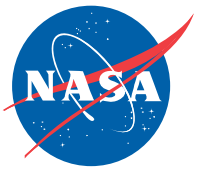
National Aeronautics and Space Administration



Federal Program Inventory

Fiscal Year 2013

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Introduction

Today, information on the federal government's programs is decentralized. A central program list can facilitate coordination across programs by making it easier to find programs that can contribute to a shared goal, as well as improve public understanding about what federal programs currently operate and how programs link to budget, performance, and other information. Congress recognized this need, and passed the GPRA Modernization Act, requiring information for each program identified by agencies to be included on a single, government-wide website consistent with guidance provided by the Office of Management and Budget (OMB).

In accordance with new requirements in OMB Circular A-11, NASA is required to provide an inventory of all programs to OMB. The completion date for the Federal Program Inventory (FPI) is May 2014, following a two-phased approach started in summer 2012. It will be publicly available at performance.gov. The FPI may, in the future, serve as the basis for further OMB efforts to increase the utility of this project.

This document describes each of NASA's 57 programs across eight budget accounts, as well as how the program supports the Agency's broader Strategic Goals and Outcomes. For each account, NASA included the budget authority reported in the President's Budget for fiscal years 2012, 2013 and 2014 (requested). Please refer to www.Performance.gov for program contributions to our Agency Priority Goals.

Please refer to www.Performance.gov for agency's contributions to Cross-Agency Priority (CAP) Goals NASA currently contributes to the following CAP Goals:

- **Science, Technology, Engineering, and Math (STEM) Education**: In support of the President's goal that the U.S. have the highest proportion of college graduates in the world by 2020, the Federal Government will work with education partners to improve the quality of science, technology, engineering and math (STEM) education at all levels to help increase the number of well-prepared graduates with STEM degrees by one-third over the next 10 years, resulting in an additional 1 million graduates with degrees in STEM subjects.
- **Data Center Consolidation**: Improve IT service delivery, reduce waste and save $3 billion in taxpayer dollars by closing at least 1200 data centers by fiscal year 2015.
- **Cybersecurity**: Achieve 95% use of critical cybersecurity capabilities on federal executive branch information systems by 2014, including strong authentication, Trusted Internet Connections (TIC), and Continuous Monitoring.
- **Sustainability**: By 2020, the Federal Government will reduce its direct greenhouse gas emissions by 28 percent and will reduce its indirect greenhouse gas emissions by 13 percent by 2020 (from 2008 baseline).
- **Entrepreneurship and Small Business**: Increase federal services to entrepreneurs and small businesses with an emphasis on 1) startups and growing firms and 2) underserved markets.
- **Strategic Sourcing:** Reduce the costs of acquiring common products and services by agencies' strategic sourcing of at least two new commodities or services in both 2013 and 2014 that yield at least a 10 percent savings.
- **Closing Skills Gaps**: Close critical skills gaps in the Federal workforce to improve mission performance. By September 30, 2013, close the skills gaps by 50 percent for 3 to 5 critical Federal Government occupations or competencies, and close additional agency-specific high risk occupation and competency gaps.

- **Energy Efficiency**: Reduce Energy Intensity (energy demand/ $ real GDP) 50 percent by 2035 (2010 as base year).

Also, please refer to www.Performance.gov for program contributions to our Agency Priority Goals.

Approach Summary

NASA identified programs based on an element of the budget structure that it refers to as "programs." NASA defines program as a strategic investment by a Mission Directorate or Mission Support Office that has defined goals, objectives, architecture, funding level, and a management structure that supports one or more projects.

This approach is partly based on the ability to link programs with Program Activity (PA) lines in budget materials. Elements of NASA's budget structure are also externally recognizable, link to an organizational component, and are persistent in nature. To avoid confusion among stakeholders, NASA used one approach to identify all its programs.

A Note on NASA's Performance Framework

Per GPRAMA requirements, NASA is currently updating its strategic plan, which will be published in 2014. This program inventory is based on the 2011 Strategic Plan, where NASA's outcomes are equivalent to the future strategic objectives outlined in OMB Circular A-11. In the future, the elements of NASA's strategy-performance framework will better align with OMB's structure for strategic plan elements.

Budget Summary as of March 1, 2013 (in millions)

Mission Directorate	FY 2012 actual [1]	FY 2013 est. [2]	FY 2014 req.
Science	$5,073.7	$5,115.9	$5,017.8
Aeronautics Research	$569.4	$572.9	$565.7
Space Technology	$573.7	$577.2	$742.6
Exploration	$3,707.3	$3,790.1	$3,915.5
Space Operations	$4,184.0	$4,249.1	$3,882.9
Education	$136.1	$136.9	$94.2
Cross Agency Support	$2,993.9	$3,012.2	$2,850.3
Construction & Environmental Compliance Restoration	$494.5	$401.9	$609.4
Office of Inspector General	$38.3	$38.2	$37.0
Totals	**$17,770.0**	**$17,893.4**	**$17,715.4**

1. The budget amount reflects the Agency's total after rescission to the FY 2012 and FY 2013 budgets. Therefore, FY 2012 and FY 2013 Mission Directorate figures may not total budget amount.
2. FY 2013 reflects the annualized continuing resolution.

1. Science $5,073.7 million

Total Budget Authority (in millions of dollars)		
FY 2012 actual	FY 2013 est.	FY 2014 est.
$5,073.7	$5,115.9	$5,017.8

Earth Science

1A. Earth Science Research

NASA's Earth Science Research program develops a scientific understanding of Earth and its response to natural or human-induced changes. Earth is a system, like the human body, comprised of diverse components interacting in complex ways. Understanding Earth's atmosphere, lithosphere, hydrosphere, cryosphere, and biosphere as a single connected system is necessary in order to improve our predictions of climate, weather, and natural hazards.

The Earth Science Research program addresses complex, interdisciplinary Earth science problems in pursuit of a comprehensive understanding of the Earth system. This strategy involves six interdisciplinary and interrelated science focus areas, including:

- Climate Variability and Change: understanding the roles of ocean, atmosphere, land, and ice in the climate system and improving predictive capability for future evolution;
- Atmospheric Composition: understanding and improving predictive capability for changes in the ozone layer, climate forcing, and air quality associated with changes in atmospheric composition;
- Carbon Cycle and Ecosystems: quantifying, understanding, and predicting changes in Earth's ecosystems and biogeochemical cycles, including the global carbon cycle, land cover, and biodiversity;
- Water and Energy Cycle: quantifying the key reservoirs and fluxes in the global water cycle and assessing water cycle change and water quality;
- Weather: enabling improved predictive capability for weather and extreme weather events; and
- Earth Surface and Interior: characterizing the dynamics of the Earth surface and interior and forming the scientific basis for the assessment and mitigation of natural hazards and response to rare and extreme events.

NASA's Earth Science Research program pioneers the use of both space-borne and aircraft measurements in all of these areas. NASA's Earth Science Research program is critical to the advancement of the interagency US Global Change Research Program (USGCRP). NASA's Earth Science Research program also makes extensive contributions to international science programs such as the World Climate Research Programme.

- **Supported Strategic Goals:** 2. Expand scientific understanding of the Earth and the universe in which we live.
- **Supported Outcomes:** 2.1. Advance Earth system science to meet the challenges of climate and environmental change.

1B. Earth Systematic Missions

Earth Systematic Missions (ESM) includes a broad range of multi-disciplinary science investigations aimed at understanding the Earth system and its response to natural and human-induced forces and changes. Understanding these forces will help determine how to predict future changes, and how to mitigate or adapt to these changes.

The ESM program develops Earth-observing research satellite missions, manages the operation of these missions once on orbit, and produces mission data products in support of research, applications, and policy communities.

Interagency and international partnerships are a central element throughout the ESM program. Several of the on-orbit missions provide data products in near-real time for use by US and international meteorological agencies and disaster responders. Five of the on-orbit missions involve significant international or interagency collaboration in development. The Landsat Data Continuity Mission (LDCM), one of the ESM program's foundational missions, involves collaboration with the US Geological Survey. GPM is a partnership being developed in cooperation with the Japanese Aerospace Exploration Agency (JAXA), and the GRACE Follow-On (GRACE-FO) mission is a partnership between NASA and the German Space and Earth Science agencies.

- **Supported Strategic Goals:** 2. Expand scientific understanding of the Earth and the universe in which we live.
- **Supported Outcomes:** 2.1. Advance Earth system science to meet the challenges of climate and environmental change.

1C. Earth System Science Pathfinder

The Earth System Science Pathfinder (ESSP) program provides an innovative approach to Earth science research by providing frequent regular, competitively selected opportunities that accommodate new and emerging scientific priorities and measurement capabilities. This results in a series of relatively low-cost, small-sized investigations and missions. These missions are led by principal investigators whose scientific objectives support a variety of studies, including the atmosphere, oceans, land surface, polar ice regions, or solid Earth.

ESSP projects include space missions, space-based remote sensing instruments for missions of opportunity, and extended duration airborne science missions. The ESSP program also supports the conduct of science research utilizing data from these missions. ESSP projects often involve partnerships with other US agencies and/or international organizations. This portfolio of missions and investigations provides opportunity for investment in innovative Earth science that enhances NASA's capability for better understanding the current state of the Earth system.

- **Supported Strategic Goals:** 2. Expand scientific understanding of the Earth and the universe in which we live.
- **Supported Outcomes:** 2.1. Advance Earth system science to meet the challenges of climate and environmental change.

1D. Earth Science Multi-Mission Operations

The Earth Science Multi-Mission Operations (MMO) program acquires, preserves, and distributes observational data from operating spacecraft to support Earth Science focus areas. This is accomplished primarily by the Earth Observing System Data and Information System (EOSDIS), which has been in operations since 1994. EOSDIS acquires, processes, archives, and distributes Earth Science data and information products. These products are created from satellite data and arrive at the rate of more than four terabytes per day.

NASA Earth Science information is archived at eight Distributed Active Archive Centers (DAACs) and four disciplinary data centers located across the United States. The DAACs specialize by topic area, and make their data available to researchers around the world.

The MMO budget supports the science data Segment for Suomi NPP, and data archive and distribution for upcoming missions including OCO-2, SMAP, GPM and ICESAT-2. EOSDIS data centers also support Earth Science suborbital campaigns. A system plan for 2015 and beyond will take into account evolutionary needs for new missions being developed in response to the National Academies decadal survey. These investments will enable the system to keep technologically current, and incorporate new research data and services.

- **Supported Strategic Goals:** 2. Expand scientific understanding of the Earth and the universe in which we live.
- **Supported Outcomes:** 2.1. Advance Earth system science to meet the challenges of climate and environmental change.

1E. Earth Science Technology

Advanced technology plays a major role in enabling Earth research and applications. The Earth Science Technology Program (ESTP) enables previously infeasible science investigations;

improves existing measurement capabilities; and reduces the cost, risk, and/or development times for Earth science instruments.

- **Supported Strategic Goals:** 2. Expand scientific understanding of the Earth and the universe in which we live.
- **Supported Outcomes:** 2.1. Advance Earth system science to meet the challenges of climate and environmental change.

1F. Applied Sciences

The NASA Applied Sciences program leverages NASA Earth Science satellite measurements and new scientific knowledge to provide innovative and practical uses for public and private sector organizations. It also enables near-term uses of Earth science knowledge, discovers and demonstrates new applications, and facilitates adoption of applications by non-NASA stakeholder organizations.

Applied Sciences projects improve decision-making activities to help the Nation better manage its resources, improve quality of life, and strengthen the economy. NASA develops Earth science applications in collaboration with end-users in public, private, and academic organizations.

Examples of these applications include:

- Improved assessment of flooding and landslide conditions with the International Red Cross to plan mitigation and response activities;
- Improved wildfire smoke predictions with the US Forest Service to reduce downwind public exposure; and
- Advances in accuracy of volcanic ash advisories for airplane pilots with the National Weather Service and the Federal Aviation Administration.

The program ensures sustained use of these products in the decision-making process of user organizations. The program also encourages potential users to envision and anticipate possible applications from upcoming satellite missions and to provide input to mission development teams to increase the societal benefits of NASA missions.

- **Supported Strategic Goals:** 2. Expand scientific understanding of the Earth and the universe in which we live.
- **Supported Outcomes:** 2.1. Advance Earth system science to meet the challenges of climate and environmental change.

Planetary Science

1G. Planetary Science Research

Planetary Science Research program provides the scientific foundation for the Nation's use of the unique data sets returned from NASA missions exploring the solar system. It is also NASA's primary interface with university faculty and graduate students in this field and the research community in general. The program develops analytical and theoretical tools, as well as laboratory data to support analysis of flight mission data. These capabilities allow Planetary Science to answer specific questions about, and increase the understanding of, the origin and evolution of the solar system. The research program achieves this by supporting research grants solicited annually and subjected to a competitive peer review before selection and award.

- **Supported Strategic Goals**: 2. Expand scientific understanding of the Earth and the universe in which we live.
- **Supported Outcomes:** 2.3. Ascertain the content, origin, and evolution of the solar system and the potential for life elsewhere.

1H. Lunar Quest

Lunar Quest conducts scientific exploration of the Moon through research and analysis and through the development of small-to-medium satellites. Lunar Quest addresses the science priorities identified in the National Academies report, "The Scientific Context for Exploration of the Moon."

- **Supported Strategic Goals:** 2. Expand scientific understanding of the Earth and the universe in which we live.
- **Supported Outcomes:** 2.3. Ascertain the content, origin, and evolution of the solar system and the potential for life elsewhere.

1I. Discovery

NASA's Discovery program provides scientists the opportunity to dig deep into their imaginations and find innovative ways to unlock the mysteries of the solar system through missions to explore the planets, their moons, and small bodies such as comets and asteroids.

The Discovery program currently has four operational spacecraft: the MErcury Surface, Space ENvironment, GEochemistry, and Ranging (MESSENGER), Deep Impact (in hibernation), Dawn, and the Gravity Recovery And Interior Laboratory (GRAIL). The program also has one instrument in operations: the Analyzer of Space Plasma and Energetic Atoms (ASPERA-3) on the ESA Mars

Express mission; one flight mission in formulation: the Interior Exploration using Seismic Investigations, Geodesy and Heat Transport (InSight); and one instrument in spacecraft integration: Strofio on the ESA BepiColombo mission to Mercury.

- **Supported Strategic Goals:** 2. Expand scientific understanding of the Earth and the universe in which we live.
- **Supported Outcomes:** 2.3. Ascertain the content, origin, and evolution of the solar system and the potential for life elsewhere.

1J. New Frontiers

The New Frontiers program explores our solar system with frequent, medium-class spacecraft missions. Within the New Frontiers program, possible mission destinations and the science goals for each competitive opportunity are limited to those identified by the National Academies as recommended science targets. These currently include: Venus In Situ Explorer, Saturn Probe, Trojan Tour and Rendezvous, the Comet Surface Sample Return, and Lunar South Pole-Aitken Basin Sample Return.

New Horizons will help us understand worlds at the edge of the solar system by making the first reconnaissance of Pluto and Charon, then visiting one or more Kuiper Belt Objects.

Juno is a mission to Jupiter that will significantly improve our understanding of the origin and evolution of the gas giant planet. This will help us better understand our entire solar system.

OSIRIS-REx is the first mission to bring pristine samples from an asteroid to study and analyze on Earth. This will increase our understanding of planet formation and the origin of life.

- **Supported Strategic Goals:** 2. Expand scientific understanding of the Earth and the universe in which we live.
- **Supported Outcomes:** 2.3. Ascertain the content, origin, and evolution of the solar system and the potential for life elsewhere.

1K. Mars Exploration

The Mars Exploration program seeks to understand whether Mars was, is, or can be, a habitable world and whether it ever supported life. As the most Earth-like planet in the solar system, Mars has a landmass approximately equivalent to the Earth's as well as many of the same geological features, such as riverbeds, past river deltas, and volcanoes. Mars also has many of the same "systems" that characterize Earth, such as air, water, ice, and geology that all interact to produce the Martian environment.

The four broad, overarching goals for Mars Exploration are to:

- Determine whether life ever arose on Mars;
- Characterize the climate of Mars;
- Characterize the geology of Mars; and
- Prepare for human exploration.

- **Supported Strategic Goals:** 2. Expand scientific understanding of the Earth and the universe in which we live.
- **Supported Outcomes:** 2.3. Ascertain the content, origin, and evolution of the solar system and the potential for life elsewhere.

1L. Outer Planets

The Outer Planets program enables science investigations spanning the diverse geography and disciplines of the outer solar system. The strategic missions in this portfolio investigate a broad array of science disciplines with more depth than is possible for smaller, tightly focused missions in the Discovery and New Frontiers programs. The science discoveries made by these strategic missions provide answers to long-held questions and theories about the origin and evolution of outer planets.

- **Supported Strategic Goals:** 2. Expand scientific understanding of the Earth and the universe in which we live.
- **Supported Outcomes:** 2.3. Ascertain the content, origin, and evolution of the solar system and the potential for life elsewhere.

1M. Planetary Science Technology

Planetary Science missions demand advances in both power and propulsion systems to enable successful trips to harsh environments, far distances from the Sun that cannot be easily solar powered, and missions with highly challenging trajectories and operations. To meet these needs, Planetary Science supports multi-mission capabilities and technology developments in key spacecraft systems, such as propulsion and power, and mission operations. The Planetary Science Technology program includes the In-Space Propulsion (ISP), Radioisotope Power Systems (RPS), Advanced Multi-Mission Operations System (AMMOS), and Plutonium projects.

- **Supported Strategic Goals:** 2. Expand scientific understanding of the Earth and the universe in which we live.
- **Supported Outcomes:** 2.3. Ascertain the content, origin, and evolution of the solar system and the potential for life elsewhere.

Astrophysics

1N. Astrophysics Research

The Astrophysics Research program analyzes the data from NASA missions to understand astronomical events such as the explosion of a star, the birth of a distant galaxy, or the nature of planets circling other stars. The program also enables the early development of new technologies for future missions, and suborbital flights of experimental payloads on balloons and sounding rockets.

The program facilitates basic research for scientists to test their theories, and to understand how they can best use data from NASA missions to develop new knowledge about the cosmos.

- **Supported Strategic Goals:** 2. Expand scientific understanding of the Earth and the universe in which we live.
- **Supported Outcomes:** 2.4. Discover how the universe works, explore how it began and evolved, and search for Earth-like planets.

1O. Cosmic Origins

Cosmic Origins supports the Spitzer Space Telescope, the scientific applications of which continue to expand, as well as NASA's partnership with ESA on the groundbreaking Herschel mission. Spitzer was used to confirm the Hubble Constant, which relates a distant galaxy's apparent velocity to its distance from Earth to within four percent. Herschel revealed the presence of large quantities of water in the proto-stellar disks from which new stars and planetary systems form. Many more discoveries are expected over the next several years as data from both observatories are analyzed.

- **Supported Strategic Goals:** 2. Expand scientific understanding of the Earth and the universe in which we live.
- **Supported Outcomes:** 2.4. Discover how the universe works, explore how it began and evolved, and search for Earth-like planets.

1P. Physics of the Cosmos

The universe can be viewed as a laboratory that enables scientists to study some of the most profound questions at the intersection of physics and astronomy. How did the universe begin? How do matter, energy, space, and time behave under the extraordinarily diverse conditions of the cosmos? The Physics of the Cosmos (PCOS) program incorporates cosmology, high-energy astrophysics, and fundamental physics projects that address central questions about the nature

of complex astrophysical phenomena such as black holes, neutron stars, dark matter and dark energy, cosmic microwave background, and gravitational waves.

The operating missions within the PCOS program are beginning to provide answers to the fundamental questions above. Scientists using data from the Fermi mission are trying to determine what composes mysterious dark matter, which will help explain how black holes accelerate immense jets of material to nearly the speed of light. The Planck mission is observing the earliest moments of the universe and is providing a high-resolution map of the cosmic microwave background. X-Ray Multi-Mirror Mission (XMM)-Newton has helped scientists solve cosmic mysteries, including enigmatic massive black holes. The Chandra mission continues to reveal new details of celestial X-ray phenomena, such as the collisions of clusters of galaxies that directly detect the presence of dark matter, and has unveiled a population of faint, obscured massive black holes that may provide the early seeds for galaxy formation and growth since the birth of the universe nearly 14 billion years ago.

PCOS includes a vigorous program of development of technologies necessary for the next generation of space missions addressing the science questions of this program.

- **Supported Strategic Goals:** 2. Expand scientific understanding of the Earth and the universe in which we live.
- **Supported Outcomes:** 2.4. Discover how the universe works, explore how it began and evolved, and search for Earth-like planets.

1Q. Exoplanet Explorer

Humankind stands on the threshold of a voyage of unprecedented scope and ambition, promising insight into some of the most timeless questions: Are we alone? Is Earth unique, or are planets like ours common? One of the most exciting new fields of research within the NASA Astrophysics portfolio is the search for planets, particularly Earth-like planets, around other stars.

During the last 15 years, astronomers have discovered over 770 planets orbiting nearby stars. Many of these planets are gas giants, similar in size to the four outer planets in our solar system, and orbit much closer to their parent stars than do the giant planets in our system. NASA's Exoplanet Exploration program is advancing along a path of discovery leading to a point where scientists can directly study the atmospheres and surface features of habitable, rocky planets, like Earth, around other stars in the solar neighborhood.

The 2009 launch of the Kepler mission, NASA's first mission dedicated to the study of extrasolar planets, ushered in a new chapter in the search for planets around other stars. From its unique vantage point of space, Kepler can detect much smaller planets than even the most powerful ground-based telescopes. Kepler provided data showing us that small planets are more

abundant than giant planets. By the end of its mission, Kepler will establish how common habitable, Earth-sized planets are in the galaxy.

NASA aims to develop systems that will allow scientists to take the pivotal step from identifying an exoplanet as Earth-sized, to determining whether it is truly Earth-like, and possibly even detecting if it bears the fingerprints of life. Such an ambitious goal includes significant technological challenges. An important component of the Exoplanet Exploration effort is a robust technology development program with the goal of enabling a future direct detection mission.

- **Supported Strategic Goals:** 2. Expand scientific understanding of the Earth and the universe in which we live.
- **Supported Outcomes:** 2.4. Discover how the universe works, explore how it began and evolved, and search for Earth-like planets.

1R. Astrophysics Explorer Program

The Astrophysics Explorer program provides frequent flight opportunities for world-class astrophysics investigations using innovative and streamlined management approaches for spacecraft development and operations. The program is highly responsive to new knowledge, new technology, and updated scientific priorities by launching smaller missions that can be conceived and executed in a relatively short development cycle. Priorities are based on an open competition of concepts solicited from the scientific community. The program emphasizes missions that can be accomplished under the control of the scientific research community within constrained mission life-cycle costs.

Standard Explorer missions cost up to $200 million in total, excluding launch services. Small Explorers (SMEX) may cost about half that, excluding launch services. Explorer missions of opportunity (MO) have a total NASA cost of under $60 million and may be of several types. The most common are partner MOs, investigations that are part of a non-NASA space mission. These missions are conducted on a no-exchange-of-funds basis with the organization sponsoring the mission. Other possible types are new science missions using existing spacecraft and small complete missions. NASA intends to solicit proposals for missions of opportunity associated with each announcement of opportunity issued for Explorer and SMEX investigations, and perhaps more frequently.

- **Supported Strategic Goals:** 2. Expand scientific understanding of the Earth and the universe in which we live.
- **Supported Outcomes:** 2.4. Discover how the universe works, explore how it began and evolved, and search for Earth-like planets.

James Webb Space Telescope

1S. James Webb Space Telescope

The James Webb Space Telescope (JWST) is a large, space-based astronomical observatory. The mission is a logical successor to the Hubble Space Telescope, extending beyond Hubble's discoveries by looking into the infrared spectrum, where the highly red-shifted early universe must be observed, where relatively cool objects like protostars and protoplanetary disks emit infrared light strongly, and where dust obscures shorter wavelengths.

The four main science goals are:

- Search for the first galaxies or luminous objects formed after the Big Bang;
- Determine how galaxies evolved from their formation until now;
- Observe the formation of stars from the first stages to the formation of planetary systems; and
- Measure the physical and chemical properties of planetary systems and investigate the potential for life in those systems.

While Hubble greatly improved knowledge about distant objects, its infrared coverage is limited. Light from distant galaxies is redshifted out of the visible part of the spectrum into the infrared by the expansion of the universe. By examining light redshifted beyond Hubble's sight, with more light-collecting area than Hubble and with near to mid-infrared-optimized instruments, JWST will observe objects farther away and further back in time. JWST will explore the poorly understood epoch when the first luminous objects in the universe came into being after the Big Bang. The focus of scientific study will include the first light of the universe, assembly of galaxies, origins of stars and planetary systems, and origins of the elements necessary for life.

- **Supported Strategic Goals:** 2. Expand scientific understanding of the Earth and the universe in which we live.
- **Supported Outcomes:** 2.4. Discover how the universe works, explore how it began and evolved, and search for Earth-like planets.

Heliophysics

1T. Heliophysics Research

Heliophysics seeks to understand the Sun and its interactions with Earth and the solar system. The goal of the Heliophysics Research program is to understand the Sun, heliosphere, and planetary environments as a single connected system and to answer these fundamental questions about this system's behavior.

What causes the Sun to vary?

How do Earth and the heliosphere respond to the Sun's changes?

What are the impacts on humanity?

The Heliophysics Research program advances knowledge of solar processes and also the interaction of solar plasma and radiation with Earth, the other planets and the Galaxy. By analyzing the connections between the Sun, solar wind, planetary space environments, and our place in the Galaxy, we are uncovering the fundamental physical processes that occur throughout the Universe. Understanding the connections between the Sun and its planets will allow us to improve predictions on the impacts of solar variability on humans, technological systems, and even the presence of life itself.

- **Supported Strategic Goals:** 2. Expand scientific understanding of the Earth and the universe in which we live.
- **Supported Outcomes:** 2.2. Understand the Sun and its interactions with the Earth and the solar system.

1U. Living with a Star

The Living with a Star (LWS) program targets specific aspects of the coupled Sun-Earth-planetary system that affect life and society and enables robotic and human exploration of the solar system. LWS provides a predictive understanding of the Sun-Earth system, the linkages among the interconnected systems, and specifically of the space weather conditions at Earth and the interplanetary medium. LWS products measure and therefore may mitigate impacts to technology associated with space systems, communications and navigation, and ground systems such as power grids. Its products improve understanding of ionizing radiation, which has human health implications on the International Space Station and high-altitude aircraft flight, as well as operations of future space exploration with and without human presence. Its products improve the definition of solar radiation for global climate change, surface warming, and ozone depletion and recovery.

- **Supported Strategic Goals:** 2. Expand scientific understanding of the Earth and the universe in which we live.
- **Supported Outcomes:** 2.2. Understand the Sun and its interactions with the Earth and the solar system.

1V. Solar Terrestrial Probes

Solar Terrestrial Probes (STP) focuses on understanding the fundamental physics of the space environment, from the Sun to Earth, other planets, and beyond to the interstellar medium. STP provides insight into the fundamental processes of plasmas (fluid of charged particles) inherent in all astrophysical systems. STP missions focus on processes such as the variability of the Sun, the responses of the planets to those variations, and the interaction of the Sun and solar system. STP missions are strategically defined and investigations are competitively selected. These missions allow the science community an opportunity to address important research focus areas and make significant progress in understanding fundamental physics.

- **Supported Strategic Goals:** 2. Expand scientific understanding of the Earth and the universe in which we live.
- **Supported Outcomes:** 2.2. Understand the Sun and its interactions with the Earth and the solar system.

1W.Heliophysics Explorer Program

The Heliophysics Explorers Program provides frequent flight opportunities for world-class scientific investigations on focused and timely science topics. Explorers uses a suite of smaller, fully competed missions that address these topics to complement the science of strategic missions of the Living With a Star and Solar Terrestrial Probes (STP) programs. Highly competitive selection ensures that the most current and best strategic science will be accomplished.

Full missions include Medium Explorers (MIDEX), Explorers (EX), and Small Explorers (SMEX). Missions of Opportunity (MO) are typically instruments flown as part of a non-NASA space mission.

EX missions were introduced within the 2011 Announcement of Opportunity. In response to the currently available expendable launch vehicles, EX missions were conceived. In September 2011 NASA selected three heliophysics EXs and three MOs for initial study. In Spring 2013, NASA will select one or two missions for implementation.

The Explorers program selected IRIS in 2009. IRIS is a small explorer mission, currently in the development phase and scheduled for launch in FY 2013.

Other Missions and Data Analysis supports numerous operating Heliophysics Explorer missions, as well as program management functions and funding for future mission selections.

- **Supported Strategic Goals:** 2. Expand scientific understanding of the Earth and the universe in which we live.
- **Supported Outcomes:** 2.2. Understand the Sun and its interactions with the Earth and the solar system.

2. Aeronautics Research $569.4 million

Total Budget Authority (in millions of dollars)		
FY 2012 actual	**FY 2013 est.**	**FY 2014 est.**
$569.4	$572.9	$565.7

2A. Aviation Safety

The current US air transportation system is widely recognized to be among the safest in the world. Over the past 10 years, the commercial accident rate has continued to drop, a credit to industry and government working together to solve problems and proactively identify new risks. However, the FAA Aerospace Forecast projects steady growth in the next 20 years, and while NextGen will meet this demand by enabling efficient passage through the increasingly crowded skies, it will come with increased reliance on automation and operating complexity. Therefore, the aviation community must continue to be vigilant for the United States to meet the public expectations for safety in this complex, dynamic domain. To meet the challenge, the Aviation Safety Program develops cutting-edge technologies to improve the intrinsic safety of current and future aircraft that will operate in NextGen. The program's contributions range from providing fundamental research and technologies on known or emerging safety concerns, to working with partners in addressing new safety challenges for NextGen. The program has three primary objectives:

- Continue to improve aviation system-wide safety;
- Advance the state-of-the-art of aircraft systems and flight crew operations; and
- Address the inherent presence of atmospheric risks to aviation.

The Aviation Safety Program has developed research plans with milestones and metrics in technology areas corresponding to these objectives. All areas emphasize innovative methods and use a systems analysis approach for identifying key issues and maintaining a research portfolio that addresses national aviation safety needs.

- **Supported Strategic Goals:** 4. Advance aeronautics research for societal benefit.
- **Supported Outcomes:** 4.1. Develop innovative solutions and advanced technologies through a balanced research portfolio to improve current and future air transportation.

2B. Airspace Systems

The Airspace Systems Program creates technologies that will help transition to the Next Generation Air Transportation System (NextGen). NextGen is a multi-agency effort to overall our National Airspace System to make air travel more convenient and dependable, while ensuring

flights are as safe, secure and hassle-free as possible. NextGen integrates new and existing technologies, policies and procedures to reduce delays, save fuel and lower aircraft exhaust emissions. The Airspace Systems Program, with the Federal Aviation Administration (FAA) and its other industry and academic partners, conceives and develops NextGen technologies that will provide advanced levels of automated support to air navigation service providers and aircraft operators for reduced travel times and travel-related delays both on the ground and in the sky. These advanced technologies provide shortened routes for time and fuel savings, with associated improvements in noise and emissions, and permit controllers to monitor and manage aircraft for greater safety in all weather conditions. As the predicted volume of air traffic climbs, this transformation aims to reduce gridlock, both in the sky and at airports.

The associated economic impacts of these delays and inefficiencies are predicted to cost the Nation tens of billions of dollars annually. Delayed flights cost an already struggling airline industry nearly $20 billion in additional operating costs. Passengers affected by delayed flights lost time valued at more than $10 billion. Other industries that rely on the airline industry suffered a loss as much as $10 billion as a result of delays. Jet fuel consumed as a result of delay cost more than $1.6 billion in 2007 leading to over 7 million-metric tons of carbon dioxide emissions. This represents over $40 billion in adverse economic impact due to aviation delays in the United States. The Airspace Systems Program works to reduce these costs. (Source: Report by the Joint Economic Committee Majority Staff, “Your Flight Has Been Delayed Again: Flight Delays Cost Passengers, Airlines, and the U.S. Economy Billions,” Chairman, Sen. Charles E. Schumer, Vice Chair, Rep. Carolyn B. Maloney, May 2008.)

This research seeks to maximize flexibility and effectiveness in the use of airports and airspace while accommodating projected growth in air traffic, and aims to enable the seamless operation and utilization of the full potential capabilities of new aircraft types such as advanced rotorcraft, unmanned aerial systems, high-speed aircraft, and hybrid wing body aircraft.

- **Supported Strategic Goals:** 4. Advance aeronautics research for societal benefit.
- **Supported Outcomes:** 4.1. Develop innovative solutions and advanced technologies through a balanced research portfolio to improve current and future air transportation.

2C. Fundamental Aeronautics

The Fundamental Aeronautics (FA) program develops knowledge, technologies, tools, and innovative concepts to enable new aircraft that will fly faster, cleaner, and quieter, and use fuel far more efficiently. These aircraft will be needed as the Nation transitions to NextGen.

NASA research is inherent in every major modern U.S. aircraft, and the type of research performed by the FA program will prime the technology pipeline, enabling continued US leadership, competitiveness, and jobs in the future. Some of the key benefits of this work include:

- Dramatically reduced aircraft noise and emissions;
- Dramatically improved fuel efficiency; and
- Increased mobility and air travel flexibility.

Research performed by the FA program impacts a wide variety of air vehicles from helicopters and commercial airliners to high-speed vehicles that can travel faster than the speed of sound. NASA's work is focused on civil applications, however, there is significant coordination with the Department of Defense to help maximize the effectiveness and impact of NASA research.

While NASA is focused on future vehicles, many of the tools and technologies that are developed have an immediate impact to industry. Ultimately, FA program research enables a future in which a variety of advanced air vehicles improve the flexibility, efficiency, and environmental impacts of the air transportation system.

- **Supported Strategic Goals:** 4. Advance aeronautics research for societal benefit.
- **Supported Outcomes:** 4.1. Develop innovative solutions and advanced technologies through a balanced research portfolio to improve current and future air transportation.

2D. Aeronautics Test

US leadership in aerospace depends on ready access to technologically advanced, efficient, and affordable aeronautics test capabilities. These capabilities include major wind tunnels, propulsion test facilities, and flight test assets including the Western Aeronautical Test Range. The Federal Government owns the majority of these critical test capabilities in the United States, primarily through NASA and DoD. However, changes in the aerospace community, primarily the decrease in demand for wind tunnel testing over the last two decades, requires an overarching strategy for the management of these National assets. The Aeronautics Test Program's mission is to retain and invest in NASA aeronautics test capabilities considered strategically important to the Agency and the Nation, and establish a strong, high-level partnership to expand cooperation and cost-sharing between NASA and DoD, facilitating the

establishment of an integrated national strategy for the management of their respective facilities. This national view is becoming more important, specifically in addressing the challenges NASA and the Nation are facing, in terms of managing and evolving this large, critical set of capabilities in a changing and increasingly demanding environment. The National Partnership for Aeronautical Testing is the high-level NASA and DoD council working to expand cooperation and the establishment of an integrated national strategy for capability management.

Aeronautics Test Program facilities and assets are dispersed across the United States. The facilities and assets are located at the Ames Research and Dryden Flight Research Centers in California, Glenn Research Center in Ohio, and Langley Research Center in Virginia. These facilities and assets are able to perform tests covering the flight envelope from subsonic through hypersonic speeds and include unique capabilities ranging from simulating icing environments to modeling extreme dynamic situations. The program offers NASA, other Government agencies, the U.S. aerospace industry, and academic institutions unmatched research and experimental opportunities that reflect four generations of accumulated aerospace skill and experience. These capabilities encompass every aspect of aerospace ground and flight-testing and associated engineering.

- **Supported Strategic Goals:** 5. Enable program and institutional capabilities to conduct NASA's aeronautics and space activities.
- **Supported Outcomes:** 5.3. Ensure the availability to the Nation of NASA-owned strategically important test capabilities.

2E. Integrated Systems Research

One of the greatest challenges that NASA faces in transitioning advanced technologies into future aeronautics systems is closing the gap caused by the difference between the maturity level of technologies developed through fundamental research and the maturity required for technologies to be infused into future air vehicles and operational systems. The Integrated Systems Research Program's goal is to demonstrate integrated concepts and technologies to a maturity level sufficient to reduce risk of implementation for stakeholders in the aviation community. The research in this program is coordinated with ongoing, long-term fundamental research within the other three aeronautics research programs, as well as efforts of other government agencies. This helps to ensure the most promising research is transitioned between the fundamental research programs and ISRP. The program conducts integrated system-level research on those promising concepts and technologies to explore, assess, and demonstrate the benefits in an operationally relevant environment. The program matures and integrates technologies for accelerated transition to practical application. The Advanced Composites Project has been added to the ISRP portfolio in FY2014 to focus on reducing the timeline for

development and certification of innovative composite materials and structures, which will help American industry retain their global competitive advantage in aircraft manufacturing.

NASA will make significant technology advancements contributing to national aviation challenges through the ISRP portfolio. The portfolio consists of three projects, the Environmentally Responsible Aviation (ERA) Project, the Unmanned Aircraft Systems Integration in the National Airspace System (UAS/NAS) Project and the Advanced Composites Project.

- **Supported Strategic Goals:** 4. Advance aeronautics research for societal benefit.
- **Supported Outcomes:** 4.2. Conduct systems-level research on innovative and promising aeronautics concepts and technologies to demonstrate integrated capabilities and benefits in a relevant flight and/or ground environment.

2F. Aeronautics Strategy and Management

The Aeronautics Strategy and Management (ASM) program provides research and programmatic support that benefits each of the other five programs. The program efficiently manages directorate functions including: Innovative Concepts for Aviation, Outreach, and Cross Program Operations.

Innovative Concepts for Aviation invests in new ideas to meet aeronautics challenges through an internal Seedling Fund and externally through the Leading Edge Aeronautics Research for NASA fund. The Seedling Fund annually provides NASA civil servants the opportunity to perform research, analysis, and develop proof-of-concepts for ideas that have the potential to meet national aeronautics needs. This fund supports early-stage efforts not currently supported by ARMD programs and projects, with the goal of infusing promising concepts into the ARMD research portfolio or into NASA's Small Business Innovation Research program for further development. The Leading Edge Aeronautics Research for NASA fund is complementary to the Seedling Fund and has similar goals, but it invests in innovative ideas from outside NASA. Developing new ideas is critical part of NASA Aeronautics' three-pronged approach of investing in new ideas, fundamental research, and integrated systems research.

- **Supported Strategic Goals**: 4. Advance aeronautics research for societal benefit and 5. Enable program and institutional capabilities to conduct NASA's aeronautics and space activities.
- **Supported Outcomes:** 4.1. Develop innovative solutions and advanced technologies through a balanced research portfolio to improve current and future air transportation; 4.2. Conduct systems-level research on innovative and promising aeronautics concepts and technologies to demonstrate integrated capabilities and benefits in a relevant flight and/or ground environment; and 5.3. Ensure the availability to the Nation of NASA-owned strategically important test capabilities.

3. Space Technology $573.7 million

Total Budget Authority (in millions of dollars)		
FY 2012 actual	FY 2013 est.	FY 2014 est.
$573.7	$577.2	$742.6

3A. Small Business Innovation Research and Small Business Technology Transfer

NASA's Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs fulfill a statutory requirement to support early-stage research and development. The programs provide the small business sector with an opportunity to compete for funding to develop technology for NASA and to commercialize that technology to spur economic growth. Research and technologies funded by competitively-awarded SBIR and STTR contracts have made important contributions to numerous NASA programs and projects. The Agency is actively working to increase the number of NASA-funded SBIR and STTR technologies used in NASA's missions and projects. Some high-profile programs benefiting directly from SBIR technologies include the Next Generation Air Transportation System; smart sensors that assess launch vehicle structural health, three-dimensional flash-Lidar technologies to assist with collision avoidance and navigation for space applications, and end-of-arm tooling on Mars surface rovers and landers.

NASA issues annual program solicitations for the SBIR and STTR programs that set forth a substantial number of topic areas. Both the list and description of topics are sufficiently comprehensive to provide a wide range of opportunities for small business concerns to participate in NASA's research and development programs.

Phase I awards give small businesses the opportunity to establish the scientific, technical and commercial merit, and feasibility of the proposed innovation in fulfillment of NASA needs. Phase II awards focus on the development, demonstration, and delivery of the proposed innovation. The most promising Phase I projects are awarded Phase II contracts through a competitive selection based on scientific and technical merit, expected value to NASA, and commercial potential. Phase II Enhancement (II-E) is an incentive for cost share to extend the research and development efforts of the current Phase II contract. Phase III is the commercialization of innovative technologies, products and services resulting from a Phase II contract. This includes further development of technologies for transition into NASA programs, other Government agencies, or the private sector. Phase III contracts are funded from sources other than the SBIR and STTR programs and may be awarded without further competition.

- **Supported Strategic Goals:** 3. Create the innovative new space technologies for our exploration, science, and economic future.

- **Supported Outcomes:** 3.1. Sponsor early stage innovation in space technologies in order to improve the future capabilities of NASA, other government agencies, and **the** aerospace industry; and 3.4. Facilitate the transfer of NASA technology and engage in partnerships with other government Agencies, industry, and international entities to generate U.S. commercial activity and other public benefits.

3B. Partnership Development and Strategic Integration

The Office of the Chief Technologist (OCT) serves as the NASA Administrator's principal advisor on matters concerning Agency-wide technology policy and programs. OCT's Partnership Development and Strategic Integration efforts provide the strategy and leadership that guide all of NASA's technology and innovation activities. OCT helps NASA achieve a dual mandate. The first is to foster technology transfer, including infusion of technologies into NASA missions, and the second is to facilitate commercialization of technologies emerging from NASA research and development. OCT coordinates NASA internal and NASA external technology strategic planning and technology transfer. This office also documents, tracks, and analyzes NASA's technology investments and technological innovations, ensuring they are consistent with the NASA technology needs and strategy.

- **Supported Strategic Goals:** 3. Create the innovative new space technologies for our exploration, science, and economic future.
- **Supported Outcomes:** 3.4. Facilitate the transfer of NASA technology and engage in partnerships with other government Agencies, industry, and international entities to generate U.S. commercial activity and other public benefits.

3C. Crosscutting Space Tech Development

NASA invests in crosscutting technologies with the objective of leveraging the development of key technologies that enable or significantly advance the space missions for multiple customers. In addition, NASA is developing a pipeline of technology investments to ensure the emergence of new ideas and the infusion of advanced capabilities into actual missions.

Maturing technologies from idea and concept inception all the way through demonstration in a relevant environment is a significant challenge, and comes with inherent technical and programmatic risk. The program effectively and efficiently manages technology development with focus on relevance and takes advantage of expected challenges in the maturation process. By supporting projects at all technology readiness levels, Crosscutting Space Technology Development creates a technology cascade, resulting in mature, ready-to-infuse technologies that increase the nation's in-space capabilities. In the process of creating these new

technologies, NASA supports training and inspires the next generation of inventors, scientists, and engineers.

Crosscutting Space Technology Development (CSTD) funds these crosscutting efforts within eight of Space Technology's nine investment areas, conducting Early Stage Innovation (includes Space Technology Research Grants, NASA Innovative Advanced Concepts, Center Innovation Fund and Centennial Challenges) Game Changing Development, Technology Demonstration Missions, Small Spacecraft Technology, and Flight Opportunities.

This program also supports NASA's role in the National Nanotechnology Initiative, the Advanced Manufacturing Partnership, and the Materials Genome Initiative. These efforts enable NASA to develop and advance technological capabilities in support of Agency mission directorates, enable collaborations with other Government agencies, and support private industry through an expansion of the Nation's technology-base.

- **Supported Strategic Goals:** 3. Create the innovative new space technologies for our exploration, science, and economic future.
- **Supported Outcomes:** 3.1. Sponsor early stage innovation in space technologies in order to improve the future capabilities of NASA, other government agencies, and the aerospace industry; 3.2. Infuse game changing and crosscutting technologies throughout the Nation’s space enterprise, to transform the Nation’s space mission capabilities.

3D. Exploration Technology Development

The capabilities NASA pursues within Exploration Technology Development (ETD) provide the long-range, enabling technologies required to conduct future human exploration missions beyond low Earth orbit. Space Technology develops and demonstrates these critical technologies to permit affordable and reliable human exploration missions for destinations that include the Moon, Lagrange points, near Earth asteroids, and Mars. Through ETD, Space Technology conducts technology development and testing in laboratories and ground facilities, as well as technology demonstrations in relevant flight environments.

Exploration Technology Development focuses on the highest priority human spaceflight technology gaps as identified in NASA’s Space Technology Roadmaps, and is guided by the technology prioritization studies performed by Exploration’s human spaceflight architecture studies. Technology development is closely coordinated with the system capability demonstrations pursued within NASA Exploration, particularly within the Advanced Exploration Systems (AES) Program.

Among the priorities identified, the following space technology projects are supported within Game Changing Development's ETD work: Solar Electric Propulsion technologies, Human-

Robotics Systems, Next Generation Life Support, In-Situ Resource Utilization, Composite Cryogenic Propellant Tanks, and Entry Systems Technologies. These technologies harness the power of the Sun for in-space propulsion, provide robotic assistance for routine and/or risky in-space operations, move toward closed-loop mission capabilities for long duration missions, improve spacecraft efficiency on launch, and enhance landing capabilities for entry on planets with atmosphere. Game Changing Development (GCD) pursues proof of concept development and testing of these technologies to either provide direct infusion into future exploration missions, or feed systems demonstrations into Technology Demonstration Missions or Advanced Exploration Systems.

NASA is also funding the following Technology Demonstration Missions within Exploration Technology Development: Solar Electric Propulsion, Human Exploration Telerobotics, Cryogenic Propellant Storage and Transfer, and Green Propellant Infusion Mission. These technologies test increasingly complicated robotic operations as they are controlled from ground stations to space-based assets, provide dramatically improved in-space cryogenic storage and transfer capabilities, and develop a greener and cheaper alternative for hazardous hydrazine fuel. After successful maturation and demonstration of these critical technologies, Space Technology will infuse them directly into future human exploration architecture and the aerospace community.

- **Supported Strategic Goals:** 3. Create the innovative new space technologies for our exploration, science, and economic future.
- **Supported Outcomes:** 3.3. Develop and demonstrate the critical technologies that will make NASA's exploration, science, and discovery missions more affordable and more capable.

4. Exploration $3,707.3 million

Total Budget Authority (in millions of dollars)		
FY 2012 actual	FY 2013 est.	FY 2014 est.
$3,707.3	$3,790.1	$3,915.5

Exploration Systems Development

4A. Orion Multi-Purpose Crew Vehicle

For the first time since the Apollo Program, astronauts will once again venture beyond low Earth orbit beginning in 2021, this time aboard the Orion Multi-Purpose Crew Vehicle (MPCV), ensuring US leadership in space for decades to come. The program has incorporated dozens of technology advancements and innovations into the spacecraft's subsystems and components. The vehicle includes crew and service modules, a spacecraft adapter, and a revolutionary launch abort system that will significantly increase crew safety. Its unique life support, propulsion, thermal protection and avionics systems are designed to enable extended duration missions into deep space.

With uncrewed test flights planned for 2014 and 2017, Orion MPCV will be ready for crewed flights in 2021. Orion MPCV's modular design will enable integration of new technical innovations as they become available. An early use of the Orion MPCV and Space Launch System (SLS) may be to rendezvous with a near-Earth asteroid redirected to a stable orbit in the Earth-Moon system, and to extract and return samples from it to Earth.

- **Supported Strategic Goals:** 1. Extend and sustain human activities across the solar system.
- **Supported Outcomes:** 1.3. Develop an integrated architecture and capabilities for safe crewed and cargo missions beyond low Earth orbit.

4B. Space Launch System

The NASA Authorization Act of 2010 directed the Agency to develop a heavy-lift rocket that will allow human exploration beyond low Earth orbit for the first time since the last flight of Apollo's Saturn V launch vehicle in 1973. The Space Launch System (SLS) will enable crews and their equipment to travel thousands, and eventually millions, of times farther into deep space than is currently possible. This will open the solar system to crewed missions such as exploring mineral-rich asteroids, and eventually the mountains and canyons of Mars. An early test of the SLS and Orion Multi-Purpose Crew Vehicle (MPCV) may be to rendezvous with a near-Earth asteroid

redirected to a stable orbit in the Earth-Moon system, and to extract and return samples from it to Earth.

Through its lifetime, SLS capability will evolve using a block upgrade approach, driven by mission requirements. In the near-term, SLS will achieve a 70-metric ton Block 1 capability that will enable early system demonstrations such as test flights near the Moon. The follow-on Block 1A upgrade will use advanced boosters to improve vehicle performance to 105 metric tons, significantly expanding deep space mission capability. The Block 2 upgrade adds an advanced upper stage, enabling performance up to 130 metric tons.

SLS development is an example of the Agency's commitment to fiscal responsibility and budget discipline. With Saturn and the Space Shuttle, NASA has half a century of experience with heavy lift launch vehicles. Leveraging this experience, combined with advances in technology and manufacturing, will allow NASA to build and operate SLS at less cost than previous heavy lift designs. NASA is leveraging a half-century of experience with heavy-lift vehicles like Saturn and the Space Shuttle, along with advances in technology and manufacturing practices, to build and operate SLS at less cost than previous heavy lift designs. NASA is committed to building SLS on schedule and on budget, with a first uncrewed test flight in 2017.

- **Supported Strategic Goals:** 1. Extend and sustain human activities across the solar system.
- **Supported Outcomes:** 1.3. Develop an integrated architecture and capabilities for safe crewed and cargo missions beyond low Earth orbit.

4C. Exploration Ground Systems

As NASA enters a new era in human space exploration, space operations at the Kennedy Space Center (KSC) are evolving to support Space Launch System (SLS) and Orion Multi-Purpose Crew Vehicle (MPCV) integration and launch. The Exploration Ground Systems (EGS) program is making necessary facility and ground support equipment modifications at KSC to enable assembly, test, launch and recovery of the SLS and Orion MPCV flight elements, as well as modernizing communication and control systems. Upon completion, the KSC launch site will provide a more flexible, affordable, and responsive national launch capability.

- **Supported Strategic Goals:** 5. Enable program and institutional capabilities to conduct NASA’s aeronautics and space activities.
- **Supported Outcomes:** 5.4. Implement and provide space communications and launch capabilities responsive to existing and future science and space exploration missions.

Commercial Spaceflight

4D. Commercial Crew

With an eye to the future of human spaceflight, NASA is looking to the US private sector to develop and operate safe, reliable, and affordable crew transportation to low Earth orbit, including the International Space Station (ISS). Partnering with the commercial space industry for access to low Earth orbit and the ISS will reduce our current reliance on foreign providers for this service and help stimulate American industry. As the commercial crew providers focus on low earth orbit, NASA is able to increase focus on developing systems that will expand our deep space exploration capabilities.

Through the Commercial Crew program, NASA is providing technical and financial support to industry partners during the development phase of their crew transportation systems. Progress is measured against milestones that were proposed by the commercial partners and negotiated with NASA before Space Act Agreements were awarded in a fully competitive process. Milestones are fixed-price and based on performance of agreed upon entrance and success criteria. Although they vary in content, milestones are designed as events that mature the partners' progress. Examples include risk reduction testing, design reviews, and partner investment reviews. If the partners fail to complete a milestone, the government owes nothing.

Once these commercial capabilities are matured and certified for use by NASA, the ISS program will purchase services from the private sector to transport NASA crew to and from the ISS. This innovative approach will end the outsourcing of human space transportation currently purchased from foreign providers and enable US private sector capability to access low Earth orbit and ISS. These activities stimulate development of a new space transportation industry available to all potential customers, including the US government. NASA's efforts will strengthen America's space industrial base, providing a catalyst for future business ventures to capitalize on affordable, globally competitive, US space access. Commercial space transportation is vital to the future of human space exploration and will enable NASA to focus on exploration beyond Earth orbit with the Space Launch System and Orion MPCV.

- **Supported Strategic Goals**: 1. Extend and sustain human activities across the solar system.
- **Supported Outcomes:** 1.2. Develop competitive opportunities for the commercial community to provide best value products and services to low Earth orbit and beyond.

Exploration Research and Development

4E. Human Research Program

Of all the critical systems involved with sending astronauts into space, the most complex is the human system. While NASA has amassed more than fifty years of crew experience in low Earth orbit, researchers are still unraveling the mysteries of how the space environment affects the human body. The Human Research Program (HRP) is charged with understanding and mitigating the highest risks to astronaut health and performance, including physiological effects from radiation, low gravity, and planetary environments, as well as the unique challenges of providing medical treatment, human factors, and behavioral health support, to explorers in a space environment. To ensure that crews remain healthy and productive during long duration exploration missions beyond low Earth orbit, HRP is working to develop countermeasures and technologies that will allow astronauts to complete their high-risk missions and preserve lifelong health.

Scientists have studied the effects of low gravity on the human body for decades, but some very significant changes have been detected only since the International Space Station (ISS) test bed has enabled crews to experience long-duration weightlessness. Such effects as muscle atrophy, bone loss, and motion sickness are widely known, but what goes on inside the heart or the skull? Researchers have learned that the heart seems to shrink and reduce its ability to fill completely in space, which could compromise exercise or temperature control. In addition, the discovery of increased intracranial pressure that can reshape the optic nerve in male astronauts is resulting in vision changes that may or may not be permanent.

Understanding these effects on astronauts' physiological systems is critical for the mission planners and system developers charged with implementing NASA's vision for human space exploration. As is the case with many space-based medical investigations however, this research may also lead to significant advancements in treating patients on Earth.

- **Supported Strategic Goals:** 1. Extend and sustain human activities across the solar system.
- **Supported Outcomes:** 1.3. Develop an integrated architecture and capabilities for safe crewed and cargo missions beyond low Earth orbit.

4F. Advanced Exploration Systems

Advanced Exploration Systems (AES) represents an innovative approach to developing foundational technologies that will become the building blocks for future space missions. Using focused in-house activities to develop and test prototype systems rapidly, AES is pioneering ways to drive a rapid pace of progress, streamline management, and more effectively utilize the NASA workforce as we transition to enabling human spaceflight beyond low-Earth orbit. Teams of NASA engineers and technologists across the country are engaged in small-scale development activities, gaining valuable hands-on experience with hardware and mastering the skills necessary for future space missions. Early integration and testing of technology will reduce risk and improve affordability of future exploration missions.

AES activities focus on crewed systems for deep space, and robotic precursor missions that gather critical knowledge about potential destinations in advance of crewed missions. Major products include systems development for reliable life support, asteroid capture mechanisms, deep space habitats, crew mobility systems, advanced space suits (including concepts for astronaut extravehicular activity with an asteroid), and autonomous space operations. AES will also collaborate with the Science Mission Directorate to explore innovative partnerships to advance Near Earth Object observation and target identification.

As prototype systems are developed, they are tested using NASA ground-based facilities or as flight experiments on the International Space Station. NASA's Space Technology Mission Directorate also contributes to the HEO effort: AES infuses new Space Technology Mission Directorate-developed technologies into exploration missions, as components integrated into prototype systems. AES also works closely with NASA's Science Mission Directorate on a joint robotic precursor activity to develop instruments, support research and analysis efforts, and plan and conduct precursor missions.

- **Supported Strategic Goals:** 1. Extend and sustain human activities across the solar system and 3. Create the innovative new space technologies for our exploration, science, and economic future.
- **Supported Outcomes:** 1.3. Develop an integrated architecture and capabilities for safe crewed and cargo missions beyond low Earth orbit and 3.3 Develop and demonstrate the critical technologies that will make NASA’s exploration, science, and discovery missions more affordable and more capable.

5. Space Operations $4,184.0 million

Total Budget Authority (in millions of dollars)		
FY 2012 actual	**FY 2013 est.**	**FY 2014 est.**
$4,184.0	$4,249.1	$3,882.9

International Space Station

5A. International Space Station Program

The culmination of efforts of the United States and its Canadian, European, Japanese, and Russian partners, the International Space Station (ISS) is a highly complex facility that provides an unparalleled capability for human, space-based research. A crew of six aboard the International Space Station, three on the US on-orbit segment, and three on the Russian segment, orbits the Earth about every 90 minutes. The US on-orbit segment is the portion of ISS operated by US and its Canadian, European, and Japanese partners. The Russian on-orbit segment is operated by Russia.

Including its solar arrays, ISS spans the area of a US football field (with end zones) and weighs over 860,000 pounds, not including visiting vehicles. Orbiting Earth 16 times per day at a speed of 17,500 miles per hour, ISS maintains an altitude that ranges from 230 to 286 miles. The complex has more livable room than a conventional five-bedroom house, with two bathrooms, a fitness center, a 360-degree bay window, and state of the art scientific research facilities. In addition to external test beds, ISS houses three major science laboratories (US Destiny, European Columbus, and Japanese Kibo).

As the world's only space-based multinational research and technology testbed, ISS is critical to the future of human space activities. The facility enables scientists to identify and quantify risks to human health and performance and to develop and test countermeasures and technologies to protect astronauts during extended human space exploration. It is also a perfect testbed for evolving critical technologies needed to venture farther into space, such as long-duration life support, navigation systems, advanced lightweight structures, propulsion, and power generation and storage.

ISS offers unique opportunities for research and development, allowing scientists to investigate biological and physical processes in an environment very different from that on Earth. Observing from and experimenting on the ISS provides the chance to learn about Earth, life, and the solar system from a very different frame of reference. NASA and its partners have used the unique “reference point” of ISS to advance science, technology, engineering, and mathematics (STEM) efforts to inspire youth to pursue those fields. The results of the research completed on ISS can be applied to many areas of science, improving life on this planet, and furthering the experience and increased understanding necessary to journey to other worlds.

The ISS international partnership is transforming space exploration from an effort for the advancement of individual nations, to an endeavor that seeks to advance humankind. ISS aims to provide direct research benefits to the public through its operations, research, and technology development activities. The designation of ISS as a National Laboratory enables partners in government, academia, and industry to use the unique environment and advanced facilities aboard ISS to perform investigations. Ultimately, ISS activities may result in health solutions, or lead to technologies that improve our capabilities in space and on Earth. Additionally, ISS supports NASA's effort to develop a low Earth orbit space economy, as the demand for ISS access provides a customer base for commercial crew and cargo system providers.

- **Supported Strategic Goals:** 1. Extend and sustain human activities across the solar system.
- **Supported Outcomes:** 1.1. Sustain the operation and full use of the International Space Station (ISS) and expand efforts to utilize the ISS as a National Laboratory for scientific, technological, diplomatic, and educational purposes and for supporting future objectives in human space exploration.

Space and Flight Support

5B. 21st Century Space Launch Complex

With the end of the Space Shuttle program, NASA has set about evolving its workforce and facilities to meet the needs of future exploration of the solar system, as well as new commercial opportunities in low Earth orbit. The Agency created the 21st Century Space Launch Complex (21CSLC) initiative to modernize and transform the Florida launch and range complex at Kennedy Space Center. Upgrades will continue through 2018 as required to meet customer needs, evolving the launch site into a more robust national launch capability for current and future NASA programs, other US government agencies, and commercial industry.

- **Supported Strategic Goals:** 5. Enable program and institutional capabilities to conduct NASA's aeronautics and space activities.
- **Supported Outcomes:** 5.4. Implement and provide space communications and launch capabilities responsive to existing and future science and space exploration missions.

5C. Space Communications and Navigation

The Space Communications and Navigation (SCaN) program provides mission-critical communications and navigation services that are required by all NASA space missions. SCaN retrieves science and spacecraft health data, uploads commands, and sends data to individual mission control centers. Navigation services accurately determine where a satellite is and where it is going, to enable plans for course changes, interpret science data, and position the spacecraft for the next communications opportunity.

Without SCaN services to move data and commands between spacecraft and Earth, customer missions and space hardware worth tens of billions of dollars would be little more than orbital debris. A communications or navigation failure on the spacecraft or in SCaN network systems could result in complete loss of a mission.

SCaN mission customers range from high altitude balloons at the edge of Earth's atmosphere, through science satellites in low Earth orbit, to the most distant manmade object, Voyager 1, which is at the brink of the solar system, over 11 billion miles from Earth. Other customers include the Hubble Space Telescope in Earth orbit, the Curiosity rover on the surface of Mars, and New Horizons on its way to Pluto. SCaN supports the International Space Station (ISS) as well as its commercial and international servicing vehicles, and will support commercial crew providers and NASA's Orion Multi-Purpose Crew Vehicle (MPCV) when they launch in the future. SCaN also provides services to foreign, international, and non-NASA US missions on a reimbursable basis.

SCaN provides customer missions with the communications and navigation services they need, at the lowest practical cost. Customer mission requirements include the mission's orbit, navigation needs, data rate, and how often communications opportunities occur. SCaN networks and the customer spacecraft must match technical parameters such as radio frequency, data coding, modulation scheme, polarization, and error correction. SCaN supports new spacecraft which are increasingly powerful, complex, and capable of acquiring ever increasing amounts of mission data, but also supports missions launched over 30 years ago that are still returning valuable science data.

SCaN provides communications and navigation services to customer missions through its three space communications networks. The Space Network communicates with missions in Earth orbit, and provides constant communication with ISS; it will also support future commercial crew and Orion MPCV missions. The Near Earth Network communicates with suborbital missions and missions in low Earth, highly elliptical Earth, and some lunar orbits. The Deep Space Network communicates with the most distant missions, such as inter-planetary probes.

The three networks require maintenance, replenishment, modernization, and capacity expansion to ensure service for existing and planned missions. SCaN also purchases ground communications links from the NASA integrated services network to move data between SCaN ground stations, NASA centers, and mission operation and data centers.

- **Supported Strategic Goals:** 5. Enable program and institutional capabilities to conduct NASA's aeronautics and space activities.
- **Supported Outcomes:** 5.4. Implement and provide space communications and launch capabilities responsive to existing and future science and space exploration missions.

5D. Human Space Flight Operations

At the core of human spaceflight is the crew. The physical presence of human beings actively involved in space exploration broadly expands the benefits and experience for people on Earth. The Human Space Flight Operations (HSFO) program supports the readiness and health of the human system, the crew that has been so integral to the success of the Space Shuttle and International Space Station (ISS) programs.

As NASA is poised to embark on a new phase of human exploration beyond Earth's orbit, the Agency cannot focus only on developing a transportation system capable of reaching destinations throughout the solar system. NASA must also prepare the human system for living and working in a hostile space environment for extended periods of time. As astronauts travel into deep space, what health risks will they face, and how can NASA mitigate them? What kind of training will astronauts require to prepare for being too far from Earth to easily return should

a technical anomaly or medical emergency occur? It is not too early to start answering these questions.

- **Supported Strategic Goals:** 5. Enable program and institutional capabilities to conduct NASA's aeronautics and space activities.
- **Supported Outcomes:** 5.2. Ensure vital assets are ready, available, and appropriately sized to conduct NASA's missions.

5E. Launch Services

Without the Launch Services Program (LSP), NASA's robotic science spacecraft would never make it into space, and robotic probes such as the Mars Curiosity Rover, would never reach other planets. For the last 14 years, the Agency has relied on the program to provide space access for scientific and communication satellites, via commercially available domestic launch services. LSP serves the NASA community by contracting launch services to fully address mission needs, and ensure that pricing is consistent and fair. In addition, the program certifies the readiness of new launch vehicles to fly NASA's spacecraft, and conducts engineering analyses and other technical tasks that maximize launch success for every NASA robotic payload.

- **Supported Strategic Goals:** 5. Enable program and institutional capabilities to conduct NASA's aeronautics and space activities.
- **Supported Outcomes:** 5.4. Implement and provide space communications and launch capabilities responsive to existing and future science and space exploration missions.

5F. Rocket Propulsion Test

Developing rocket propulsion systems is an important aspect of working in space, but it is also a dangerous and costly undertaking. Whether the payload will ultimately be a robotic science experiment or a human-crewed mission, it is crucial that the propulsion system be safe, reliable, and accurate. Thus, a rigorous engine test program is a critical component of any rocket propulsion development activity. NASA's Rocket Propulsion Test (RPT) program maintains and manages a wide range of facilities capable of ground testing rocket engines and components under controlled conditions.

With test facilities located throughout the country, RPT is able to maintain a world-class test infrastructure that provides a single entry point for users. The program retains a skilled workforce that is adaptable to increasingly complex rocket engine development and testing needs. RPT evaluates customer test requirements and desired outcomes, while striving to minimize test time and cost. By consolidating and streamlining NASA's rocket test facilities in

this way, the program can efficiently manage usage and eliminate the need for duplicate facilities.

As NASA's principal implementing authority for rocket propulsion testing, the program reviews, approves, and provides direction on test assignments, capital improvements, and test facility modernization and refurbishment. The program integrates multi-site test activities, identifies and protects core capabilities, and develops advanced testing technologies.

RPT also represents NASA as a member of the National Rocket Propulsion Test Alliance, which is an inter-agency alliance between NASA and DoD, established to facilitate efficient and effective use of the federal government's rocket propulsion test capabilities. The RPT Program Manager serves as the co-chair of this alliance, which also coordinates government investment aimed at satisfying the Nation's rocket propulsion developmental and operational testing needs, and is a member of the NRPTA Senior Steering Group.

- **Supported Strategic Goals:** 5. Enable program and institutional capabilities to conduct NASA's aeronautics and space activities.
- **Supported Outcomes:** 5.3. Ensure the availability to the Nation of NASA-owned strategically important test capabilities.

6. Education $136.1 million

Total Budget Authority (in millions of dollars)		
	FY 2013 est.	FY 2014 est.
$136.1	$136.9	$94.2

6A. Aerospace Research and Career Development

Aerospace Research and Career Development (ARCD) supports national STEM efforts through the National Space Grant College and Fellowship Program (Space Grant) and the Experimental Program to Stimulate Competitive Research (EPSCoR).

The NASA Authorization Act of 1988 (P.L. 100-147) established Space Grant with a goal of enhancing the Nation's science enterprise by funding education, research, and public service projects through a national network of university-based Space Grant consortia. The NASA Authorization Act, FY 1992 (P.L. 102-588) established EPSCoR to strengthen the research capability of jurisdictions that have not in the past participated equitably in competitive aerospace research activities. The goal of the NASA EPSCoR is to provide seed funding that will enable jurisdictions to develop an academic research enterprise directed toward long-term, self-sustaining, nationally competitive capabilities in aerospace and aerospace-related research. This capability will, in turn, contribute to the jurisdiction's economic viability and expand the Nation's base for aerospace research and development.

These national projects enable NASA to advance more strategically STEM literacy by enhancing science and engineering education and research efforts in higher education, K-12, and informal education. In addition to education, ARCD promotes research and technology development opportunities for faculty and research teams that advance the Agency's scientific and technical priorities.

- **Supported Strategic Goals:** 6. Enable program and institutional capabilities to conduct NASA's aeronautics and space activities that share NASA with the public, educators, and students to provide opportunities to participate in our Mission, foster innovation, and contribute to a strong national economy.
- **Supported Outcomes:** 5.1 Identify, cultivate, and sustain a diverse workforce and inclusive work environment that is needed to conduct NASA missions; 6.1. Improve retention of students in STEM disciplines by providing opportunities and activities along the education pipeline; and 6.2. Promote STEM literacy through strategic partnerships with formal and informal organizations and 6.4. Inform, engage, and inspire the public by sharing NASA's missions, challenges, and results.

6B. STEM Education and Accountability

The STEM Education and Accountability program makes unique NASA assets, including people, resources, and facilities available in support of the Nation's STEM education priorities. The program supports professional development of interns, fellows, and educators, while integrating NASA assets and content into programs designed by the Department of Education, National Science Foundation, and the Smithsonian Institution. It connects NASA's partners, including higher education institutions, minority-serving institutions, community colleges, NASA visitor centers, museums, and planetariums to the broad scientific discoveries, aeronautics research, and exploration missions of the Agency.

Through the Minority University Research and Education Project, NASA supports the Nation's Historically Black Colleges and Universities, Hispanic Serving Institutions, and Tribal Colleges through multi-year research grants. Additionally, the project provides internships, scholarships, fellowships, mentoring, and tutoring for underserved and underrepresented learners in K-12, informal, and higher education settings, that includes community colleges, particularly those serving a high proportion of minority and underserved students, including persons with disabilities and women.

- **Supported Strategic Goals:** 5. Enable program and institutional capabilities to conduct NASA's aeronautics and space activities; and 6. Enable program and institutional capabilities to conduct NASA's aeronautics and space activities that share NASA with the public, educators, and students to provide opportunities to participate in our Mission, foster innovation, and contribute to a strong national economy.
- **Supported Outcomes:** 5.1 Identify, cultivate, and sustain a diverse workforce and inclusive work environment that is needed to conduct NASA missions; 6.1. Improve retention of students in STEM disciplines by providing opportunities and activities along the education pipeline; 6.2. Promote STEM literacy through strategic partnerships with formal and informal organizations; and 6.4. Inform, engage, and inspire the public by sharing NASA's missions, challenges, and results.

7. Cross Agency Support $2,993.9 million

Total Budget Authority (in millions of dollars)		
FY 2012 actual	**FY 2013 est.**	**FY 2014 est.**
$2,993.9	$3,012.2	$2,850.3

7A. Center Management and Operations

NASA's Center Management and Operations (CMO) budget supports the ongoing management, operations, and maintenance of nine Centers and three major component facilities in nine states. CMO includes two major activities: Center Institutional Capabilities and Center Programmatic Capabilities.

Institutional capabilities provide the facilities, staff, and administrative support to ensure that Center operations are effective and efficient and that activities meet statutory, regulatory, and fiduciary responsibilities. Programmatic capabilities support scientific and engineering activities at the Centers. These programmatic capabilities ensure that technical skills and assets are ready and available to meet programmatic and project milestones; that missions and research are technically and scientifically sound; and that center practices are safe and reliable. Missions rely on these programmatic and institutional capabilities to provide the skilled staff and specialized infrastructure required to accomplish their objectives.

- **Supported Strategic Goals:** 5. Enable program and institutional capabilities to conduct NASA's aeronautics and space activities.
- **Supported Outcomes**: 5.2. Ensure vital assets are ready, available, and appropriately sized to conduct NASA's missions.

Agency Management and Operations

7B. Agency Management

Agency Management and Operations (AMO) provides management and oversight of Agency missions and performance of NASA-wide mission support activities. AMO activities at NASA Headquarters ensure that core services are ready and available Agency-wide for performing mission roles and responsibilities; Agency operations are effective and efficient, and activities are conducted in accordance with all statutory, regulatory, and fiduciary requirements.

NASA Headquarters develops policy and guidance for the Centers and provides strategic planning and leadership. Headquarters establishes Agency-wide requirements and capabilities that improve collaboration, efficiency, and effectiveness. Agency management leverages resources and capabilities to meet mission needs, eliminate excess capacity, and scale assets accordingly.

AMO provides for policy-setting, executive management, and direction for all corporate functions. AMO supports the operational costs of the Headquarters installation. The AMO theme is divided into four parts: Agency Management, Safety and Mission Success, Agency Information Technology (IT) Services, and Strategic Capabilities Asset Program.

- **Supported Strategic Goals:** 5. Enable program and institutional capabilities to conduct NASA's aeronautics and space activities; and 6. Enable program and institutional capabilities to conduct NASA's aeronautics and space activities that share NASA with the public, educators, and students to provide opportunities to participate in our Mission, foster innovation, and contribute to a strong national economy.
- **Supported Outcomes:** 5.1 Identify, cultivate, and sustain a diverse workforce and inclusive work environment that is needed to conduct NASA missions; 5.2. Ensure vital assets are ready, available, and appropriately sized to conduct NASA's missions; 5.5. Establish partnerships, including innovative arrangements, with commercial, international, and other government entities to maximize mission success; 6.1. Improve retention of students in STEM disciplines by providing opportunities and activities along the education pipeline; 6.3. Engage the public in NASA's missions by providing new pathways for participation; and 6.4. Inform, engage, and inspire the public by sharing NASA's missions, challenges, and results.

7C. Safety and Mission Success

Safety and Mission Success (SMS) protects the health and safety of the NASA workforce and improve the likelihood that NASA's programs, projects, and operations will be completed safely and successfully. Safety and Mission Success includes programs that provide technical excellence, mission assurance, and technical authority. It also includes work managed by the Office of the Safety and Mission Assurance, including the NASA Safety Center and Independent Verification and Validation Facility (IV&V); the Office of Chief Engineer (OCE) including the NASA Engineering and Safety Center; and the Office of the Chief Health and Medical Officer (OCHMO). The elements of SMS reflect the recommendations outlined in many studies and by advisory boards and panels. These programs directly support NASA's core values and serve to improve the likelihood for safety and mission success for NASA's programs, projects, and operations while protecting the health and safety of NASA's workforce.

Safety and Mission Success develops policy and procedural requirements. This program results in recommendations to the Administrator, mission directorates, Center Directors, and program managers who ultimately are responsible for the safety and mission success of all NASA activities and the safety and health of the workforce. SMS resources provide the foundation for NASA's system of checks and balances, enabling the effective application of the strategic management framework and the technical authorities defined in NASA's Strategic Management and Governance Handbook. SMS funds provide training and maintain a competent technical workforce within the disciplines of system engineering (including system safety, reliability, and quality) and space medicine.

SMS resources are essential for evaluating the implications on safety and mission success, including the health and medical aspects of new requirements and departures from existing requirements. With this funding, discipline experts analyze the criticality of the associated risks and evaluate the risks acceptability through an established process of independent reviews and assessments. The information and advice from these experts provide critical data that is used by the technical authorities to develop authoritative decisions related to application of requirements on programs and projects.

- **Supported Strategic Goals:** 5. Enable program and institutional capabilities to conduct NASA's aeronautics and space activities.
- **Supported Outcomes:** 5.2. Ensure vital assets are ready, available, and appropriately sized to conduct NASA's missions.

7D. Agency IT Services (AITS)

The Agency Information Technology Services (AITS) program provides many of the Agency's information technology services, including IT security policy and incident monitoring, Web

services for the Agency's Web sites, network management, enterprise business applications and end user services. The AITS program provides innovative IT solutions to assist NASA's scientists, engineers and analysts achieve mission success. The program also improves citizen access to NASA scientific data and increases citizen participation in NASA activities.

The AITS program is transforming the IT service model from a decentralized Center-based model to an enterprise model. To achieve this transformation, the AITS program implemented the IT Infrastructure Integration Program (I3P) to improve security, achieve cost efficiencies, and provide standardized services to all users across the Agency. AITS develops and maintains NASA's current and target architectures and service optimization objectives. This program supports federal green IT and data center consolidation efforts. Core capabilities include the NASA Enterprise Application Competency Center, NASA Data Center, Security Operations Center, and the IT Discovery and Application Management Services.

The AITS program manages NASA's Web sites and services which facilitate the Agency's statutory requirement to disseminate information concerning its activities and missions results. NASA Web services consolidates NASA's Web infrastructure, enhance business and technical agility, eliminate vendor specific dependencies, drive down operational overhead for Web presence, drive down the cost of custom Web/on-demand services for missions, programs, and projects, improve NASA IT security, explore shared services across NASA Centers, and improve online customer service delivery through innovative technology. The program also implements services to allow citizens, collaborators, and other partners to use existing social media and other applications to access NASA systems and information.

- **Supported Strategic Goals:** 5. Enable program and institutional capabilities to conduct NASA's aeronautics and space activities.
- **Supported Outcomes:** 5.2. Ensure vital assets are ready, available, and appropriately sized to conduct NASA's missions.

7E. Strategic Capabilities Assets Program

TThe Strategic Capabilities Assets Program (SCAP) ensures that test facilities identified as essential by the Agency are in a state of readiness. SCAP maintains the skilled workforce and performs essential preventative maintenance to keep these facilities available to meet program requirements. Core capabilities SCAP supports are thermal vacuum chambers, simulators, and the Arc Jet Facility.

SCAP establishes alliances between all Centers with like assets, makes recommendations on the disposition of capabilities no longer required, identifies re-investment/re-capitalization requirements within and among classes of assets, and implements changes. SCAP reviews the

Agency's assets and capabilities each year to ensure that the requirements for the facilities continue to be valid.

SCAP ensures maximum benefit across the Government by broadening its alliances outside the Agency for capabilities (e.g., thermal vacuum chambers). This is facilitated by a collaborative working group, the Space Environment Test Alliance Group, which includes NASA, Department of Defense (DoD), and other partner entities. The group members gain awareness of capabilities across agencies, academia, and industry; share best practices; provide technical support; and refer test programs to facilities best suited to meet test requirements.

- **Supported Strategic Goals:** 5. Enable program and institutional capabilities to conduct NASA's aeronautics and space activities.
- **Supported Outcomes:** 5.3. Ensure the availability to the Nation of NASA-owned strategically important test capabilities.

8. Construction & Environmental Compliance Restoration $494.5 million

Total Budget Authority (in millions of dollars)		
FY 2012 actual	**FY 2013 est.**	**FY 2014 est.**
$494.5	$401.9	$609.4

Construction of Facilities (CoF)

8A. Institutional CoF

NASA's Institutional CoF program includes programmatic and non-programmatic projects supporting two overarching Agency goals:

- Reduce facility-related risks to mission success, property, and personnel. CoF projects include repairs and/or improvements to NASA's existing facilities based on a prioritized system using a risk informed process; and
- Increase sustainability and environmental friendliness. These projects support NASA's core capabilities within a smaller, more efficient footprint. Projects include replacement of old, obsolete, costly facilities with new, high performance facilities that consolidate core functions and improve flexibility over the life of the facilities. These replacement facilities incorporate new technologies and are designed with flexibility so they can address programmatic requirements, both known and still evolving over the next 40 years.

NASA's demolition program eliminates obsolete, un-needed infrastructure to improve efficiency and eliminate safety and environmental risks.

- **Supported Strategic Goals:** 5. Enable program and institutional capabilities to conduct NASA's aeronautics and space activities.
- **Supported Outcomes:** 5.2. Ensure vital assets are ready, available, and appropriately sized to conduct NASA's missions.

8B. Exploration CoF

This program provides construction required to achieve Space Launch System (SLS), Orion Multi-Purpose Crew Vehicle (MPCV), and Exploration Grounds Systems program activities.

- **Supported Strategic Goals:** 5. Enable program and institutional capabilities to conduct NASA's aeronautics and space activities.

- **Supported Outcomes:** 5.2. Ensure vital assets are ready, available, and appropriately sized to conduct NASA's missions.

8C. Space Operations CoF

This program provides construction to support 21st Century Space Launch Complex (21st CSLC), Space Communications and Navigation (SCaN), and Launch Systems.

- **Supported Strategic Goals:** 5. Enable program and institutional capabilities to conduct NASA's aeronautics and space activities.
- **Supported Outcomes:** 5.2. Ensure vital assets are ready, available, and appropriately sized to conduct NASA's missions.

Environmental Compliance and Restoration

8D. Environmental Compliance and Restoration

NASA's Environmental Compliance and Restoration (ECR) program cleans up hazardous materials and wastes that have been released to the surface or groundwater at NASA installations, NASA-owned industrial plants supporting NASA activities, current or former sites where NASA operations have contributed to environmental problems, and other sites where the Agency is legally obligated to address hazardous pollutants. ECR program activities include projects, studies, assessments, investigations, sampling, plans, designs, construction, related engineering, program support, monitoring, and regulatory Agency oversight. Funding also covers land acquisitions necessary to ensure operation of remedial treatment processes and sites as part of remediation and cleanup measures.

- **Supported Strategic Goals:** 5. Enable program and institutional capabilities to conduct NASA's aeronautics and space activities.
- **Supported Outcomes:** 5.2. Ensure vital assets are ready, available, and appropriately sized to conduct NASA's missions.

9. Office of Inspector General $38.3 million

Total Budget Authority (in millions of dollars)		
FY 2012 actual	FY 2013 est.	FY 2014 est.
$38.3	$38.2	$37.0

9A. Inspector General

The Office of Inspector General (OIG) conducts audits, reviews, and investigations of NASA programs to prevent and detect fraud, waste, abuse, and mismanagement and to assist NASA management in promoting economy, efficiency, and effectiveness.

The OIG Office of Audits conducts independent and objective audits of NASA programs, projects, operations, and contractor activities. In addition, the Office of Audits oversees the work of the independent public accounting firm that conducts the annual audit of NASA's financial statements. Office of Audits reviews target high-risk areas and Agency management challenges, responds to NASA's changing needs and priorities, and provides measurable results that help NASA achieve its space exploration, scientific, and aeronautics research missions.

The OIG Office of Investigations pursues allegations of cybercrime, fraud, waste, abuse, and misconduct related to NASA programs, projects, operations, and resources. The Office of Investigations refers its findings to the Department of Justice for criminal prosecution and civil litigation or to NASA management for administrative action. Through its investigations, the Office of Investigations develops recommendations for NASA management to reduce the Agency's vulnerability to criminal activity. Given that NASA spends approximately 85 percent of its budget on contracts and grants, the Office of Investigations targets its resources to maintaining the integrity of NASA's procurement process and the safety of NASA's missions and information systems. In the procurement area, the Office of Investigations' caseload includes investigations of suspected false claims submitted by NASA contractors, product substitution and counterfeit parts, and conflict of interest cases involving NASA employees who place private gain before public service.

Finally, the Office of Investigations seeks to prevent and deter misconduct at NASA through an aggressive "lessons learned" approach with NASA management. To this end, the OIG works with NASA officials to remedy vulnerabilities within their programs and operations that may have allowed misconduct to occur.

- **Supported Strategic Goals:** OIG does not directly support any strategic goal, but indirectly supports all NASA strategic goals.
- **Supported Outcomes:** OIG does not directly support any strategic goal, but indirectly supports all NASA outcomes.

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