Orbital Sciences is currently mating the main engines for its Antares vehicle to the core stage in preparation for an integrated static fire later this year. The maiden flight of the Antares is planned for the second quarter of 2012 and the COTS demonstration mission is planned for the third quarter. The pad complex at Wallops Flight Facility in Virginia is being readied and space flight hardware, including the first Pressurized Cargo Module, two Antares core sections, and a Castor-30 upper stage, has already been delivered to Wallops Flight Facility.

The Commercial Crew Program (CCP) aims to facilitate the development of a U.S. commercial crew space transportation capability with the goal of achieving safe, reliable, and cost effective access to and from low Earth orbit and ISS. Since 2009, NASA has conducted two CCDev competitions, soliciting proposals from U.S. industry to further advance commercial crew space transportation system concepts and mature the design and development of elements of the system. During the second CCDev competition, known as CCDev2, NASA awarded four funded Space Act Agreements that are currently being executed with Blue Origin, The Boeing Company, Sierra Nevada Corporation, and SpaceX, all of which are making good progress in achieving their milestones. NASA has also signed Space Act Agreements without funding with three additional companies: Alliant Techsystems, Inc., United Launch Alliance, and Excalibur Almaz, Incorporated .

Under the CCP, NASA plans to partner with U.S. industry, providing technical and financial assistance to facilitate industry's development of an integrated crew transportation system. In the longer term, once those entities are certified, NASA plans to buy transportation services from commercial entities for U.S. and U.S.-designated astronauts to the ISS.

Congress appropriated \$406 million for CCP in FY 2012 which reflected a substantial reduction from NASA's request for this program. The FY 2012 appropriation enables the Agency to move forward with its plans to support the development of commercial services that may eventually support crew transportation and rescue capabilities in support of ISS. However, the constrained budget environment necessitated a reassessment of NASA's overall strategy for this Program. On December 15, 2011, NASA announced a modified competitive acquisition strategy designed to make the best use of available resources and to pursue the most effective path to the achievement of a commercial crew capability. Instead of using firm-fixed price contracts for the next phase of the Program, the Agency plans to continue using multiple, competitively awarded and funded Space Act Agreements for another round of CCP. NASA will use procurement contracts to certify these capabilities before they are used to support ISS. Using competitive Space Act Agreements instead of contracts at this juncture will allow NASA to maintain multiple partners during this phase of the Program, and provide NASA with the flexibility to more easily adjust to various funding levels. This new acquisition strategy will allow NASA to preserve greater competition and maintain momentum to provide a U.S.-based commercial crew launch capability at the earliest possible time.

NASA is pleased with the steady progress of U.S. commercial providers in developing domestic cargo and crew transportation services. NASA currently has contracts for cargo services and intends to purchase crew services from U.S. providers once they are certified to our crew requirements. Obtaining needed cargo and crew transportation services from U.S. providers is NASA's preferred method for sustaining and fully utilizing the ISS. Nevertheless, given current funding levels for the development of U.S. crew transportation systems, we anticipate the need to purchase Soyuz crew transportation and rescue capabilities into 2017. As NASA has previously testified, modification of the Iran, North Korea, Syria Non-proliferation Act (INKSNA) provisions will likely be required for the continued operation of ISS and other space programs after 2016. The Administration plans to propose appropriate provisions and looks forward to working with the Congress on their enactment. NASA is evaluating how this issue

impacts the development of U.S. crew transportation systems and NASA's acquisition of services for the ISS and goods and services for other NASA human spaceflight activities, given the possibility that some U.S. domestic providers will need to use Russian goods and services. In addition to the need driven by the ISS transportation requirements, NASA will require Russia-unique critical capabilities for the life of the ISS, such as sustaining engineering for the Russian built U.S. owned Functional Cargo Block, that are not available elsewhere.

The FY 2013 budget request includes \$333.7 million for **Exploration Research and Development (ERD)**. The Exploration Research and Development (ERD) theme will expand fundamental knowledge that is key to human space exploration, and will develop advanced exploration systems and capabilities that will enable humans to explore space in a more sustainable and affordable way. ERD is comprised of the Human Research Program (HRP) and the Advanced Exploration Systems (AES) Program, which will provide knowledge and advanced human spaceflight capabilities. NASA's Office of the Chief Technologist (see below) coordinates closely with ERD to ensure that NASA's long range, crosscutting Space Technology research is complementary to ERD's human exploration focused work.

HRP and its associated projects will continue to develop technologies, countermeasures, diagnostics, and design tools to keep crews safe and productive on long-duration space missions. ISS crews are conducting relevant human medical research to develop knowledge in the areas of clinical medicine, human physiology, cardiovascular research, bone and muscle health, neurovestibular medicine, diagnostic instruments and sensors, advanced ultrasound, exercise and pharmacological countermeasures, food and nutrition, immunology and infection, exercise systems, and human behavior and performance. While this research is aimed at enabling astronauts to push the boundaries of exploration beyond low-Earth Orbit (LEO), NASA anticipates that investigations conducted aboard ISS may have broad application to terrestrial medicine, as well. For example, the growing senior population may benefit from experiments in the areas of bone and muscle health, immunology, and from the development of advanced diagnostic systems.

The AES Program is pioneering new approaches for rapidly developing prototype systems, demonstrating key capabilities, and validating operational concepts for future human missions beyond Earth orbit. AES activities are uniquely related to crew safety and mission operations in deep space, and are strongly coupled to future vehicle and exploration capability development. Early integration and testing of prototype systems will reduce risk and improve affordability of exploration mission elements. The prototype systems developed in the AES Program will be demonstrated in ground-based test beds, field tests, underwater tests, and flight experiments on the ground and then on the ISS. Many AES projects will evolve into larger integrated systems and mission elements that will be tested on ISS before we venture beyond Earth orbit, thus leveraging the value of the Station as a vital exploration test-bed.

The FY 2013 budget request includes \$70.6 million for the **Space Shuttle Transition and Retirement (T&R)**. In 2011, the Shuttle flew out its remaining missions safely. On February 24, Discovery launched on mission STS-133, carrying supplies to ISS, as well as the permanent a Multi-purpose Module (PMM)-- a Multi-Purpose Logistics Module (MPLM) transformed to remain on orbit, expanding the Station's storage volume. On May 16, Endeavour, STS-134, carried the Alpha Magnetic Spectrometer (AMS) and attached it to the Station's truss structure. The final Shuttle mission, STS-135, launched on July 8, delivered critical supplies to the ISS. With the landing of Atlantis on July 21, 2011, the 30-year Shuttle Program was brought to a close. The Space Shuttle Program is now focused on the transition of key assets and infrastructure to future programs, and the retirement, and disposition of Program assets.

In FY 2012, NASA is funding United Space Alliance's (USA's) Space Program Operations Contract (SPOC) Pension Liability. During the Shuttle Program, USA consistently incorporated and billed the maximum allowable costs into their indirect rates, but the deterioration of the equities and credit markets

caused their plan to be underfunded by a currently estimated \$522 million. The estimate will fluctuate until payout in the summer of 2012. The variance is protected in the transition and retirement budget line item. The Space Program Operations Contract, which accounts for almost all of USA's business base, is a cost-type contract covered by the Cost Accounting Standards (CAS). These standards stipulate that any costs of terminating plans are a contractual obligation of the Government (if deemed allowable, allocable, and reasonable). NASA and USA entered into an agreement under which USA froze their pension plans as of December 31, 2010, and deferred any decision about terminating their plan until after NASA received its FY 2012 appropriation, allowing NASA to address this issue with FY 2012 funds. If funding remains after the pension plan termination, it will be used to defray Space Shuttle closeout costs that would otherwise require FY 2013 funding. If there is a shortfall, it will reduce available Space Shuttle funds for closeout and some activity could move later than planned. NASA will keep Congress informed as this issue evolves.

The FY 2013 budget request includes \$3,007.6 million for the **International Space Station (ISS) Program**. This funding will support ISS Operations and Maintenance, ISS Research, and ISS Crew and Cargo Transportation. The ISS has transitioned from the construction era to that of operations and research, with a 6-person permanent crew, 3 major science labs, an operational lifetime through at least 2020, and a growing complement of cargo vehicles, including the European Automated Transfer Vehicle (ATV) and the Japanese H-II Transfer Vehicle (HTV). The FY 2013 budget request reflects the importance of this unparalleled research asset to America's human spaceflight program.

In the NASA Authorization Act of 2005 (P.L. 109-155), Congress designated the U.S. segment of the ISS as a National Laboratory, and directed the Agency to seek to increase the utilization of the ISS by other Federal entities and the private sector. NASA has made great strides in its effort to engage other organizations in the ISS program, and the Agency now has Memoranda of Understanding with five Federal agencies and Space Act Agreements with nine companies and universities. In the NASA Authorization Act of 2010 (P.L. 111-267), Congress directed that the Agency enter into a cooperative agreement with a not-for-profit organization to manage the activities of the ISS National Laboratory. To this end, on August 31, 2011, NASA finalized a cooperative agreement with the Center for the Advancement of Science in Space (CASIS) to manage the portion of the ISS that operates as a U.S. National Laboratory. CASIS will be located in the Space Life Sciences Laboratory at Kennedy Space Center in Florida. The independent, nonprofit research management organization will help ensure the Station's unique capabilities are available to the broadest possible cross-section of U.S. scientific, technological and industrial communities. CASIS will develop and manage a varied Research and Development portfolio based on U.S. national needs for basic and applied research; seek to establish a marketplace to facilitate matching research pathways with qualified funding sources; and stimulate interest in using the national lab for research and technology demonstrations and as a platform for science, technology, engineering and mathematics (STEM) education. The goal is to support, promote and accelerate innovations and new discoveries in science, engineering and technology that will improve life on Earth.

The FY 2013 budget request includes \$935.0 million for **Space and Flight Support (SFS)**. The budget request provides for critical infrastructure indispensable to the Nation's access to and use of space, including Space Communications and Navigation (SCaN), Launch Services Program (LSP), Rocket Propulsion Test (RPT), and Human Space Flight Operations (HSFO). The SFS budget also includes investment in the 21st Century Space Launch Complex, whose primary objective is to modernize and transform the Florida launch and range complex at the Kennedy Space Center to benefit current and future NASA programs, along with other emerging users. Fiscal Year 2013 is an important period for NASA's Space Communications and Navigation (SCaN) Program. The Program is responsible for NASA's Tracking and Data Relay Satellites (TDRS) that provide a critical backbone for space communications. FY 2013 will include the scheduled launch TDRS-K, an additional satellite in the

system; completion of TDRS L integration; and the development of TDRS-M, which will be ready for launch in 2015. These spacecraft will refurbish this important network as aging TDRS are retired after 20 years of service to the Nation. Also under construction is a 34-meter antenna at the Deep Space Network's Canberra Deep Space Communication Complex, with plans to build a second, to replace the aging 70-meter antenna. These antennae in the Southern Hemisphere will be particularly important as the Earth's rotation brings this site into the best range for tracking NASA's deep space missions in the coming decade. In preparation for supporting NASA's space science program, SCA-N is developing space communications technology, including the Lunar Laser Communications Demonstration and the Laser Communication Relay Demonstration, which will lead to the capability of handling the huge increase in scientific data expected from NASA's planned spacecraft. Additionally, this capability could enable greater bandwidth and capabilities to support expanded education, participatory engagement, and interactive exploration opportunities. SCA-N also anticipates the launch of its SCA-N Test-bed in June on the Japanese Space Agency's HTV cargo vehicle. The test-bed, composed of three Software-Defined Radios, will provide the bridge to advance technological innovation by actual testing in the real space environment. As a pathfinder it will be made available to industry, academia and other Government agencies.

The Launch Services Program (LSP) has several planned NASA launches in FY 2013, including the, Landsat Data Continuity Mission (LDCM), Tracking and Data Relay Satellite (TDRS)-K, and Interface Region Imaging Spectrograph (IRIS), and will continue to provide support for the development and certification of emerging launch services. In FY 2013, the Rocket Propulsion and Test (RPT) program will continue to conduct test facility management, maintenance, sustaining engineering, operations, and facility modernization projects required to keep the test-related facilities in the appropriate state of operational readiness. The RPT program will continue to assist in rocket propulsion testing requirements definition for low Earth orbit and in-space propulsion systems and related technologies

Technology

The Office of the Chief Technologist (OCT) coordinates the Agency's overall technology portfolio. OCT ensures that NASA's investments are cost-effective and that they are aligned with the Agency's near- and far-term goals. Over the last year, OCT has engaged thousands of technologists and innovators to develop and test cutting-edge technologies distributed across the country. While the NRC conducted its review of NASA's technology roadmaps, OCT worked with mission architecture teams to identify key technology areas requiring immediate investment. Using these internal, cross-Agency working groups, NASA selected nine technologies to receive priority funding based on their criticality in extending human presence beyond low Earth orbit and their ability to dramatically further scientific exploration of the solar system. These "Big 9" projects are: Laser Communications Relay Demonstration, Cryogenic Propellant Storage and Transfer, Low Density Supersonic Decelerators, Composite Cryogenic Propellant Tanks, Robotic Satellite Servicing, Hypersonic Inflatable Aerodynamic Decelerators, Deep Space Atomic Clock, Large-Scale Solar Sail, and Human-Robotic Systems.

On February 1, 2012, the NRC released its final review of NASA's Draft Space Technology Roadmaps. The NRC identified sixteen top-priority technologies necessary for future missions, and which could also benefit American aerospace industries and the nation. The sixteen were chosen by the NRC from its own ranking of 83 high-priority technologies out of approximately 300 identified in the draft roadmaps. In the coming months, OCT will lead an agency-wide analysis and coordination effort to inform future technology investments on the basis of the NRC report.

The FY 2013 request for Space Technology is \$699 million and funds on-going high-priority space technology projects that will increase the nation's capability to operate in space and enable long-term

human exploration and develop efficiencies for deep space science missions. In FY 2013, NASA will begin to see major milestones achieved within Space Technology's "Big 9" efforts. Designed to deliver data rates that will enable new class of deep-space exploration missions, the Laser Communications Relay Demonstration project will begin ground validation activities of advanced laser communication systems. Enabling precise landing of higher-mass payloads to the surface of planets, the Low Density Supersonic Decelerators effort will complete three critical full-scale tests to demonstrate parachute and inflatable decelerator performance required prior to supersonic-speed flight demonstration. The Composite Cryogenic (low-temperature) Propellant Tank project will design and build a five-meter-diameter composite cryogenic propellant tank that will yield lower mass and lower cost rocket propellant tanks. The Cryogenic Propellant Storage and Transfer demonstration mission will conduct ground tests of the critical technologies required to enable long-term storage and handling of cryogenic fluids in space in preparation for a flight demonstration. While these projects will make visible individual steps in FY 2013, they are part of a broader portfolio of activities that Space Technology will pursue in order to generate new technologies for use by NASA, other government agencies, and U.S. industry.

Within Space Technology, NASA funds Crosscutting Space Technology Development at \$293.8 million to enable NASA to develop transformational, broadly applicable technologies and capabilities that are necessary for NASA's future science and exploration missions, and also collaborates on the aerospace needs of other government agencies and the U.S. space enterprise. NASA's CSTD activities are funded through a mix of competitive and strategically-guided projects to attract a broad array of participants. Investments support research fellowships, NASA Innovative Advanced Concepts (NIAC), Centennial Challenges, suborbital flight opportunities, and advancements in small satellite technologies and systems.

NASA also funds Exploration Technology Development at \$202 million to invest in the long-range technologies required for humans to explore beyond low Earth orbit. ETD technologies are higher risk investments that complement architecture and systems development efforts within Exploration by maturing breakthrough technology prior to integration with operational capabilities. As projects are matured, new projects are selected competitively to provide the opportunity to develop the best ideas, innovations, approaches and processes for the future human space exploration efforts.

Funded based on a percentage of the Agency's total extramural R&D, the Small Business Innovative Research (SBIR) and Small Business Technology Transfer (STTR) programs continue to support research and development performed by small businesses through competitively-awarded contracts. Estimated at approximately \$173.7 million in FY 2013, these programs produce innovations for both Government and commercial applications. SBIR and STTR provide the high-technology small business sector with the opportunity to develop technology for NASA, and commercialize that technology to provide goods and services that address other national needs based on the products of NASA innovation.

Partnership Development and Strategic Integration, funded at \$29.5 million, comprises key Agency responsibilities managed by OCT: technology partnerships, technology transfer and commercialization, and the coordination of NASA's technology investments across the Agency through technology portfolio tracking and technology road-mapping. By providing coordination between Mission Directorates and Centers, and identifying collaboration opportunities with other government agencies and performing technology transfer, NASA can deliver forward-reaching technology solutions for future science and exploration missions, and help address significant national needs.

Within this portfolio, OCT engages in national technology development initiatives such as the National Robotics Initiative, the National Nanotechnology Initiative and the Advanced Manufacturing Partnership, and seeks partnerships with external entities for collaborative technology development. OCT engages the larger aerospace community including other Government agencies, and where there are mutual interests, develops partnerships to efficiently develop breakthrough capabilities.

Education

The FY 2013 request includes \$100 million for NASA's Office of Education to develop Science Technology Engineering and Mathematics (STEM) education activities that only NASA can provide. The funding request would allow undergraduate and graduate students to work alongside NASA scientists and engineers through internships and fellowships at NASA centers. It includes educator professional development, helping our country's educators become proficient in STEM topics, and providing them opportunities to practice hands-on investigations. NASA will also continue to support the institutions where learning takes place. Through the Space Grant and Minority University Research and Education projects, NASA will work with hundreds of universities and community colleges, strengthening their capacity to train the next generation of scientists and engineers, encouraging student design challenges, and connecting faculty with NASA research. And, because we know inspiration doesn't just happen in a classroom, we will engage learners in NASA content at our visitor centers and in partnership with museums, science centers, planetariums and other informal education venues.

NASA is one of many Federal government programs that support STEM education. NASA is working with other agencies through the National Science and Technology Council's Committee on STEM Education to effect optimal revisions to fund coordinated and effective student and teacher opportunities. NASA will focus its resources on demonstrated areas of strength in its unique role in STEM education. NASA brings many assets to support the Administration's emphasis on (STEM education beyond funding. Our people, platforms like the ISS and our facilities across the Nation all contribute to strengthening STEM education.

Recognizing that the nature of our work is inspirational to learners and educators, NASA will leverage the talents of our workforce to support the critical STEM education needs of our Nation. In collaboration with other Federal agencies, NASA will leverage unique assets like the International Space Station (ISS), to provide meaningful experiences. In March, Educator Astronaut Joe Acaba, a former middle and high school teacher, will begin a six-month mission onboard the ISS. During his time in space, he will work closely with our education team on the ground to share his experience with classrooms across America.

Cross-Agency Support

The FY 2013 budget request includes \$2,847.5 million for Cross-Agency Support, which provides critical mission support activities that are necessary to ensure the efficient and effective operation and administration of the Agency. These important functions align and sustain institutional and program capabilities to support NASA missions by leveraging resources to meet mission needs, establishing Agency-wide capabilities, and providing institutional checks and balances. Within this budget request, NASA has taken steps to reduce its administrative expenses, including a hiring slowdown and reduced travel.

NASA's FY 2013 budget request includes \$2,093.3 million for **Center Management and Operations**, which funds the critical ongoing management, operations, and maintenance of nine NASA Centers, as well as associated major component facilities. NASA Centers continue to provide high-quality support and the technical engineering and scientific talent for the execution of programs and projects. This technical expertise represents a true national resource. Center Management and Operations provides the basic support required to meet internal and external legal and administrative requirements; effectively manage human capital, information technology, and facility assets; responsibly execute financial management and all NASA acquisitions; ensure independent engineering and scientific technical oversight of NASA's programs and projects in support of mission success and safety considerations; and, provide a safe, secure, and sustainable workplace that meets local, state, and Federal requirements.

NASA's FY 2013 budget request includes \$754.2 million for Agency Management and Operations, which funds the critical management and oversight of Agency missions, programs and functions, and performance of a broad spectrum of NASA-wide activities. These programs include Safety and Mission Success activities, essential to reducing the likelihood of loss of life and likelihood of mission success in our human and robotic programs. Safety and Mission Success funding supports the maintenance of independent safety, health, medical and engineering assessments of systems and processes, as well as the performance of the broad risk assessments, mitigations, and acceptance related to critical Agency decisions. Agency Information Technology Services (AITS) encompasses Agency-level cross-cutting services and initiatives in Information Technology (IT) innovation, business and management applications, and infrastructure necessary to enable the NASA Mission. The Strategic Capabilities Assets Program (SCAP) ensure that vital Agency test capabilities and assets, such as flight simulators and thermal vacuum chambers are sustained in order to serve Agency and national needs. The Agency Management and Operations account funds salary and benefits for civil service employees at NASA Headquarters, as well as other Headquarters personnel costs, such as mandated training. It also contains labor funding for Agency-wide personnel costs, such as Agency training, and workforce located at multiple NASA Centers that provide the critical skills and capabilities required to execute mission support programs Agency-wide.

Construction and Environmental Compliance and Restoration

The FY 2013 budget request includes \$619.2 million for Construction and Environmental Compliance and Restoration. NASA Construction and Environmental Compliance and Restoration provides for the design and execution of all facilities construction projects, including discrete and minor revitalization projects, demolition of closed facilities, and environmental compliance and restoration.

The FY 2013 budget request includes \$552.8 million for the **Construction of Facilities (CoF)** Program, which funds capital repairs and improvements to ensure that facilities critical to achieving NASA's space and aeronautics programs are safe, secure, sustainable, and operate efficiently. The Agency continues to place emphasis on achieving a sustainable and energy-efficient infrastructure by replacing old, inefficient, deteriorated buildings and infrastructure with new, efficient, and high performance buildings and infrastructure that will meet NASA's mission needs while reducing the Agency's overall footprint and future operating costs. In August 2011, NASA opened the Agency's first building designed for "Net-Zero" energy operations, the Propellants North Administration and Maintenance Facility at the Kennedy Space Center in Florida. Two active programs that result in NASA achieving greater efficiencies and reduced operating costs are NASA's demolition program and recapitalization program, in which old inefficient facilities are replaced with new, efficient, consolidated facilities. Twelve horizontal infrastructure projects that sustain our major utility systems are included in this request; completion of these projects will reduce our usage of potable and process water, electricity and steam.

The FY 2013 budget request includes \$66.4 million for the **Environmental Compliance and Restoration (ECR)** Program, which supports the ongoing clean-up of sites where NASA operations have contributed to environmental problems. The ECR Program prioritizes these efforts to ensure that human health and the environment are protected. This Program also supports strategic investments in sustainable environmental methods and practices aimed at reducing NASA's environmental footprint and lowering the risk of future cleanups.

Conclusion

NASA's FY 2013 budget request of \$17.7 billion represents a substantial investment in a balanced program of science, exploration, technology and aeronautics research. Despite the constrained budget

environment facing the Nation, this request supports a robust space program that keeps us on a path to achieving a truly audacious set of goals. NASA is working to send humans to an asteroid and ultimately to Mars, to observe the first galaxies form, and to expand the productivity of humanity's only permanently-crewed space station. We are making air travel safer and more efficient, learning to live and work in space, and developing the critical technologies to achieve these goals. The coming year will include the first commercial cargo flights to the ISS, a nuclear powered robot the size of a small car landing on the surface of Mars, and the launch of the Nation's next land observing satellite. We have spacecraft studying the Sun, circling Mercury, cruising to Pluto and investigating almost everything in-between. In the face of very difficult times, the American people continue to support the most active, diverse and productive space program in the world. We at NASA are honored by our fellow citizens' continued support and we are committed to accomplishing the goals that Congress and the President have laid out for us. The program described and supported by our FY 2013 budget request represents our plan to accomplish those goals.