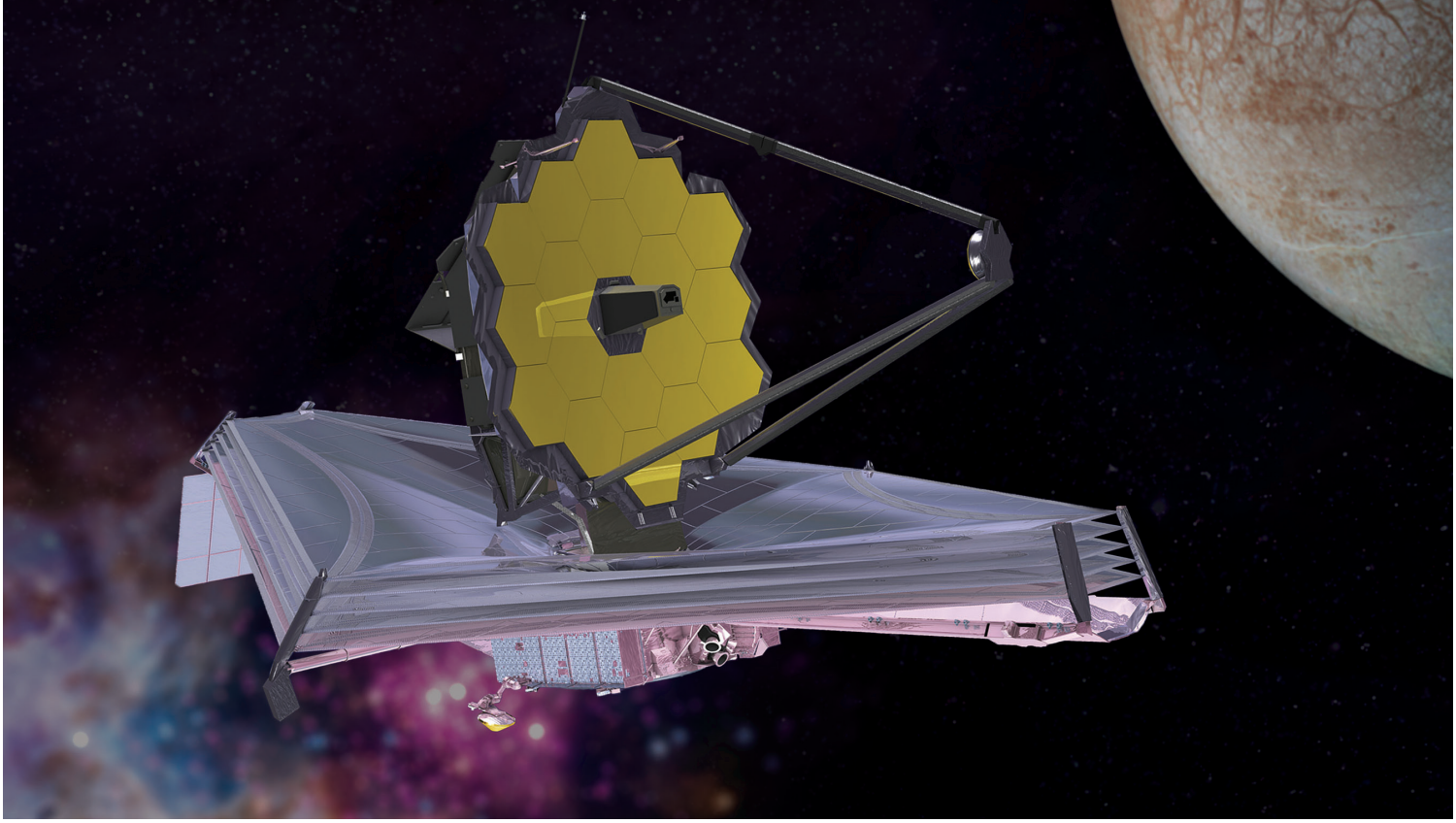
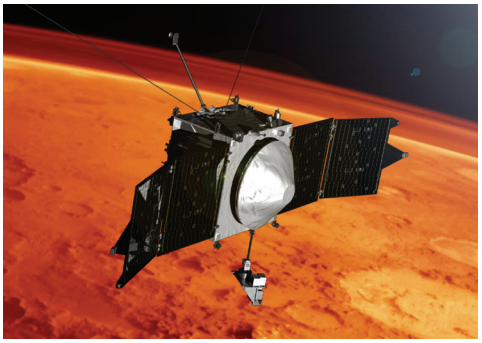
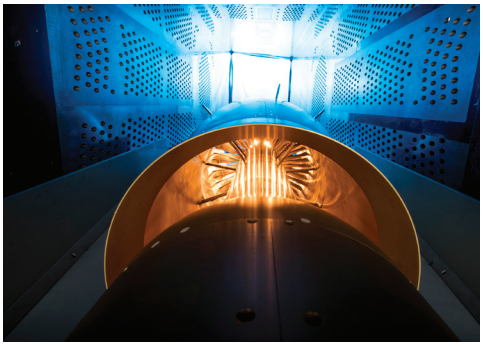
National Aeronautics and Space Administration

FY 2017
AGENCY FINANCIAL REPORT







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COVER IMAGE CAPTIONS AND CREDITS

Front Cover - Main Image:

Artist's concept of the James Webb Space Telescope (Webb). Photo credit: NASA

Front Cover - Bottom Images (left to right):

(left) Sonic Booms in Atmospheric Turbulence, or SonicBAT, flights were performed at NASA's Armstrong Flight Research Center in Edwards, California, to help NASA researchers measure the effect of low-altitude turbulence on sonic booms reaching the ground. This will help engineers further the study of shockwaves, and will assist in the development of tools necessary to further the development of future supersonic commercial aircraft. Photo credit: NASA/Carla Thomas

(center) On June 17, 2017 NASA's MAVEN (Mars Atmosphere and Volatile Evolution Mission) celebrated 1,000 Earth days in orbit around the Red Planet. Since its launch in November 2013 and its orbit insertion in September 2014, MAVEN has been exploring the upper atmosphere of Mars. MAVEN is bringing insight to how the Sun stripped Mars of most of its atmosphere, turning a planet once possibly habitable to microbial life into a barren desert world. This artist concept shows the MAVEN spacecraft and the limb of Mars. Photo credit: NASA's Goddard Space Flight Center

(right) In an effort to improve fuel efficiency, NASA and the aircraft industry are rethinking aircraft design. Inside the 8' x 6' wind tunnel at NASA Glenn Research Center, engineers recently tested a fan and inlet design, commonly called a propulsor, which could use four to eight percent less fuel than today's advanced aircraft. The new propulsor is designed to be embedded in the aircraft's body, where it would ingest the slower flowing air that normally develops along an aircraft's surface, called the boundary layer, and use it to help propel the aircraft. Photo credit: NASA

Rear Cover:

A group of United States (U.S.) Navy divers, Air Force pararescuemen and Coast Guard rescue swimmers practice Orion underway recovery techniques in the Neutral Buoyancy Laboratory at NASA's Johnson Space Center in Houston on September 21, 2016. The uncrewed Orion spacecraft will splashdown in the Pacific Ocean off the San Diego coast at the end of its test flight with the agency's Space Launch System (SLS) rocket during Exploration Mission 1 (EM-1). EM-1, Orion's first flight atop the SLS, will pave the way for future missions with astronauts and help NASA prepare for missions to Mars. Photo credit: NASA/Radislav Sinyak.

NASA engineers successfully conducted a development test of the RS-25 rocket engine Thursday, August 18, 2016 at NASA's Stennis Space Center near Bay St. Louis, Mississippi. Photo credit: NASA

TABLE OF CONTENTS

The two-stage SpaceX Falcon 9 launch vehicle lifts off from Launch Complex 39A at NASA's Kennedy Space Center carrying the Dragon resupply spacecraft to the International Space Station. Liftoff was on August 14, 2017 at 12:31 p.m. EDT. On its 12th commercial resupply services mission to the International Space Station, Dragon brought up more than 6,400 pounds of supplies and new science experiments and equipment for technology research. Photo credit: NASA/Tony Gray and Sandra Joseph

MESSAGE FROM THE ACTING ADMINISTRATOR

November 15, 2017

The National Aeronautics and Space Administration (NASA) is proud to present our Fiscal Year (FY) 2017 Agency Financial Report, which provides information on our financial performance and insight into our stewardship of resources, congressional appropriations, and taxpayer dollars. Every day, NASA is pushing boundaries in aeronautics and low-earth orbit space operations through research, development, and technological advances, as we expand into cis-lunar and deep space operations.

The constant innovations and leaps into space are not simple tasks, and they require meticulous financial planning. Efficient and effective financial management makes our mission possible. The following financial report displays exactly how your tax dollars are spent to maximize NASA's impact as a Federal agency.

NASA's budget is not solely allocated to ventures in outer space -it is used to strengthen our economy as we unlock new opportunities, new technologies, and new sources of prosperity. We also hope to inspire children to pursue education in science, technology, engineering, and math, and our technological advances enhance American defense and security.

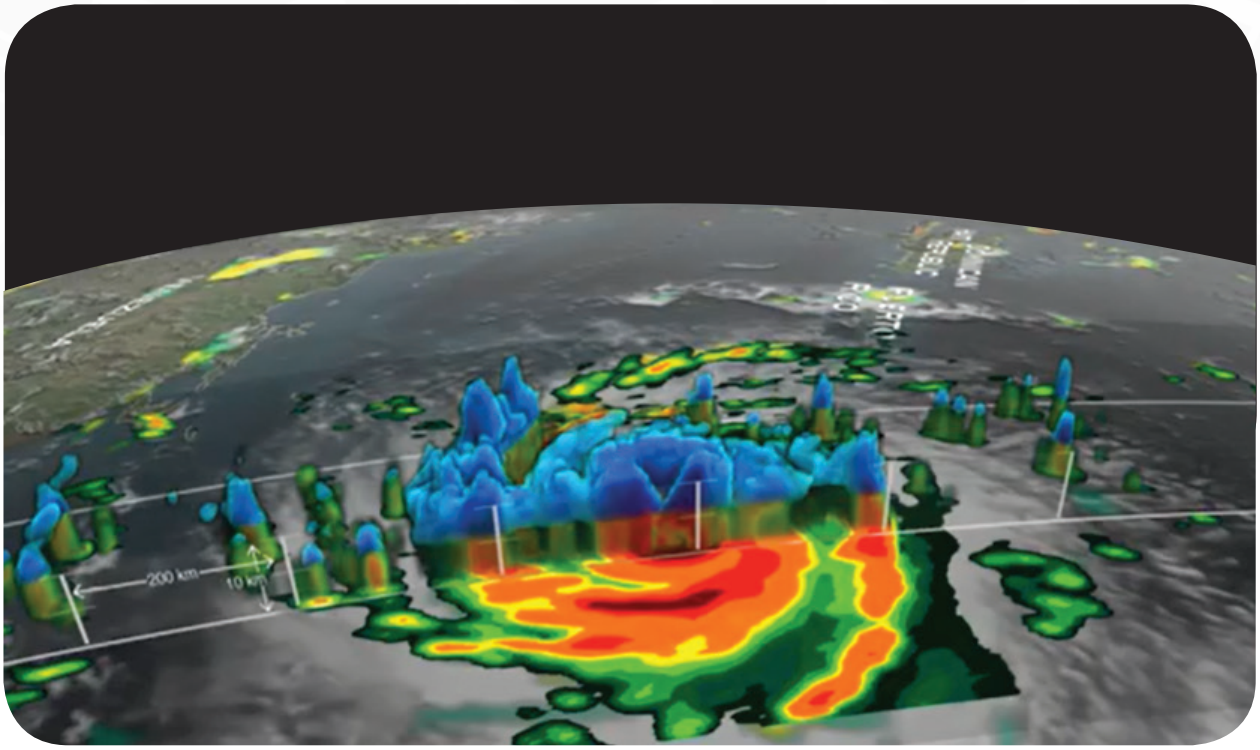
As NASA continues to unlock the mysteries of space and ensure the Nation's world preeminence in exploring the cosmos, our commitment to our budget and our people remains steadfast. We are committed to nurturing an innovative environment that fosters teamwork and excellence. For the fifth year in a row, employees named NASA the Best Place to Work in the Federal Government among large agencies.

As shown in this report, we strive to put your tax dollars to innovative and efficient use. Working in close coordination across Government through the new National Space Council, and with our commercial and international partners, we are charting a new future in space with opportunities for all. If you would like more information on this vision and our progress toward our strategic goals, I invite you to read our FY 2018 Volume of Integrated Performance, which includes the FY 2016 Annual Performance Report, FY 2017 Performance Update, and FY 2018 Annual Performance Plan.

Sincerely,

Robert M. Lightfoot, Jr.
Administrator (Acting)

Did you know?



NASA's expertise in space and scientific exploration contributed essential services for early forecasting of 2017's Hurricane Harvey, Irma and Maria. NASA satellites, computer modeling, instruments, aircraft and field missions contribute to this mix of information to give scientists a better understanding of these storms. Contributing missions include the Global Precipitation Measurement (GPM), the Cyclone Global Navigation Satellite System (CYGNSS), and NASA-NOAA's Joint Polar Satellite System (JPSS) and Geostationary Operational Environmental Satellite Program (GOES). Photo credit: NASA

Section 1
Management's Discussion and Analysis

Engineers and astronauts conducted testing in a representative model of the Orion spacecraft at NASA's Johnson Space Center in Houston to gather the crew's feedback on the design of the docking hatch and on post-landing equipment operations. The testing, shown here with astronauts Stephanie Wilson, Karen Nyberg and Rick Mastracchio (L to R), was done to evaluate the equipment used during egress to ensure that a fully suited crew member carrying survival equipment can get out of the spacecraft through the docking hatch if necessary.

While the crew will primarily use the side hatch for entry and exit on Earth and the docking hatch to travel between Orion and a habitation module on long-duration deep space missions, the crew will need to be able to exit out of the docking hatch if wave heights in the Pacific Ocean upon splashdown are too high. The work is being done to help ensure all elements of Orion's design are safe and effective for the crew to use on future missions on the journey to Mars. Photo credit: NASA/Chris Gunn

WELCOME TO NASA

NASA produces an Agency Financial Report (AFR) and Annual Performance Report (APR). NASA will publish its Fiscal Year (FY) 2017 APR concurrently with the President's Budget Request and will post it on NASA's Web site at http://www.nasa.gov/news/budget/.

This FY 2017 AFR provides an overview of NASA's major programmatic and financial results for FY 2017. It integrates financial and program performance to demonstrate stewardship and accountability and highlights FY 2017 achievements.

NASA demonstrates stewardship of its resources and accountability for results through compliance with the Chief Financial Officers Act (CFO Act) and the Government Performance and Results Act Modernization Act of 2010 (GPRAMA). Financial aspects of the Agency's business operations are accounted for according to U.S. Generally Accepted Accounting Principles (GAAP). GAAP, for Federal entities, are the standards prescribed by The Federal Accounting Standards Advisory Board (FASAB).

NASA presents both performance and financial results of operations by strategic goal. Highlights of key program activities contributing to each strategic goal are provided in the Mission Performance discussion (starting on page 11). A high-level summary of the linkage between program results and the cost of operations is provided in the Statement of Net Cost (SNC), which can be found in the Financial section (starting on page 45). The SNC presents comparative net cost of operations during FY 2017 and FY 2016 by strategic goal and for the Agency as a whole. In addition, the Financial Highlights, which can be found in the Financial Performance section (starting on page 29), explains any significant changes in NASA's financial condition from FY 2016 to FY 2017.

NASA's 2017 Astronaut Candidate Class stopped for a group photo while getting fitted for flight suits at Ellington Airport near NASA's Johnson Space Center in Houston. Photo credit: NASA

Financial systems that meet requirements of the Federal Financial Management Improvement Act (FFMIA) are vital to NASA's financial management program. The AFR describes NASA's compliance with the FFMIA, as well as the built-in checks and balances required by the Office of Management and Budget's (OMB) Circular No. A-123, *Management's Responsibility for Enterprise Risk Management and Internal Control*, which places responsibility for internal controls over financial reporting on Agency management for the purpose of safeguarding assets and improving efficiency and effectiveness of operations.

Finally, the AFR presents the Agency's audited FY 2017 and FY 2016 financial statements, the related independent auditors' audit opinion, and other information. The FY 2017 AFR can be found on NASA's Web site at http://www.nasa.gov/news/budget/.

Air Force Colonel and NASA astronaut Jack Fischer works outside the U.S. Destiny laboratory module to attach wireless antennas during the 201st spacewalk in support of International Space Station maintenance and assembly. This was a short and unplanned contingency spacewalk whose primary task was the removal and replacement of a failed computer data relay box that controls the functionality of important station components such as solar arrays and radiators. Photo credit: NASA

Did you know?

On August 21, 2017, the U.S. experienced a coast-to-coast total eclipse for the first time in 99 years! NASA took advantage of this long eclipse path by collecting data that's not usually accessible - including studying the solar corona, testing new corona observing instruments, and tracking how our planet's atmosphere, plants, and animals respond to the sudden loss of light and heat from the Sun. Photo credit: NASA

VISION AND MISSION

Our Vision: We reach for new heights and reveal the unknown for the benefit of humankind.

Our Mission: Drive advances in science, technology, aeronautics, and space exploration to enhance knowledge, education, innovation, economic vitality, and stewardship of Earth.

CORE VALUES

NASA's tradition of excellence is rooted in the four uncompromising shared core values of safety, teamwork, excellence, and integrity as well as the firm belief that we refuse to be deterred by failure.

1. SAFETY

2. TEAMWORK

3. EXCELLENCE

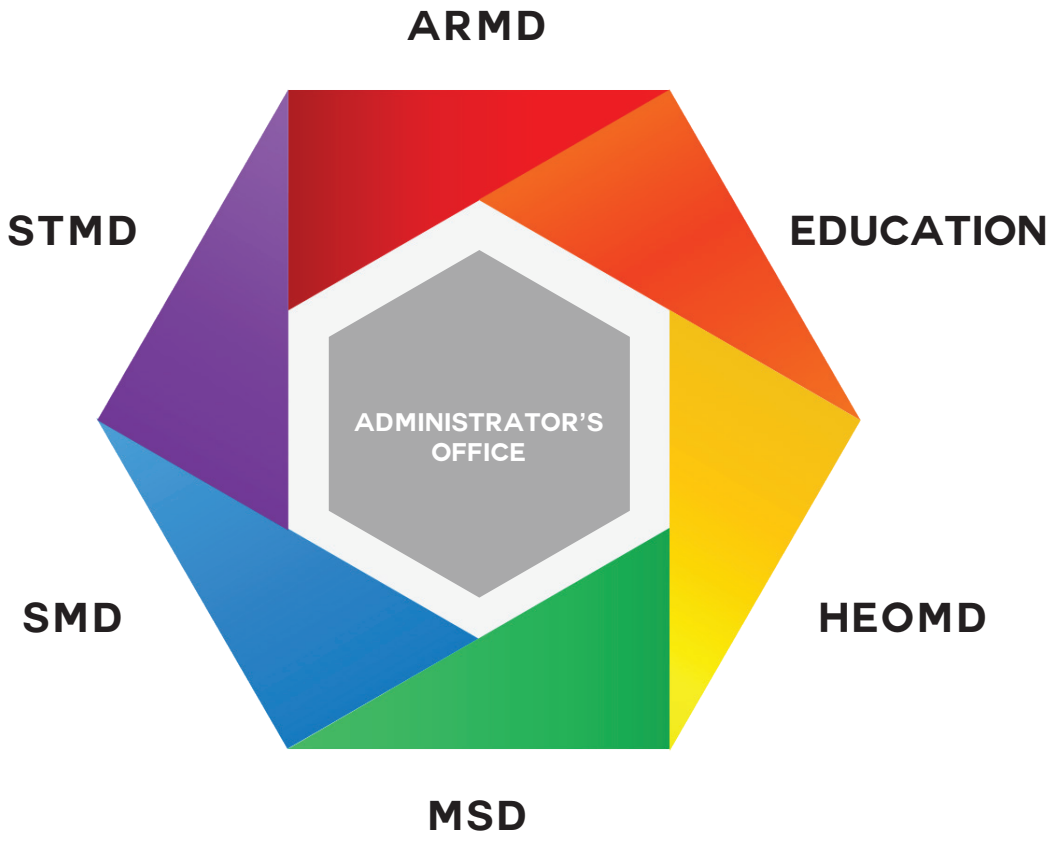
4. INTEGRITY

Photo credit (left to right) 1 At NASA's Kennedy Space Center in Florida, a Fire Rescue vehicle stands by in a parking area near the Vehicle Assembly Building for training with pilots in NASA Aircraft Operations. The exercise is designed to develop procedures for using agency helicopters to transport injured patients to a local hospital. The activity taking place in Kennedy's Launch Complex 39 turn-basin parking lot was only one of several drills. It was part of a new training program that was developed by Kennedy's Fire Rescue Department along with NASA Aircraft Operations to sharpen the skills needed to help rescue personnel learn how to collaborate with helicopter pilots in taking injured patients to hospitals as quickly as possible. Photo credit: NASA/Dan Casper • **2** NASA astronaut Shane Kimbrough is carried into a medical tent shortly after he, Russian cosmonaut Sergey Ryzhikov of Roscosmos, and Russian cosmonaut Andrey Borisenko of Roscosmos landed in their Soyuz MS-02 spacecraft in a remote area near the town of Zhezkazgan, Kazakhstan on Monday, April 10, 2017. Photo credit: NASA • **3** J. Keith Motley, Chancellor, University of Massachusetts Boston, and Chair, Association of Public and Land-grant Universities (APLU) Commission on Access, Diversity and Excellence, speaks at the Symposium on Supporting Underrepresented Minority Males in Science, Technology, Engineering and Mathematics (STEM), Tuesday, February 28, 2012 at NASA Headquarters in Washington. Photo credit: NASA/Carla Cioffi • **4** The Moon, or Supermoon, is seen as it sets over the Martin Luther King Jr. Memorial on Monday, November 14, 2016, in Washington, DC. A Supermoon occurs when the Moon's orbit is closest (perigee) to Earth. Early Monday morning, the Moon was the closest it has been to Earth since 1948 and it appeared 30 percent brighter and 14 percent bigger than the average monthly full Moon. Photo credit: NASA/Aubrey Gemignani

NASA's Vision, Mission, and Core Values are established in the Strategic Plan which can be found on NASA's Website at https://www.nasa.gov/sites/default/files/files/FY2014_NASA_SP_508c.pdf.

ORGANIZATION

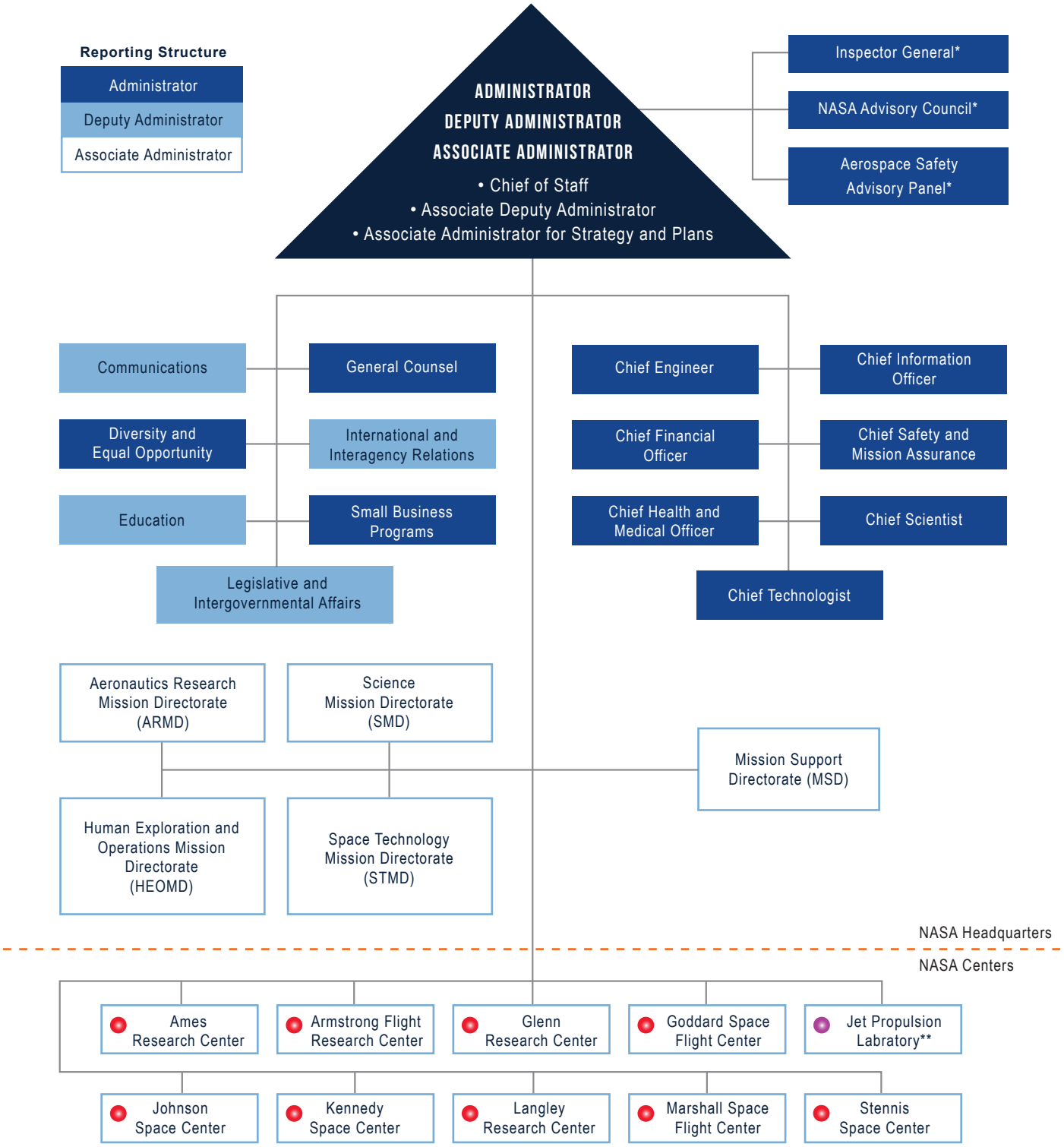
NASA's organizational structure is designed to accomplish its Mission and provide a framework for sound business operations, management controls, and safety oversight. The Office of the Administrator provides the overarching vision and strategic direction for the Agency. The Agency's science, research, and technology development work is implemented through four Mission Directorates supported by the Mission Support Directorate and the Office of Education:



- Administrator's Staff Offices
  https://www.nasa.gov/nasa-leadership
- Mission Support Directorate (MSD)
  https://www.nasa.gov/msd
- Science Mission Directorate (SMD)
  https://science.nasa.gov/
- Space Technology Mission Directorate (STMD)
  https://www.nasa.gov/directorates/spacetech/home/index.html
- Aeronautics Research Mission Directorate (ARMD)
  https://www.nasa.gov/aeroresearch
- Office of Education (Education)
  https://www.nasa.gov/offices/education/about/index.html
- Human Exploration and Operations Mission Directorate (HEOMD)
  https://www.nasa.gov/directorates/heo/index.html

More information about NASA organization is available at http://www.nasa.gov/about/org_index.html

ORGANIZATIONAL STRUCTURE



Notes:

* Advisory groups and Inspector General are independent organizations that report to the NASA Administrator.

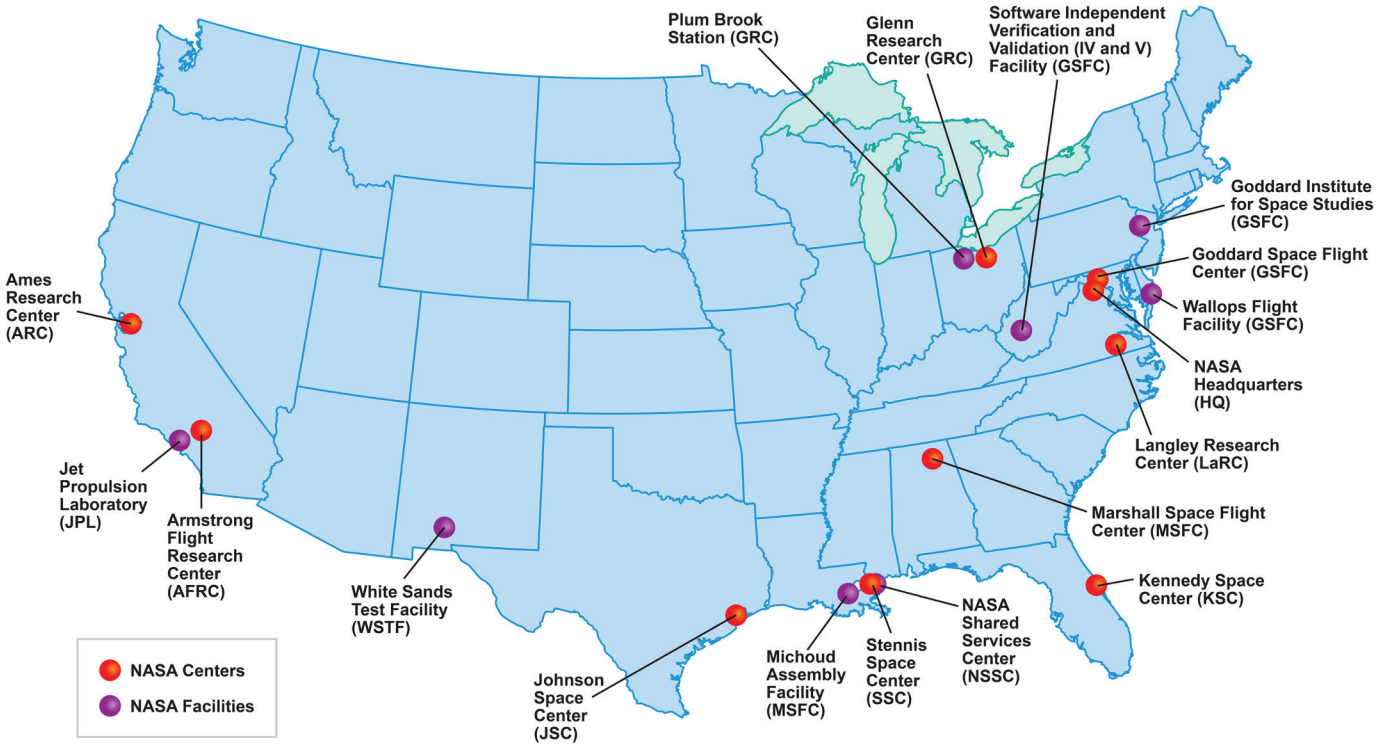
** A Federally Funded Research and Development Center managed by the California Institute of Technology.

CENTERS AND FACILITIES NATIONWIDE

Under the leadership of the Administrator, NASA's Mission Directorates, MSD, and staff offices at Headquarters provide overall guidance and direction to the Agency. NASA's Centers and installations conduct the Agency's day-to-day work in laboratories, on airfields, in wind tunnels, in control rooms, and in NASA's other one-of-a-kind facilities.

The NASA Shared Services Center (NSSC) was established in March 2006 to provide all NASA Centers timely, accurate, and cost-effective support services in the areas of financial management, human resources, information technology, procurement, and business support services.

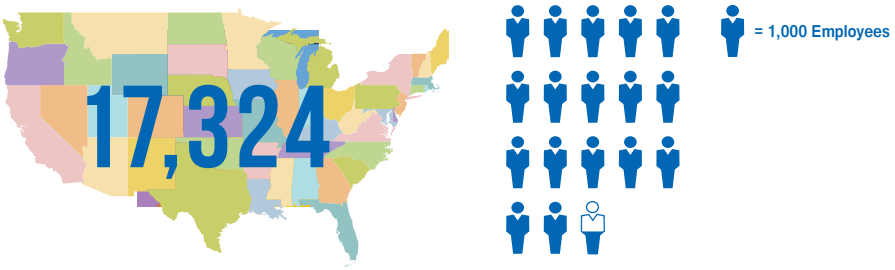
NASA Centers and Facilities

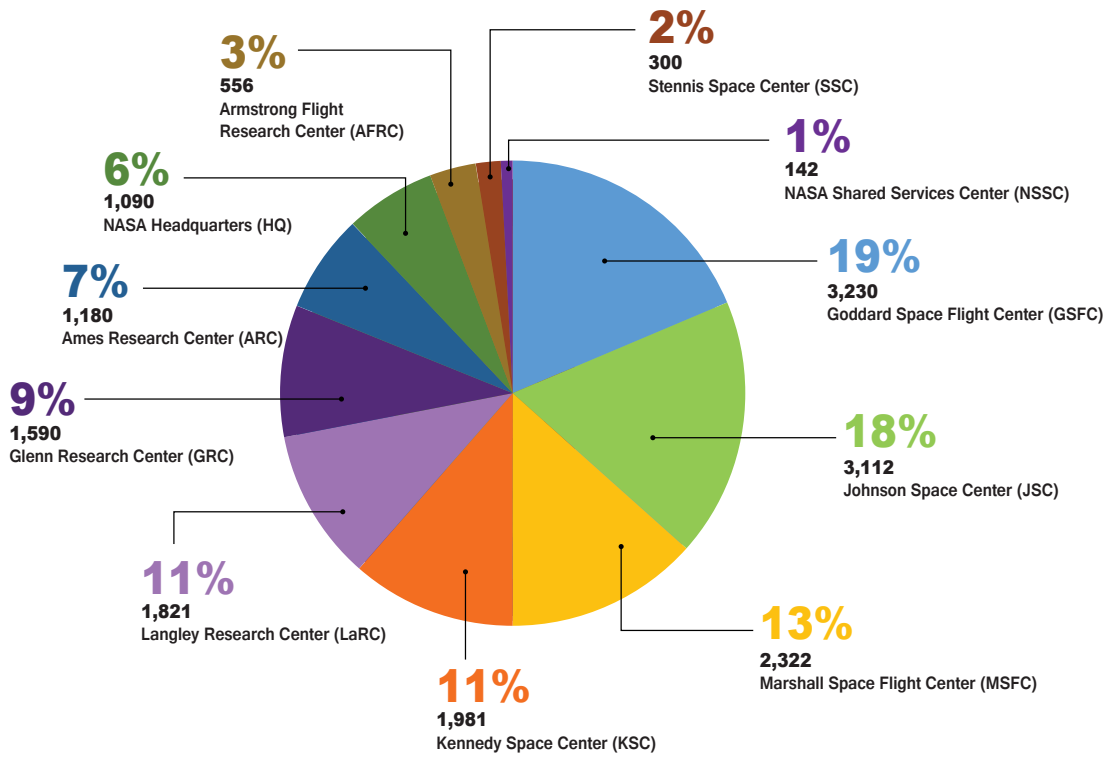


Note: JPL is a Federally Funded Research and Development Center in Pasadena, California. The California Institute of Technology manages JPL.

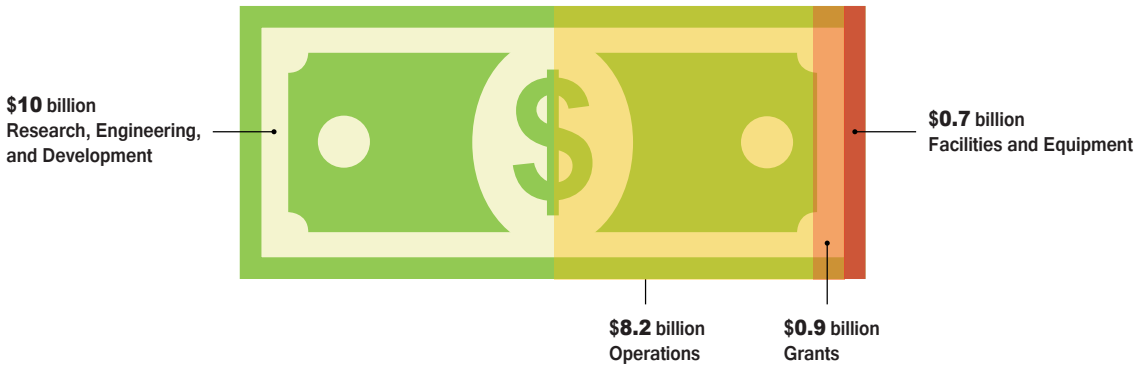
NASA BY THE NUMBERS

NASA's Civil Service Workforce





$19.8 Billion Budget in FY 2017



More information about NASA's workforce is available at https://wicn.nssc.nasa.gov/

MISSION PERFORMANCE

The Polar Night Nitric Oxide or PolarNOx experiment from Virginia Tech is launched aboard a NASA Black Brant IX sounding rocket at 8:45 a.m. EST, January 27, 2017 from the Poker Flat Research Range in Alaska. PolarNOx is measuring nitric oxide in the polar night sky. Nitric oxide in the polar night sky is created by auroras. Under appropriate conditions it can be transported to the stratosphere where it may destroy ozone resulting in possible changes in stratospheric temperature and wind and may even impact the circulation at Earth's surface. Photo credit: NASA/Wallops/Jamie Adkins

PERFORMANCE OVERVIEW

In the NASA 2014 Strategic Plan, NASA lays out its strategy to discover, develop, and serve on Earth and in space through three strategic goals. The first strategic goal focuses on expanding knowledge, capability, and opportunity in space. The second strategic goal focuses on our work to improve the understanding of life on Earth. Finally, the third strategic goal focuses on major management priorities and challenges. These three overarching and timeless strategic goals align with a total of fifteen strategic objectives. These strategic objectives are split unevenly, with seven objectives focused on Strategic Goal 1 (Objectives 1.1 – 1.7), four objectives focused on Strategic Goal 2 (Objectives 2.1 – 2.4), and four objectives focused on Strategic Goal 3 (Objectives 3.1 – 3.4).

Within these objective "families," NASA's performance and progress is rated through "parent" Performance Goals (PGs) and "child" Annual Performance Indicators (APIs). This hierarchy is best visualized below in Figure 1. PGs are measures used to categorize performance in programs and areas across multi-year periods and may be Agency specific. PGs do not last longer than four years, since they are updated in accordance with each new administration's priorities. APIs, on the other hand, rate performance in a single year, and are more practical for understanding how well the annual budget funded a portion of a program.

The NASA 2014 Strategic Plan can be found at https://www.nasa.gov/sites/default/files/files/FY2014_NASA_SP_508c.pdf.

NASA STRATEGY AND PERFORMANCE FRAMEWORK 2014 STRATEGIC PLAN

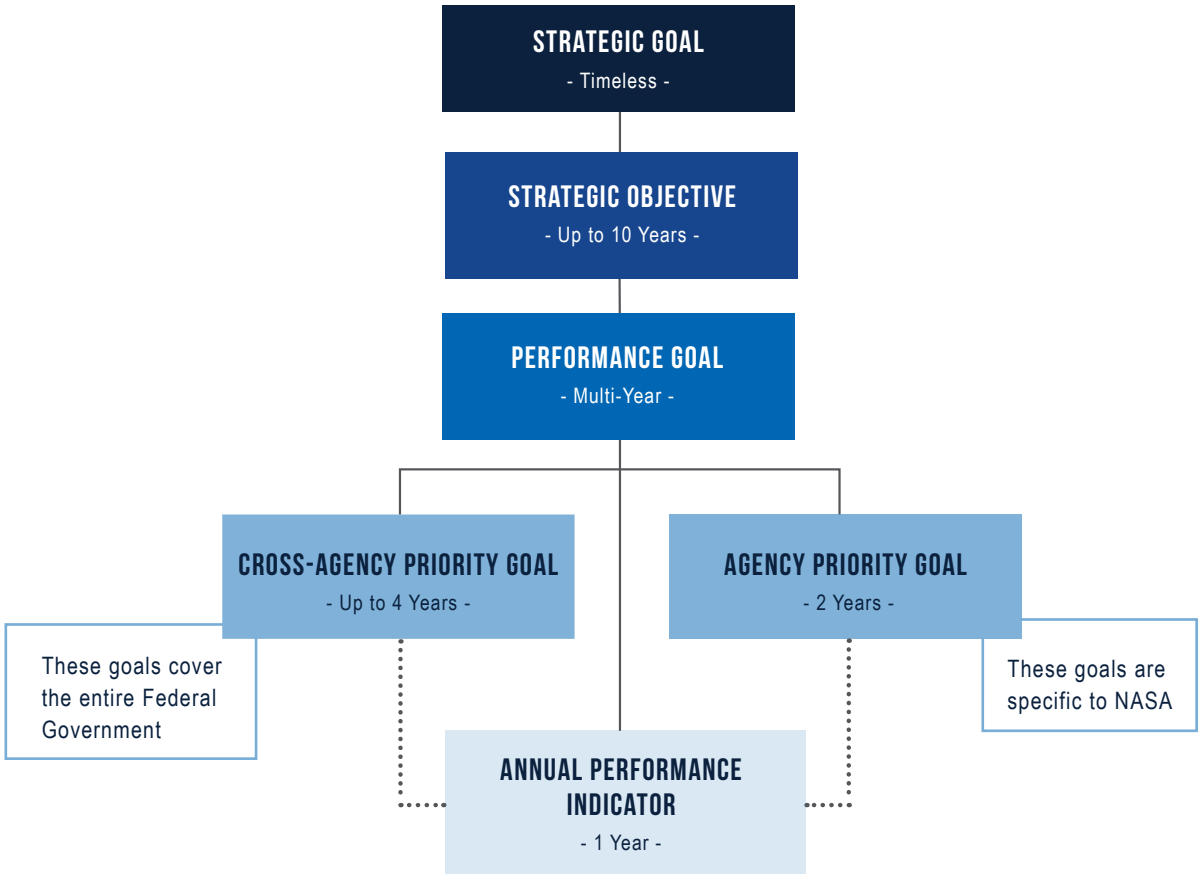


Figure 1: Hierarchy of performance metrics in the U.S. Federal Government.

In this FY 2017 AFR, NASA presents a high-level summary of performance from FY 2017, reflecting preliminary year-end assessments of progress towards the Performance Goals and Annual Performance Indicators. Final ratings and more detailed information will be provided in the FY 2018 APR, which can be found in the FY 2019 Volume of Integrated Performance, published in February 2018 at https://www.nasa.gov/news/budget/index.html.

NASA determines these ratings based on a series of internal assessments that are part of ongoing monitoring of NASA's program and project performance. External entities, such as scientific peer review committees and aeronautics technical evaluation bodies, validate select ratings prior to publication in the APR.

For reporting purposes, NASA uses a color-coded system to represent the assessment and rating of performance. Every performance metric has specific, individualized rating criteria. The generic rating criteria in the table below are illustrative of the types of individualized criteria assigned to each performance measure and broadly apply to the performance metrics.

Green

On Track or Complete

NASA completed or expects to complete this performance measure within the estimated timeframe.

Yellow

Slightly Below Target and/or Behind Schedule

NASA completed or expects to complete this performance measure, but is slightly below the target and/or moderately behind schedule.

Red

Significantly Below Target and/or Behind Schedule

NASA did not or does not expect to complete this performance measure within the estimated timeframe. The program is substantially below the target and/or significantly behind schedule.

White

Cancelled or Postponed

NASA senior management cancelled or postponed this performance measure. The Agency no longer is pursuing activities related to this performance measure or the program did not have activities during the fiscal year.

Gray

Unrated

NASA Performance Contacts are delayed in gathering the final rating for this performance measure due to scheduling conflicts, administrative turnover, or prolonged committee reviews. Gray ratings are historically uncommon.

Note: These are generic criteria provided for informational purposes only. NASA develops measure-specific criteria to rate all of the Agency's performance goals and annual performance indicators.

NASA'S THREE STRATEGIC GOALS ARE:

ONE Expand the frontiers of knowledge, capability, and opportunity in space.

TWO Advance understanding of Earth and develop technologies to improve the quality of life on our home planet.

THREE Serve the American public and accomplish our Mission by effectively managing our people, technical capabilities, and infrastructure.

INSPIRE students to be our future scientists, engineers, explorers, and educators through interactions with NASA's people, missions, research, and facilities.

EXPAND partnerships with international, intergovernmental, academic, industrial, and entrepreneurial communities, recognizing them as important contributors of skill and creativity to our missions and for the propagation of our results.

COMMIT to environmental stewardship through Earth observation and science, and the development and use of green technologies and capabilities in NASA missions and facilities.

SAFEGUARD the public trust through transparency and accountability in our programmatic and financial management, procurement, and reporting practices.

INVEST in next-generation technologies and approaches to spur innovation.

FY 2016 - FY 2017 AGENCY PRIORITY GOALS

NASA developed four Agency priority goals for FY 2016 - FY 2017, consistent with the requirements of GPRAMA. The FY 2017 Agency priority goals are listed below. More information is available at https://obamaadministration.archives.performance.gov/agencies.html.

Human Exploration and Operations, Exploration Systems Development:

Achieve critical milestones in development of new systems for the human exploration of deep space. By September 30, 2017, NASA will have begun integration and testing of the Exploration Mission (EM)-1 Orion Crew Module (CM), including the first power-on of the vehicle; delivered all four EM-1 Space Launch System (SLS) Core Stage RS-25 engines to the Michoud Assembly Facility in preparation for integration into the Core Stage; and completed construction of Exploration Ground Systems (EGS) Pad B.

Human Exploration and Operations, International Space Station Program:

Increase the occupancy of the International Space Station's (ISS) internal and external research facilities by adding new instruments and capabilities. By September 30, 2017, NASA will increase the occupancy of the ISS internal and external research facility sites with science and technology payload hardware to 75 percent.

Human Exploration and Operations, Commercial Crew Program:

Facilitate the development of and certify U.S. industry-based crew transportation systems while maintaining competition, returning ISS crew transportation to the United States. By September 30, 2017, the Commercial Crew Program (CCP), along with its industry partners, will make measurable technical and programmatic progress toward the certification of commercial crew transportation systems, including the completion of at least one Design Certification Review.

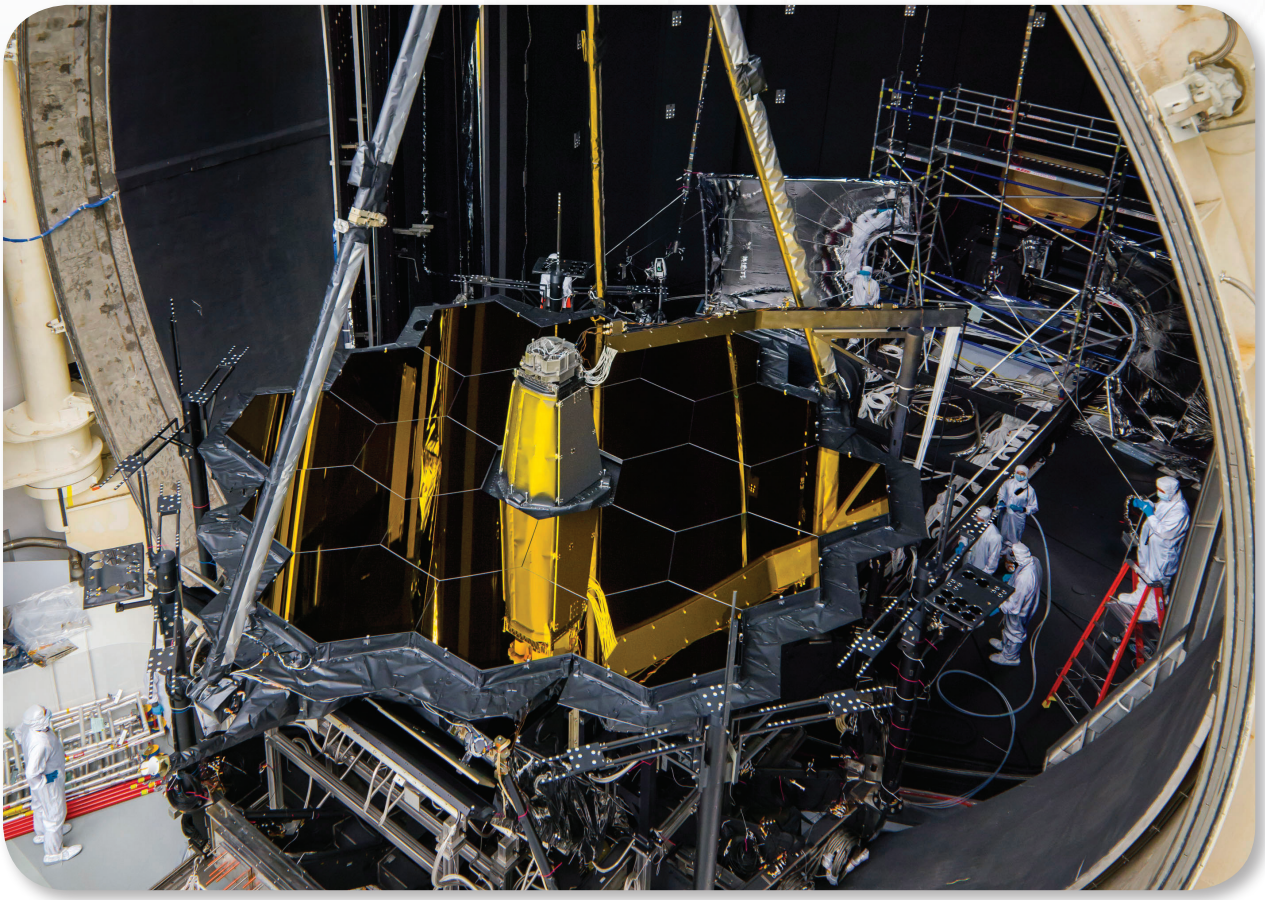
Science, James Webb Space Telescope Program:

Revolutionize humankind's understanding of the Cosmos and humanity's place in it. By October 2018, NASA will launch the James Webb Space Telescope (Webb). To enable this launch date, NASA will complete the testing of the Webb Optical Telescope Element plus Integrated Science Instrument Module by September 30, 2017.

DID YOU KNOW?

On April 24, 2017, NASA Astronaut Peggy Whitson established the new record for the most time spent in space by an American astronaut. She has spent more than 76 weeks of her life floating in microgravity! It's not the first time in her career at NASA that Whitson has established new milestones; here are just a few: first NASA Science Officer, first female to command the Space Station, first female Chief of the Astronaut Office, and most spacewalks for a female astronaut. Photo credit: NASA

Did you know?



It's freezing in Houston! NASA's James Webb Space Telescope was placed in Johnson Space Center's historic Chamber A on June 20, 2017 to prepare for its final three months of testing in a cryogneic vacuum that mimics temperatures in space. Photo credit: NASA

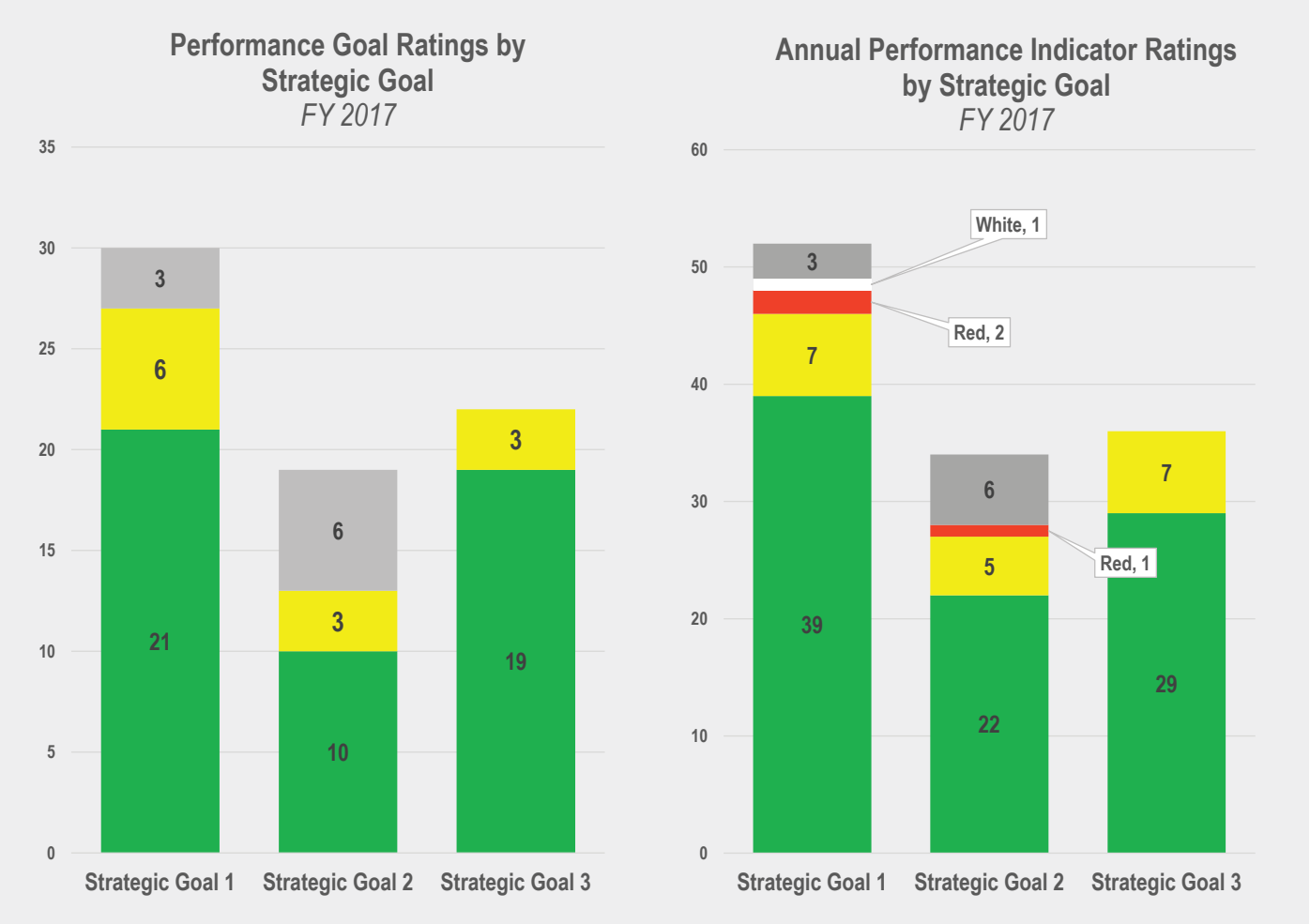
STRATEGIC GOALS & HIGHLIGHTS

Orion's three main orange and white parachutes help a representative model of the spacecraft descend through sky above Arizona, where NASA engineers tested the parachute system on September 13, 2017, at the U.S. Army Proving Ground in Yuma. NASA is qualifying Orion's parachutes for missions with astronauts.

During this test, engineers replicated a situation in which Orion must abort off the Space Launch System rocket and bypass part of its normal parachute deployment sequence that typically helps the spacecraft slow down during its descent to Earth after deep space missions. The capsule was dropped out of a C-17 aircraft at more than 4.7 miles in altitude and allowed to free fall for 20 seconds, longer than ever before, to produce high aerodynamic pressure before only its pilot and main parachutes were deployed, testing whether they could perform as expected under extreme loads. Orion's full parachute system includes 11 total parachutes -- three forward bay cover parachutes and two drogue parachutes, along with three pilot parachutes that help pull out the spacecraft's three mains. Photo credit: NASA

Given the nature of some NASA programs, which include long-lead procurements and basic research, it may be difficult to quantify program impacts in the initial stages of program implementation. To ensure programs remain on track, NASA uses performance metrics based on rating criteria established by the appropriate mission directorates and program leadership. These criteria define if a performance goal (PG) or annual performance indicator (API) is rated green (on track or complete), yellow (slightly below target and/or behind schedule), or red (significantly below target and/or behind schedule). PGs and APIs can also be rated white (cancelled/postponed) or gray (unrated). This scale is used to understand NASA's performance at a high level and to better determine our progress in all three strategic goal areas.

Below are graphs of FY 2017's PGs and APIs and their associated ratings. Notice there are many more PGs, as they encompass larger programs and qualifications (i.e., send a satellite into orbit before October 2018). There are numerous APIs, associated with various tasks and parts of a program (i.e., test rocket boosters, test satellite operation, create safe transport vehicle for satellite hardware, maintain launch schedule, etc.)



Performance Goals (PG) and Annual Performance Indicator (API) summaries across NASA's three strategic goals in FY 2017

Every four years, corresponding to a change in presidential administration, NASA develops a new Strategic Plan to outline its aspirations. For more information on the strategic plan, please find the 2014-2018 Strategic Plan at https://www.nasa.gov/sites/default/files/files/FY2014_NASA_SP_508c.pdf.

STRATEGIC OBJECTIVES

The strategic objectives are defined below. As a reminder, these objectives can be found in NASA's 2014-2018 Strategic Plan, and are no longer current after the release of the 2018-2022 Strategic Plan.

Objective 1.1 (Human Exploration): Expand human presence into the solar system and to the surface of Mars to advance exploration, science, innovation, benefits to humanity, and international collaboration.

Objective 1.2 (ISS): Conduct research on the International Space Station (ISS) to enable future space exploration, facilitate a commercial space economy, and advance the fundamental biological and physical sciences for the benefit of humanity.

Objective 1.3 (Commercial): Facilitate and utilize U.S. commercial capabilities to deliver cargo and crew to space.

Objective 1.4 (Heliophysics): Understand the Sun and its interactions with Earth and the solar system, including space weather.

Objective 1.5 (Planetary Science): Ascertain the content, origin, and evolution of the solar system and the potential for life elsewhere.

Objective 1.6 (Astrophysics): Discover how the universe works, explore how it began and evolved, and search for life on planets around other stars.

Objective 1.7 (Space Technology): Transform NASA missions and advance the Nation's capabilities by maturing crosscutting and innovative space technologies.

Objective 2.1 (Aeronautics): Enable a revolutionary transformation for safe and sustainable U.S. and global aviation by advancing aeronautics research.

Objective 2.2 (Earth Science): Advance knowledge of Earth as a system to meet the challenges of environmental change, and to improve life on our planet.

Objective 2.3 (Technology): Optimize Agency technology investments, foster open innovation, and facilitate technology infusion, ensuring the greatest national benefit.

Objective 2.4 (Education): Advance the Nation's STEM education and workforce pipeline by working collaboratively with other agencies to engage students, teachers, and faculty in NASA's missions and unique assets.

Objective 3.1 (Mission Support): Attract and advance a highly skilled, competent, and diverse workforce, cultivate an innovative work environment, and provide the facilities, tools, and services needed to conduct NASA's missions.

Objective 3.2 (Technical Capabilities): Ensure the availability and continued advancement of strategic, technical, and programmatic capabilities to sustain NASA's Mission

Objective 3.3 (IT Services): Provide secure, effective, and affordable information technologies and services that enable NASA's Mission.

Objective 3.4 (Safety and Mission Success): Ensure effective management of NASA programs and operations to complete the mission safely and successfully.

STRATEGIC GOAL 1

Expand the frontiers of knowledge, capability, and opportunity in space

Overview

NASA has continually expanded the boundaries of science, technology, and imagination. Technologies and ideas that once only existed in the realm of science fiction have become science fact. Proving that the seemingly impossible is possible, NASA helps maintain U.S. leadership in space and creates new generations of space entrepreneurs and enthusiasts who believe humanity's future lies among the stars. This goal encapsulates a cycle of discovery, where every advance in our knowledge provides us unique insights and opportunities to improve our understanding of the universe, which leads to enhanced capabilities in space and on Earth. This, in turn, raises new questions and leads not only to new answers, but also new tools.

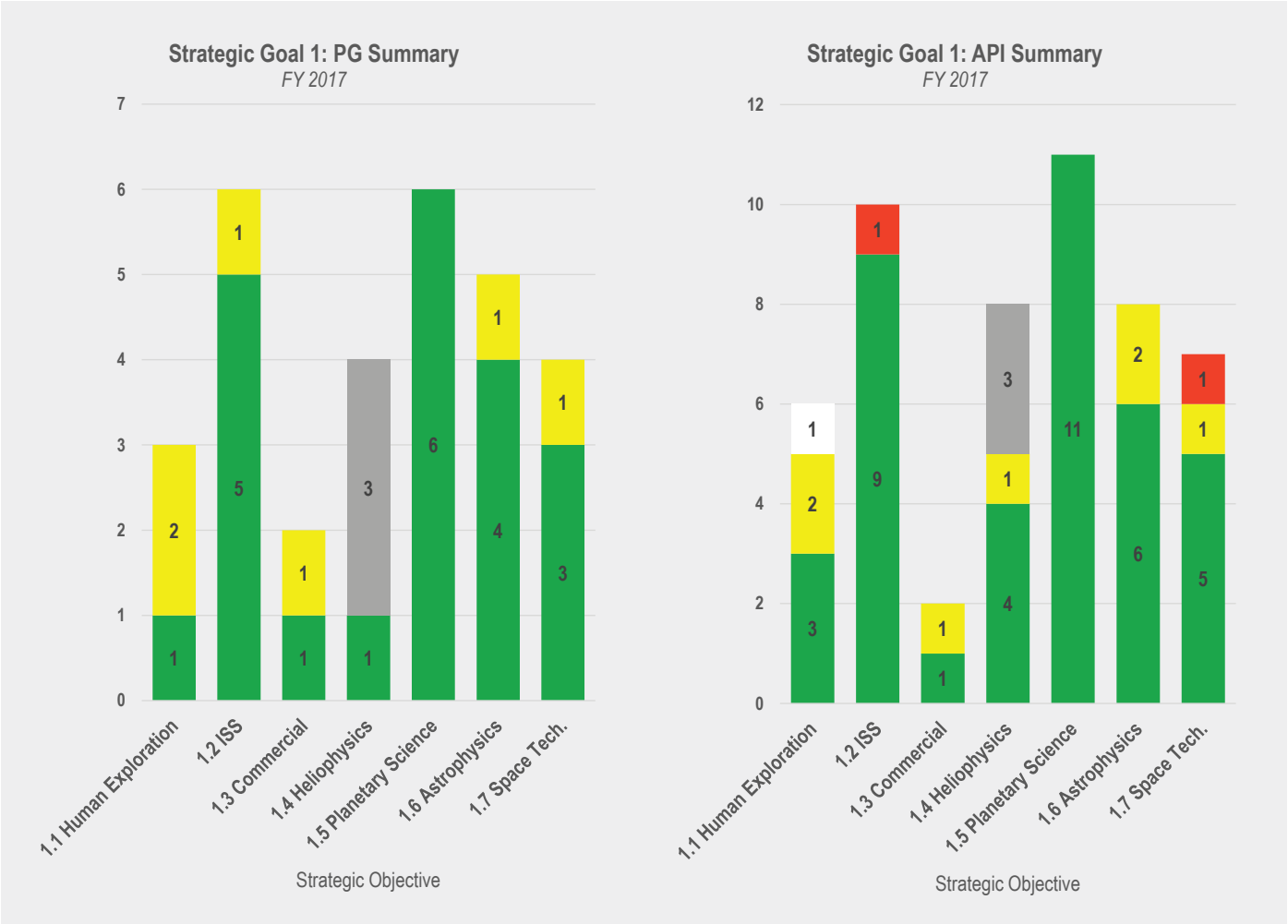
Highlight: Orion Exit Procedures

When astronauts return to Earth from destinations beyond the Moon in NASA's Orion spacecraft and splashdown in the Pacific Ocean, they will still need to safely get out of the spacecraft and back on dry land. Using the waters off the coast of Galveston, Texas, a NASA and Department of Defense team tested Orion exit procedures in a variety of scenarios July 10-14, 2017.

During the crew egress testing, a joint team from the Orion and Ground Systems Development and Operations programs, along with assistance from the U.S. Coast Guard, Navy and Air Force, evaluated how the crew will get out of the capsule with assistance and by themselves.

Astronauts and engineering test subjects wore Orion Crew Survival System spacesuits, modified versions of NASA's orange Advanced Crew Escape suits in development for use during Orion launch and entry, making the testing as true to mission scenarios as possible. Photo credit: NASA/Josh Valcarcel

STRATEGIC GOAL 1 | FY 2017 Performance Summary



Performance Goals

Strategic Goal 1 contains 21 green-rated PGs, 6 yellow-rated PGs, and 3 unrated PGs. The yellow ratings are in Exploration Systems Development, Exploration Research and Development, International Space Station, Commercial Spaceflight, James Webb Space Telescope, and Space Technology. The unrated measures are in Heliophysics.

The ratings are preliminary and subject to change. The final ratings and detailed explanations, including for the unrated measures, will be available in the FY 2019 Volume of Integrated Performance, scheduled for publication in February 2018.

Annual Performance Indicators

Strategic Goal 1 contains 39 green-rated APIs, 7 yellow-rated APIs, 2 red-rated APIs, 1 white-rated API, and 3 unrated APIs. The yellow, red, and white ratings are in Exploration Systems Development, Exploration Research and Development, International Space Station, Commercial Spaceflight, Heliophysics, James Webb Space Telescope, Astrophysics, and Space Technology. The unrated measures are in Heliophysics.

The ratings are preliminary and subject to change. The final ratings and detailed explanations, including for the unrated measures, will be available in the FY 2019 Volume of Integrated Performance, scheduled for publication in February 2018

STRATEGIC GOAL 2

Advance understanding of Earth and develop technologies to improve the quality of life on our home planet

Overview

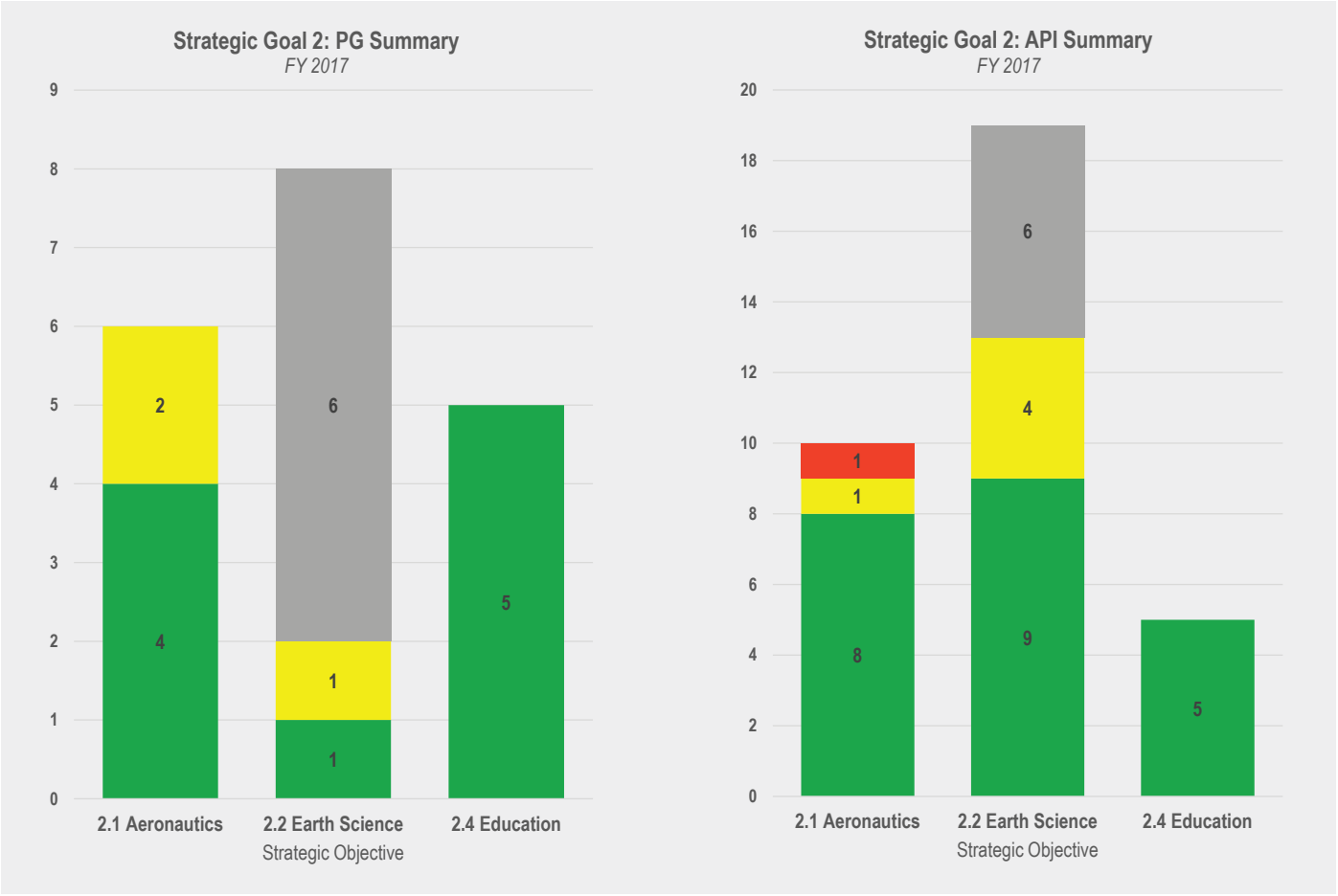
NASA is committed to improving life right here on Earth. Whether developing new aircraft technologies for safer, more efficient air travel, uncovering the complexities of Earth's natural systems, or transferring technologies to the commercial marketplace, NASA has a record of accomplishments in advancing understanding of Earth and helping to improve life for its inhabitants. Every discovery NASA makes, all knowledge gained through our space endeavors, and every advance in technology benefits us on Earth.

Highlight: Low Boom Flight Demonstration

As NASA proceeds toward the possible development of a proposed Low-Boom Flight Demonstration aircraft, or LBFD, research done by the Agency's Commercial Supersonic Technology project, or CST, continues to investigate ways to mitigate or minimize the disruptive sonic boom associated with supersonic flight, as well as approaches to overcome other technical barriers to innovation in commercial supersonic flight.

NASA engineers have integrated the 65-degree wing test article that had been previously tested in the wind tunnel, to the underside of a NASA F-15 (shown above). The swept wing model will test several configurations of distributed roughness elements, or DREs, along the test article's leading edge at speeds up to Mach 2. This will allow researchers to examine how different configurations of DREs impact laminar flow (the smooth layer of air near the wing), and consequently, the fuel efficiency of future supersonic aircraft. Photo credit: NASA/Carla Thomas

STRATEGIC GOAL 2 | FY 2017 Performance Summary



Performance Goals

Strategic Goal 2 contains 10 green-rated PGs, 3 yellow-rated PGs, and 6 unrated PGs. The yellow ratings are in Aeronautics and Earth Science. The unrated measures are in Earth Science.

Effective in late FY 2016, NASA discontinued reporting under Strategic Objective 2.3. NASA restructured the Office of the Chief Technologist, which was reported under Strategic Objective 2.3, with the Space Technology Mission Directorate, which is reported under Strategic Objective 1.7, to better align functions with roles and responsibilities.

The ratings are preliminary and subject to change. The final ratings and detailed explanations, including for the unrated measures, will be available in the FY 2019 Volume of Integrated Performance, scheduled for publication in February 2018.

Annual Performance Indicators

Strategic Goal 2 contains 22 green-rated APIs, 5 yellow-rated APIs, 1 red-rated APIs, and 6 unrated APIs. The yellow and red ratings are in Aeronautics and Earth Science. The unrated measures are in Earth Science.

Effective in late FY 2016, NASA discontinued reporting under Strategic Objective 2.3. NASA restructured the Office of the Chief Technologist, which was reported under Strategic Objective 2.3, with the Space Technology Mission Directorate, which is reported under Strategic Objective 1.7, to better align functions with roles and responsibilities.

The ratings are preliminary and subject to change. The final ratings and detailed explanations, including for the unrated measures, will be available in the FY 2019 Volume of Integrated Performance, scheduled for publication in February 2018.

STRATEGIC GOAL 3

Serve the American public and accomplish our mission by effectively managing our people, technical capabilities, and infrastructure

Overview

NASA is proud to be the U.S. agency charged with exploring the unknown in space and driving new advances in aerospace science and technology on behalf of the American public. Reaching for the stars requires dedication, recognizing that we are stewards of taxpayer dollars, critical human capital, and one-of-a-kind facilities. We maintain a large and diverse set of technical capabilities and assets to support NASA missions and the work of other Federal agencies and the private sector to test, validate, and optimize innovations.

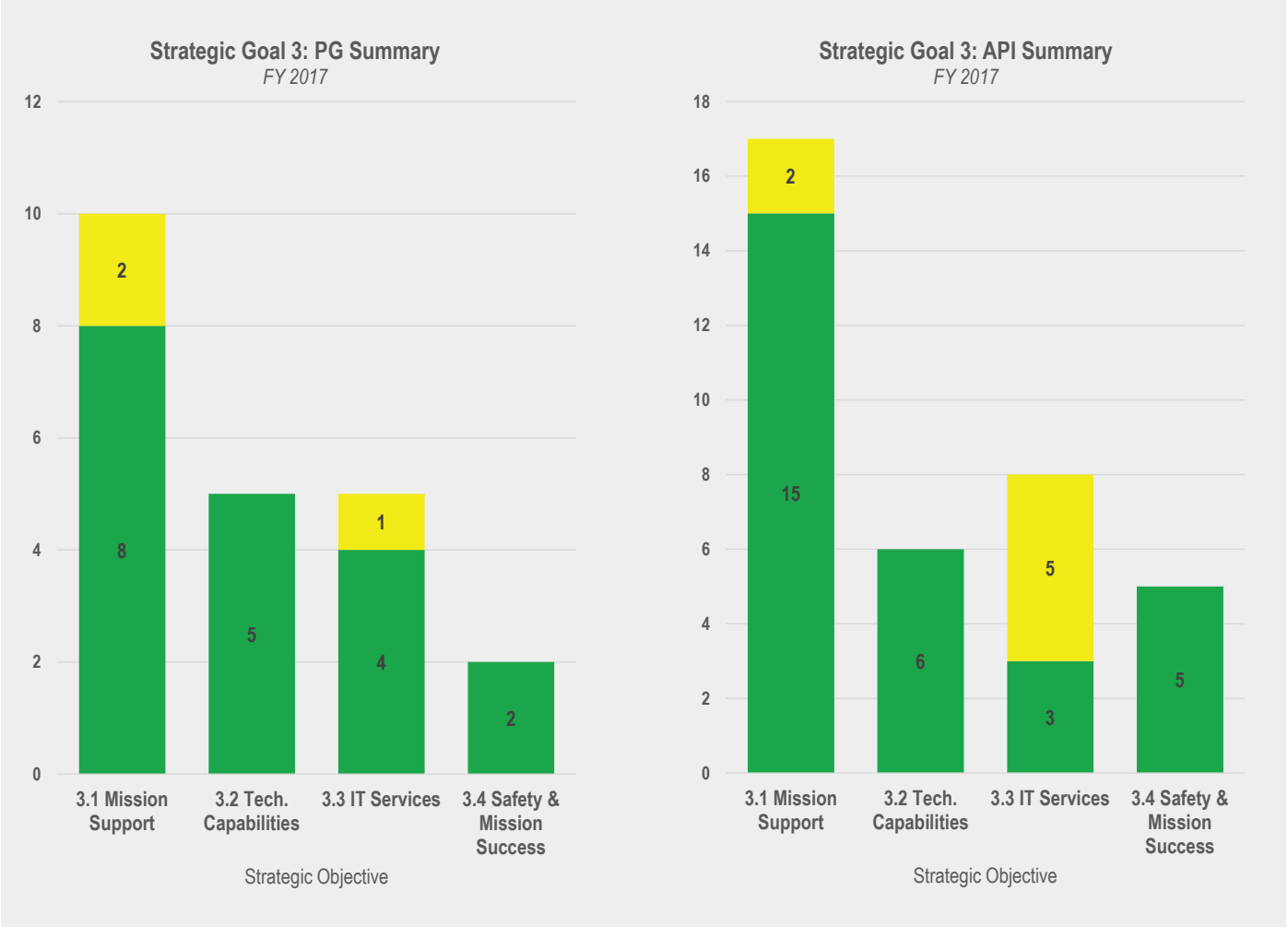
Highlight: Langley Research Center celebrates 100 years of Excellence!

In 1917 -- just fourteen years after the Wright Brothers made their first historic powered flight -- the United States decided to establish the first civilian laboratory dedicated to unlocking the mysteries of flight. It was on the banks of the Chesapeake Bay in Hampton, VA. For 100 years since then, Langley scientists and engineers created, built and managed a series of instruments, both on planes and on spacecraft, to study the planet's changing climate. Langley set new environmental science standards by collecting and archiving the resultant data.

A better understanding of Earth's atmosphere would lead to work on how best to touch down on other worlds. With the Viking 1 landing in 1976, Langley led the first successful U.S. mission to the surface of Mars, setting the stage for subsequent Red Planet exploration. Another milestone occurred in August 2012, with the successful landing of the Mars Curiosity rover, whose heat shield included a suite of advanced sensors developed by and at Langley.

As aviation lifts into the second decade of the 21st century, Langley continues a rich heritage of aeronautical innovation. For more information on the history of Langley, please visit their website at https://www.nasa.gov/langley. Photo credit: NASA

STRATEGIC GOAL 3 | FY 2017 Performance Summary



Performance Goals

Strategic Goal 3 contains 19 green-rated PGs and 3 yellow-rated PGs. The yellow ratings are in Agency Management and Operations.

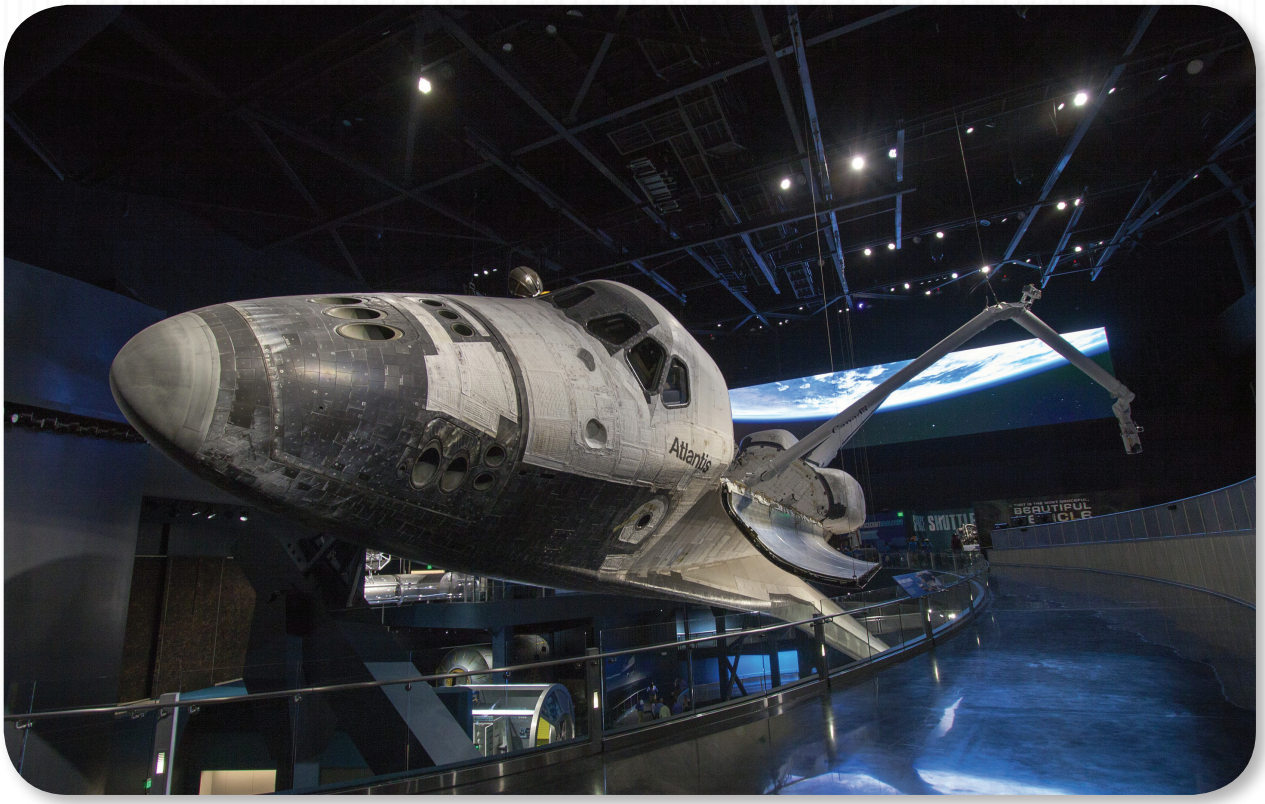
The ratings are preliminary and subject to change. The final ratings and detailed explanations will be available in the FY 2019 Volume of Integrated Performance, scheduled for publication in February 2018.

Annual Performance Indicators

Strategic Goal 3 contains 29 green-rated APIs and 7 yellow-rated APIs. The yellow ratings are in Agency Management and Operations.

The ratings are preliminary and subject to change. The final ratings and detailed explanations will be available in the FY 2019 Volume of Integrated Performance, scheduled for publication in February 2018.

Did you know?



You can see several of NASA's heritage assets on display at our various visitor centers including Space Center Houston at Johnson Space Center and the Kennedy Space Center Visitor Complex. One of NASA's largest heritage assets on display is the Space Shuttle Atlantis at KSC. Atlantis lifted off on its maiden voyage on October 3, 1985, on Mission 51-J. On July 8, 2011, Atlantis launched for the last mission of the Space Shuttle Program, Mission STS-135, for a cargo delivery to the International Space Station (ISS). Photo credit: NASA

LOOKING FORWARD

Dr. Patrick Shea inspects a nearly 4 3/4-foot (1.3 percent scale) model of the second generation of NASA's Space Launch System in a wind tunnel for ascent testing at NASA's Ames Research Center in Silicon Valley, California. The tests will help determine the larger, more powerful rocket's behavior as it climbs and accelerates through the sound barrier after launch. To also test a new optical measurement method, Ames engineers coated the SLS model with Unsteady Pressure-Sensitive Paint, which under the lighting glows dimmer or brighter according to the air pressure acting on different areas of the rocket. Dr. Shea, who is from NASA's Langley Research Center in Hampton, Virginia, was SLS aerodynamic test lead for the work at Ames. Photo credit: NASA/Ames/Dominic Hart

LOOKING FORWARD

Artist's concept of the Orion, NASA's new deep-space exploration vehicle. Photo credit: NASA

NASA is proud to be the U.S. Agency charged with exploring the unknown in space and driving new advances in aerospace science and technology on behalf of the American public. Currently, we are seeking to implement sustainable long-term plans, preparing new missions, and developing new systems for the human exploration of the Moon, Mars, and deep space. We have plans for human missions to explore cis-lunar space (the region between Earth and the Moon), beginning with Exploration Mission-2 (EM-2).

One step we have already taken in this leap is the recruiting and training of a class of 12 new astronaut candidates, the largest astronaut class since 2000. Selected from the record-breaking 18,300 applications, the five women and seven men are training for missions on the International Space Station (ISS), commercial spacecraft, and deep space missions aboard the Orion spacecraft and Space Launch System (SLS) rocket. Before long, American astronauts will return to cis-lunar space to build and begin testing technologies and techniques needed to keep humans safe, healthy, and productive on a mission to Mars. Ranging from environmental control and life support to advanced propulsion and automated rendezvous and docking, these capabilities will be robust, affordable, sustainable, and adaptable to a variety of destinations in deep space.

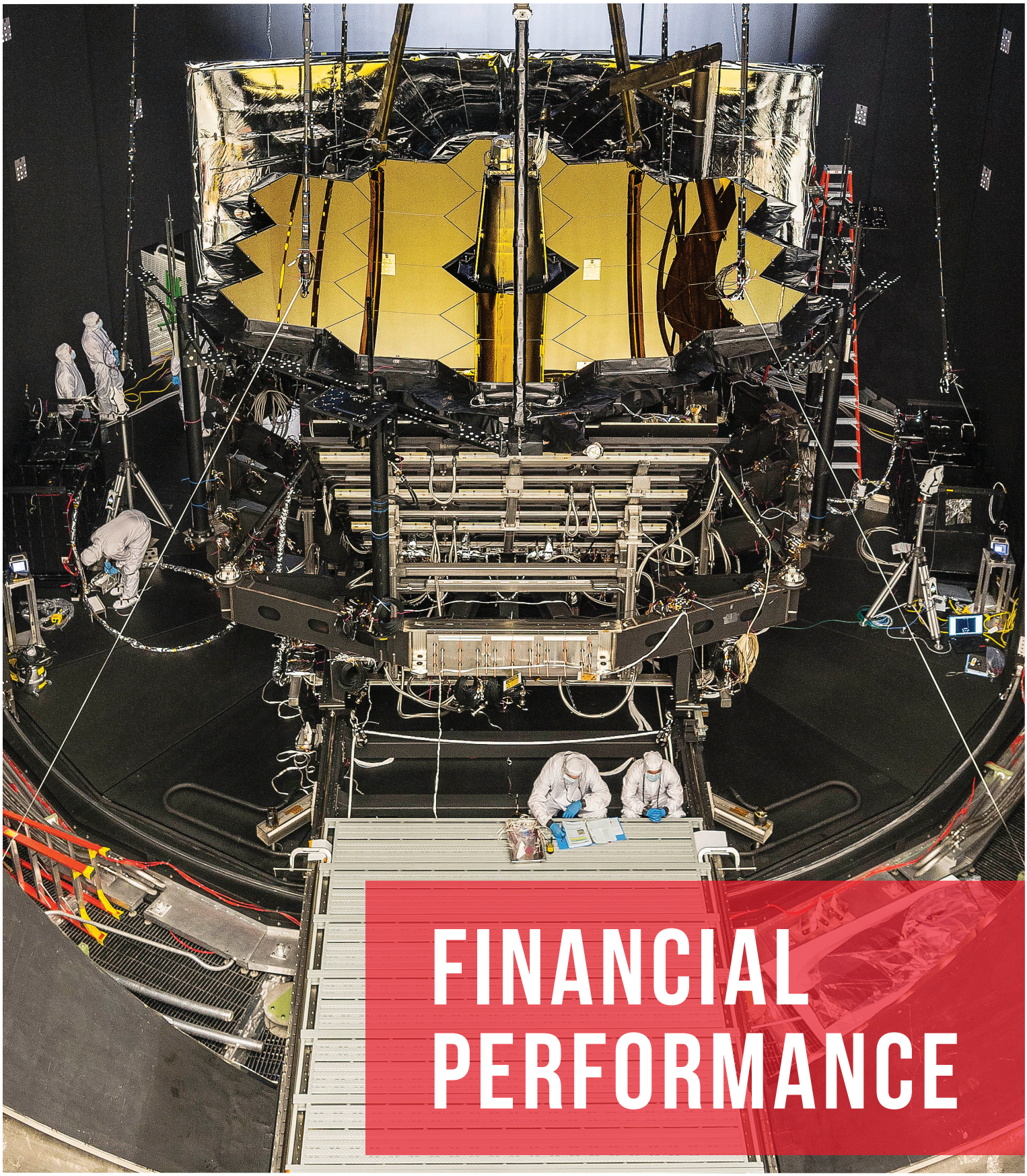
In addition to human exploration, NASA's James Webb Space Telescope (Webb) is expected to launch in 2019 and be the premier scientific observatory of the next decade – unlocking the mysteries of the universe for humankind. Together, scientific discovery and human exploration are not only reaching out to unlock the mysteries of the cosmos; they are continuously improving and safeguarding life on Earth. NASA missions are contributing to better understanding of weather and natural disasters, like Hurricane Harvey and Hurricane Irma. There are new medical treatments resulting from NASA studies that research the effects of low-gravity and spaceflight impacts on the human body. NASA provides America with tools for leadership and inspiration in aerospace science and technology. Our technology developments are at the root of economic stability and growth for many industries, both bound to Earth and destined for space.

U.S. leadership in space is due in part to NASA's ability to inspire and create access to complex challenges. We continue to retain and serve as a unique national resource of engineers, scientists, technologists, and business specialists. Our goal is to enable all of NASA's space-based, air-based, and Earth-based research and innovation activities producing the best return on the Nation's investment.

Today, men and women all over the world are committed to expanding human knowledge of our place in the universe. Together with NASA, American companies are on the cutting edge of space technology, developing new launch vehicles, spacecraft, and instruments that will take us further into space faster than ever before.

We strive to accomplish our mission with the utmost care—recognizing that we are stewards of taxpayer dollars, critical human capital, and one-of-a-kind facilities. With guidance from the National Space Council, NASA will lead a new era of space technologies and advancements for our Nation.

For more information on our formalized strategic goals, please refer to NASA's 2018-2022 Strategic Plan, set for publication in February 2018.



FINANCIAL PERFORMANCE

NASA's James Webb Space Telescope sits inside Chamber A at NASA's Johnson Space Center, Houston. Photo credit: NASA/Chris Gunn

FINANCIAL PERFORMANCE

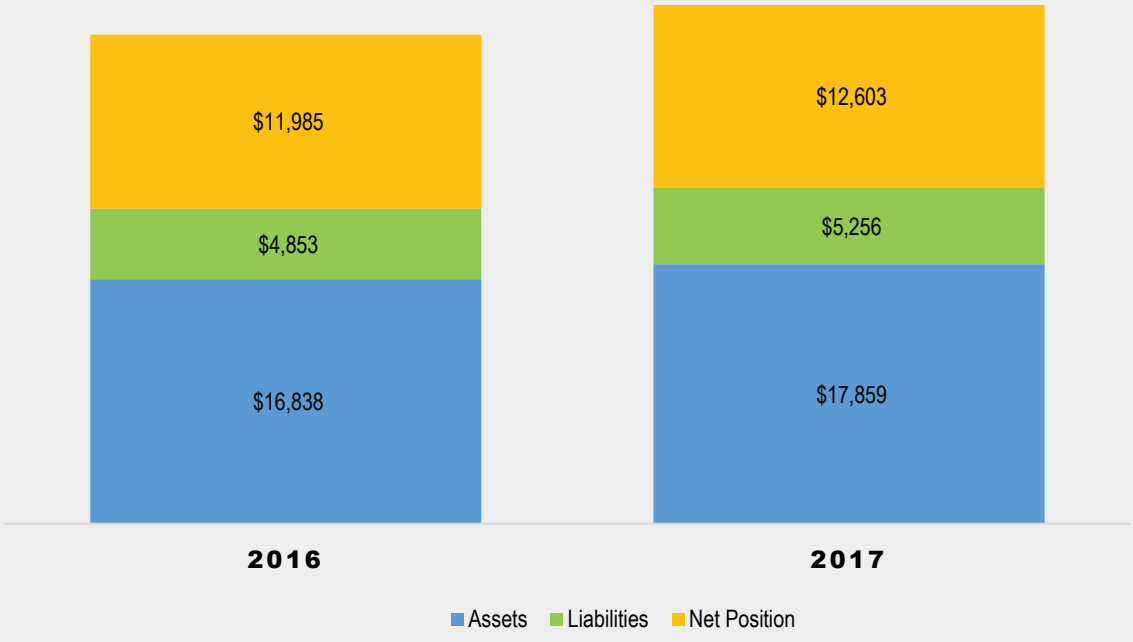
Financial Highlights

Overview of Financial Position

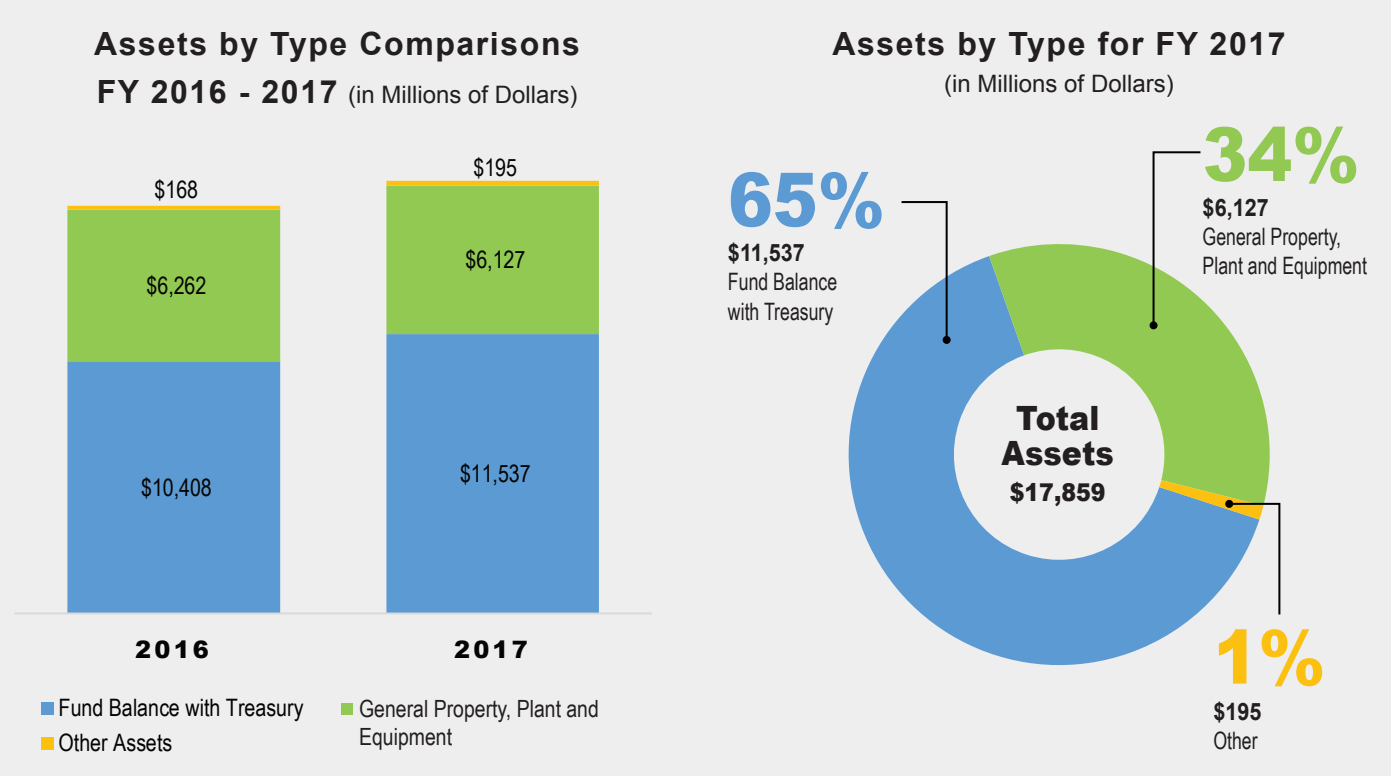
NASA's Balance Sheet provides a comparable snapshot of the Agency's financial position as of September 30, 2017 and September 30, 2016. It displays amounts in three primary categories.

- **Assets:** the current and future economic benefits owned or available for use by NASA.
- **Liabilities:** the amounts owed by NASA but not yet paid.
- **Net Position:** represents the activity between revenues and other financing sources and expenditures since its inception.

Comparative Balance Sheet FY 2016 - FY 2017
(in Millions of Dollars)



Total Assets were the largest of the three categories (Total Liabilities plus Total Net Position will always equal Total Assets). NASA's asset balance as of September 30, 2017, was $17.9 billion, 6 percent higher than FY 2016.



The Agency's Fund Balance with Treasury (FBWT) and its General Property, Plant and Equipment (G-PP&E) were the two primary components of the total asset balance.

FBWT, which represents NASA's cash balance with the U.S. Department of the Treasury, was the largest asset at $11.5 billion, 65 percent of total assets. The increase of $1.1 billion over FY 2016 is primarily due to activity with crew and cargo services for the International Space Station, Space Transportation, and the Commercial Crew.

NASA's G-PP&E had a net book value of $6.1 billion as of September 30, 2017, 34 percent of total assets. The balance has decreased slightly since FY 2016, primarily due to ongoing depreciation on existing assets.

The Other category represents the amount of Investments, Accounts Receivable, and Other Assets as of September 30, 2017. The increase of $27 million, 16 percent higher than FY 2016, is primarily comprised of billings due from National Oceanic and Atmospheric Administration (NOAA) on the reimbursable Joint Polar Satellite System (JPSS) program and the Air Force on the Space Communication and Navigation (SCAN) program.

Total Liabilities as of September 30, 2017, were $5.3 billion, 8 percent higher than FY 2016. Environmental and Disposal Liabilities, Accounts Payable, and Other Accrued Liabilities represent the majority of NASA's liabilities.

Environmental and Disposal Liabilities of $1.7 billion represent the estimated cost to clean up both known and projected environmental hazards. These liabilities increased by $92 million or 6 percent from FY 2016. The increase was primarily due to a new methodology for estimating the asbestos cleanup liability by using actual costs incurred to clean up asbestos in NASA facilities and structures that were recently demolished or fully renovated. Additionally, the change is due to availability of new and/or updated information on the extent of contamination at restoration project sites.

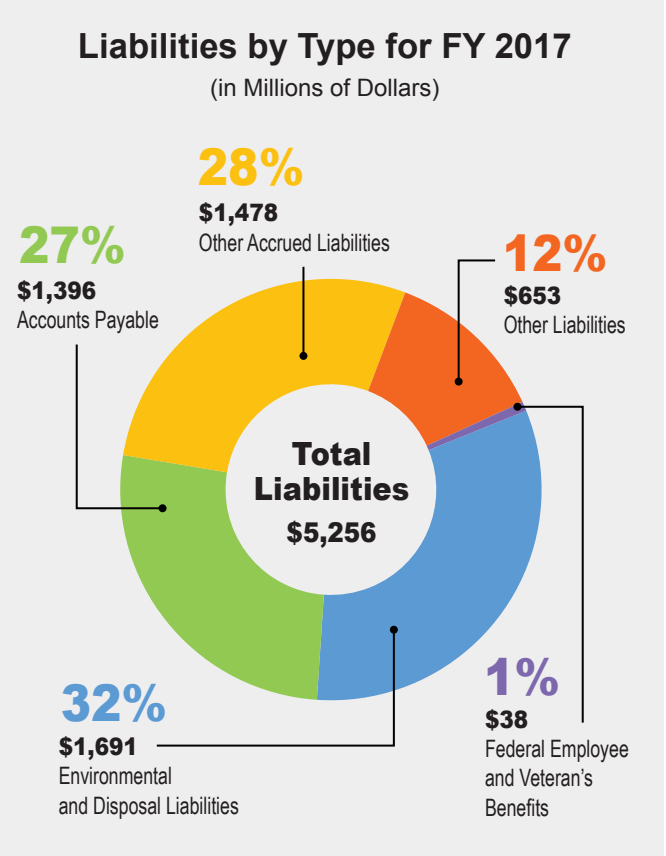
Accounts Payable, which represents amounts owed to other entities, was $1.4 billion, an increase of $73 million or 6 percent compared to FY 2016.

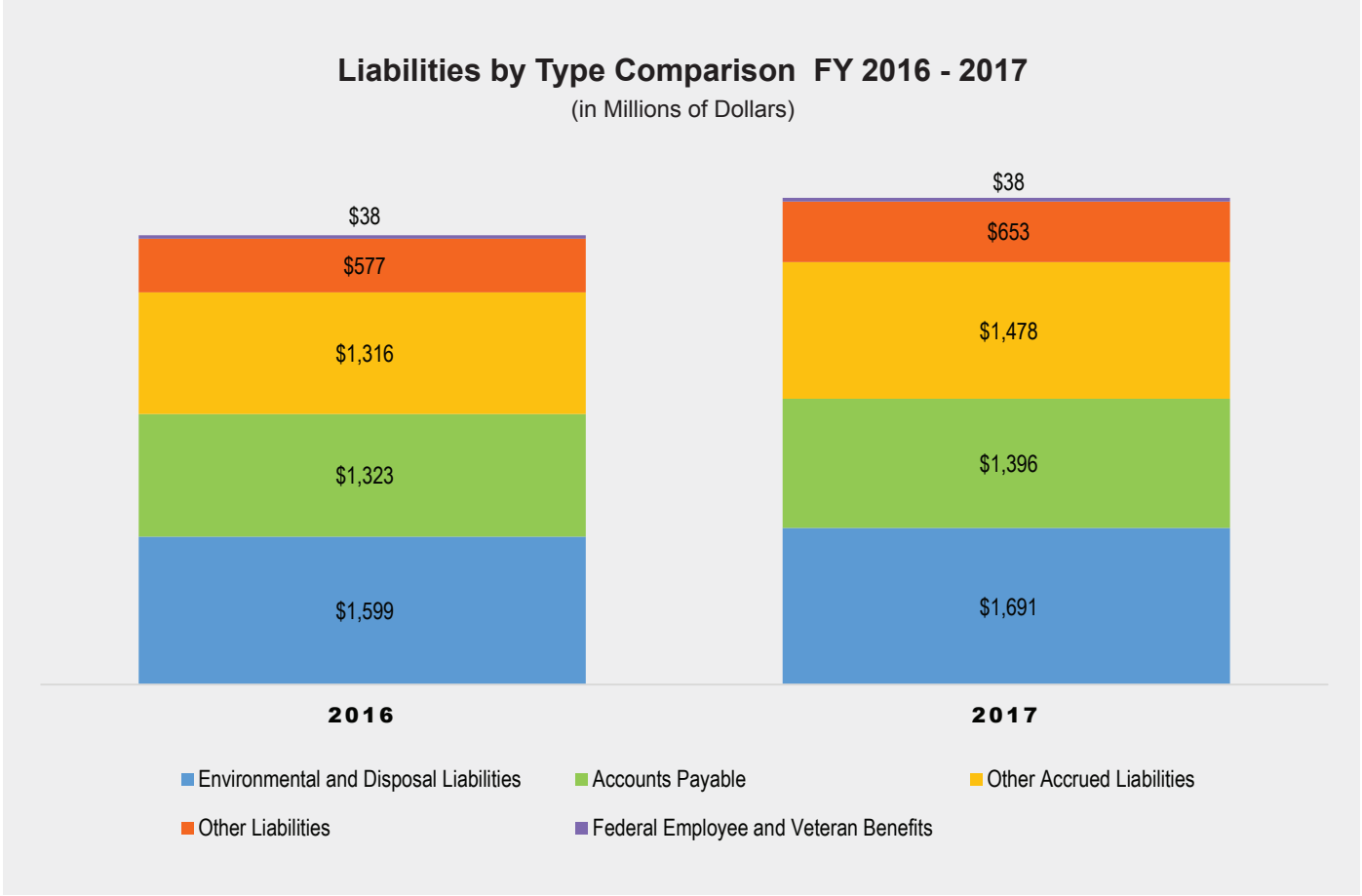
Other Accrued Liabilities with public entities were $1.5 billion, an increase of $162 million or 12 percent compared to FY 2016.

Other Liabilities, which represents various amounts including Advances from Others, Unfunded Annual Leave, and Accrued Funded Payroll, were $653 million, an increase of $76 million or 13 percent compared to FY 2016.

Federal Employee and Veteran Benefits are amounts the Department of Labor estimates on behalf of NASA for future workers' compensation liabilities for current employees.

Total Net Position, comprised of Unexpended Appropriations and Cumulative Results of Operations ("net worth"), increased by $618 million, 5 percent higher than FY 2016. Unexpended Appropriations, at $8.4 billion, increased by 12 percent from FY 2016. Cumulative Results of Operations, at $4.2 billion, decreased by 7 percent from FY 2016.





Sources of Funding

The Statement of Budgetary Resources provides information on the budgetary funding available to NASA. NASA's resources consist primarily of funds received from two sources:

- Appropriations from Congress for the current fiscal year and unobligated balances from prior fiscal years.
- Revenue from agreements with other governmental organizations or private entities.

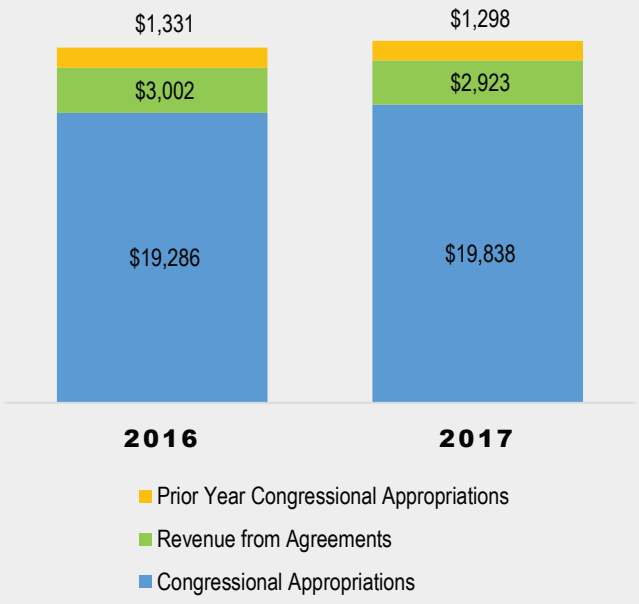
In FY 2017, the total funds available for use by the Agency were $24.1 billion.

Appropriations from Congress for FY 2017, at $19.8 billion, comprised 83 percent of the funds available for use by the Agency. Congress designates the funding available to the Agency for a specific NASA mission. Appropriations that remained available from prior years comprised $1.3 billion, 5 percent of NASA's available resources in FY 2017.

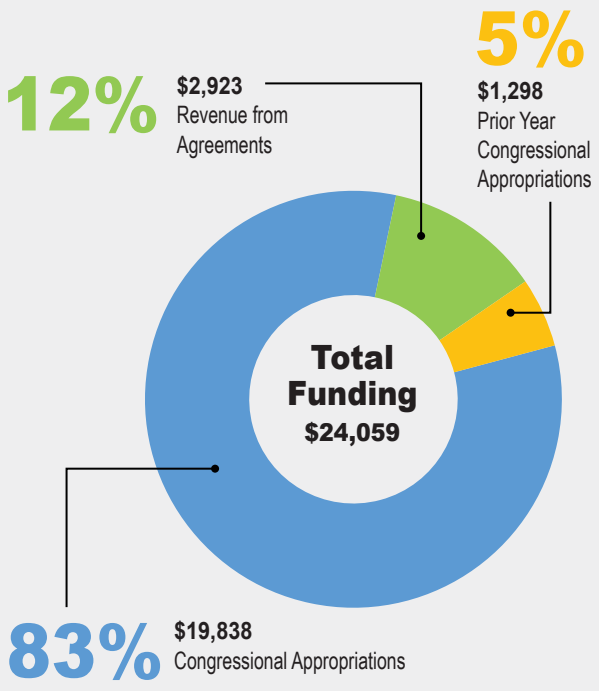
NASA's FY 2017 funding also included $2.9 billion comprised of earned and expected revenue collections from agreements, 12 percent of NASA's available resources in FY 2017. Earned and expected revenue is received under NASA's authority to provide goods, services, or use of facilities to other entities on a reimbursable basis.

In FY 2017, NASA obligated $22.7 billion for programmatic and institutional use of the $24.1 billion available. An obligation binds the overnment to make an expenditure (or outlay) of funds, and reflects a reservation of budget authority that will be used to pay for a contract, labor, or other items. The remaining $1.4 billion may be obligated until the funds are no longer available for NASA's missions.

Sources of Funding Comparison
FY 2016 - 2017 (in Millions of Dollars)



Sources of Funding for FY 2017
(in Millions of Dollars)



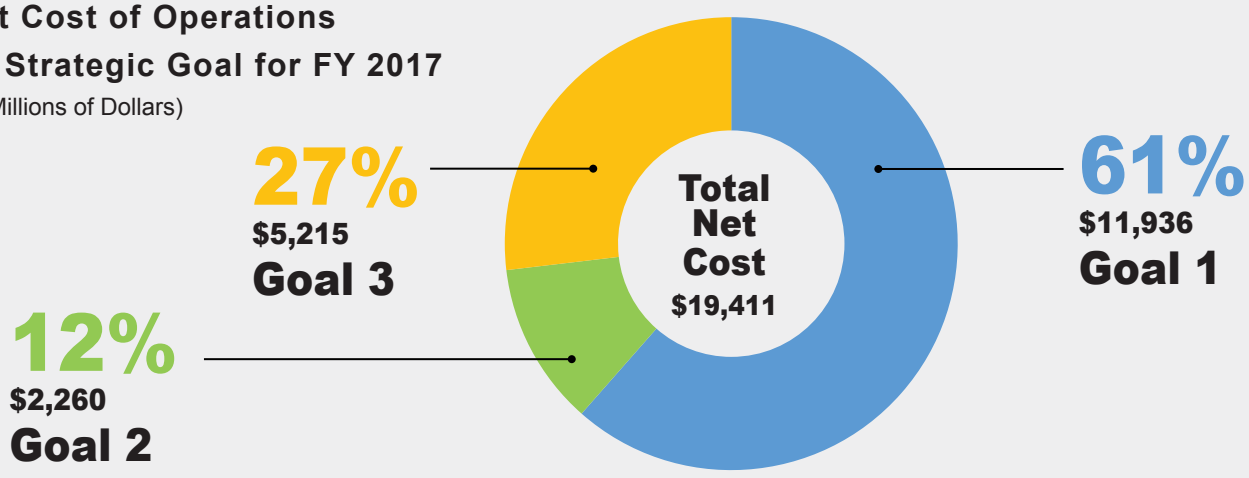
NASA's Super Guppy aircraft has been closed and secured at the Shuttle Landing Facility at NASA's Kennedy Space Center in Florida. The Orion Exploration Mission-1 (EM-1) structural test article is secured inside the Super Guppy and will be transported to Lockheed Martin's Denver facility for testing. The Orion spacecraft will launch atop NASA's Space Launch System rocket on EM-1, its first deep space mission. Photo credit: NASA/Bill White.

Results of Operations

Net Cost of Operations

The Statement of Net Cost presents NASA's net cost of operations by strategic goal. NASA's strategic goals are described in the Mission Performance section of the Agency Financial Report. The Net Cost of Operations represents gross costs incurred less revenue earned for work performed for other government organizations or private entities. As of September 30, 2017, NASA's gross costs were $21.7 billion, a decrease of $87 million from FY 2016. Earned Revenue from other governmental organizations or private entities was $2.3 billion, an increase of $96 million from FY 2016, leaving NASA with a FY 2017 net cost of $19.4 billion, a decrease of $183 million from FY 2016.

Net Cost of Operations by Strategic Goal for FY 2017
(in Millions of Dollars)



- Strategic Goal 1: Expand the frontiers of knowledge, capability, and opportunity in space.
- Strategic Goal 2: Advance understanding of Earth and develop technologies to improve the quality of life on our home planet.
- Strategic Goal 3: Serve the American public and accomplish our Mission by effectively managing our people, technical capabilities, and infrastructure.

Gross Costs of Operations

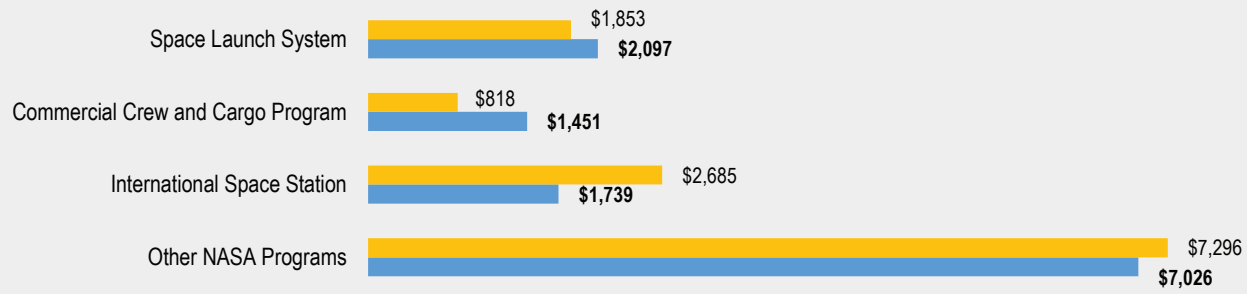
NASA's day-to-day operations are performed at NASA and contractor facilities around the globe and in space.

Gross costs of operations is presented in the following table, detailing select NASA programs that support each strategic goal. Gross costs of operations include expenses incurred for NASA's research and development (R&D) investments that are expected to maintain or increase national economic productive capacity or yield other future benefits. Refer to the Required Supplementary Stewardship Information section (page 68) of this report for further discussion. A discussion of activities and costs that were reimbursed primarily by other government organizations or private entities (for example, earned revenue) is also provided.

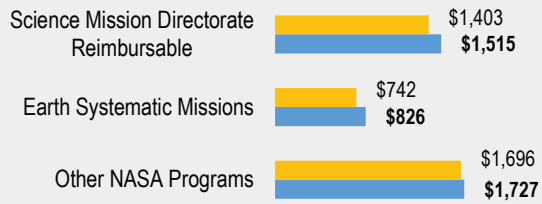
Comparative Gross Costs of Operations by Strategic Goal FY 2016 - 2017

(in Millions of Dollars)

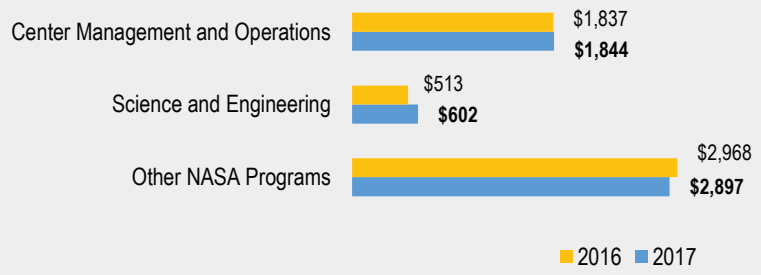
Strategic Goal 1: Expand frontiers of knowledge, capability, and opportunity in space.



Strategic Goal 2: Advance understanding of Earth and develop technologies to improve the quality of life on our home planet.



Strategic Goal 3: Serve the American public and accomplish our Mission by effectively managing our people, technical capabilities, and infrastructure.



Strategic Goal 1: Expand the frontiers of knowledge, capability, and opportunity in space.

Gross Costs for Strategic Goal 1 were $12.3 billion, a decrease of $339 million or 3 percent from FY 2016 costs. The costs for this strategic goal represent 57 percent of total Agency gross cost. The three primary programs that support this goal were International Space Station (ISS), Space Launch System (SLS), and Commercial Crew and Cargo, which contributed to nearly half of the cost of Strategic Goal 1.

- The SLS program had costs of $2.1 billion, $244 million higher costs compared to FY 2016. These costs are mainly associated with the complex delivery and integration of the SLS core stage, Launch Vehicle Stage Adapter, Orion Stage Adapter, flight software, and motor segments. Additionally, funds were expended for Exploration Upper Stage development that was initiated in FY 2016 as enacted by Congress.

- The ISS program had costs of $1.7 billion, $946 million lower than FY 2016. During FY 2016, NASA transferred Commercial Crew and Cargo out of ISS and started tracking its costs as a separate program. In addition, most ISS components were fully depreciated in March 2016, which resulted in significant cost decreases.

- The Commercial Crew and Cargo program had costs of $1.5 billion, $633 million higher compared to FY 2016. When NASA transferred the Commercial Crew and Cargo out of ISS in FY 2016, program costs incurred under the ISS were not transferred out; therefore, costs in FY 2016 for Commercial Crew and Cargo appear to be much lower than FY 2017, but are not. In FY 2016, costs were split between two different themes. FY 2017 was the first full year the Space Transportation theme absorbed all the Commercial Crew and Cargo costs.

- Other NASA programs that contribute to Strategic Goal 1 include major flight development projects such as Commercial Crew, James Webb Space Telescope, and Mars 2020, in addition to technology development programs such as Solar Electric Propulsion.

Strategic Goal 2: Advance understanding of Earth and develop technologies to improve the quality of life on our home planet.

Gross Costs for Strategic Goal 2 were $4.1 billion, an increase of $227 million, or 6 percent over FY 2016 costs. The costs for this strategic goal represent 19 percent of total Agency gross cost. Almost half of the costs incurred for Strategic Goal 2 are in support of activities performed for other government organizations or private entities who reimburse NASA for these costs (earned revenue). The primary reimbursable activities are described in the earned revenue discussion below.

The largest NASA organization and programs supporting Strategic Goal 2 were the Science Mission Directorate reimbursable funding portfolio and the Earth Systematic Mission.

Continued on next page →

Did you know?

NASA's Space Launch System, or SLS, is a powerful, advanced launch vehicle for a new era of human exploration beyond Earth's orbit. With its unprecedented power and capabilities, SLS will launch crews of up to four astronauts in the agency's Orion spacecraft on missions to explore multiple, deep-space destinations.

Offering more payload mass, volume capability, and energy to speed missions through space than any current launch vehicle, SLS is designed to be flexible and evolvable and will open new possibilities for payloads, including robotic scientific missions to places like Mars, Saturn, and Jupiter. Photo Credit: NASA

- The Science Mission Directorate reimbursable funding portfolio incurred costs of $1.5 billion, $112 million higher compared to FY 2016. This change is driven by work performed for other agencies and some fluctuation in costs occurs from year to year.

- The Earth Systematic Mission program incurred costs of $826 million, $84 million higher compared to FY 2016. Costing fluctuations occur from year to year in large programs such as this.

- Other NASA programs that contribute to Strategic Goal 2 include various Earth Science and Aeronautics research projects.

Strategic Goal 3: Serve the American public and accomplish our Mission by effectively managing our people, technical capabilities, and infrastructure.

Gross Costs for Strategic Goal 3 were $5.3 billion, an increase of $25 million, 0.5 percent over FY 2016 costs. The costs for this strategic goal represent 24 percent of total Agency gross cost. The largest NASA program supporting Strategic Goal 3 was Center Management and Operations (CMO).

- CMO had costs of $1.8 billion, $7 million higher compared to FY 2016. The change in cost is negligible compared to the size of the program, and represents a constant level of activity year-over-year.

- Other NASA programs that contribute to Strategic Goal 3 include various mission support and safety functions, such as the Space Communications and Navigation program, the Launch Services program, and Construction of Facilities projects.

Earned Revenue

Total earned revenue, which represents work performed by NASA for other Government organizations or private entities, was $2.3 billion in FY 2017, an increase of $96 million from FY 2016. Two programs accounted for over half of NASA's earned revenue in FY 2017: Joint Polar Satellite System (JPSS) and Geostationary Operational Environmental Satellites – R Series (GOES-R). In addition, the Jet Propulsion Laboratory does a significant amount of reimbursable work for other Government agencies.

- NASA supports JPSS in partnership with NOAA. JPSS had earned revenue of $881 million, an increase of $120 million from FY 2016, primarily due to JPSS-1 completion and launch scheduled for FY 2018 quarter 1.

- Earned Revenue from GOES-R was $419 million, a decrease of $130 million from FY 2016, primarily due to the successful launch on November 19, 2016. The spacecraft is now in operations.

- Earned Revenue at the JPL was $343 million, an increase of $166 million from FY 2016.

LIMITATIONS OF THE FINANCIAL STATEMENTS

The principal financial statements have been prepared to report the financial position and results of operations of NASA, pursuant to the requirements of 31 U.S.C. 3515(b). While the statements have been prepared from the books and records of NASA in accordance with GAAP for Federal entities and the formats prescribed by OMB, the statements are in addition to the financial reports used to monitor and control budgetary resources, which are prepared from the same books and records. The statements should be read with the realization that they are for a component of the U.S. Government, a sovereign entity.

Did you know?

There are more than 700,000 known asteroids left over from the birth of our solar system 4.6 billion years ago. If all of the asteroids were combined into a ball, they would still be much smaller than the Earth's Moon. About once a year, a car-sized asteroid hits Earth's atmosphere, creates an impressive fireball, and burns up before reaching the surface. Photo credit: NASA

SYSTEMS, CONTROLS, AND LEGAL COMPLIANCE

Teams of undergraduate and graduate students that participated in NASA's 8th Annual Robotic Mining Competition eat dinner in the Apollo-Saturn V Center at NASA's Kennedy Space Center Visitor Complex in Florida, before the awards ceremony. More than 40 student teams from colleges and universities around the U.S. used their uniquely designed mining robots to dig in a supersized sandbox filled with BP-1, or simulated Martian soil, and participated in other competition requirements, May 22-26, 2017, at the visitor complex. The Robotic Mining Competition is a NASA Human Exploration and Operations Mission Directorate project designed to encourage students in science, technology, engineering, and math, or STEM fields. The project provides a competitive environment to foster innovative ideas and solutions that could be used on NASA's Journey to Mars. Photo credit: NASA/Leif Heimbold

INTERNAL CONTROL FRAMEWORK

The Federal Managers' Financial Integrity Act (FMFIA)[a] requires Agency heads to evaluate and report on the internal control and financial systems to ensure the integrity of Federal programs and operations. This evaluation aims to provide reasonable assurance that internal controls are operating effectively to ensure efficient operations, reliable financial reporting, and compliance with applicable laws and regulations.

Internal control is at the core of NASA fulfilling its mission and achieving its goals while safeguarding governmental resources. NASA management is responsible for implementing internal control activities that support the meeting of the organization's objectives. NASA's policy is to comply with OMB Circular No. A-123[b], *Management's Responsibility for Enterprise Risk Management and Internal Control*, which provides Government-wide requirements for internal control and accountability, based on the FMFIA and has since FY 2015 introduced Enterprise Risk Management (ERM) concepts in designing and assessing the Agency internal controls. OMB Circular No. A-123 also requires agencies to establish internal controls over operations, reporting and compliance.

NASA evaluates internal control across the Agency at various levels of the organization to ensure significant risks are identified, and related internal controls that address those risks are tested and evaluated. NASA evaluates the effectiveness of the internal controls over operations, management systems, and reporting with consideration of reviews and other relevant sources of information. NASA's executive leadership provides annual certifications reporting on the effectiveness of internal controls that are implemented to meet objectives. In addition, the NASA Office of the Chief Financial Officer (OCFO) deploys an extensive annual testing and assessment methodology that evaluates internal controls over financial reporting. NASA considers ERM activities, reviews the Agency risk profile and considers fraud risk along with providing assurance on internal controls.

The FMFIA assurance statement is primarily based on self-certifications submitted by NASA Officials-in-Charge. These certifications are based upon organizational self-assessments guided by the Government Accountability Office's (GAO) *Standards for Internal Control in the Federal Government* (known as the Green Book[c]). The self-assessments are informed by various sources of information such as internal reviews of controls, as well as recommendations for improvements from external audits, investigations, and reviews conducted by the Office of Inspector General (OIG) and the GAO. The Mission Support Council (MSC), the organization responsible for oversight of NASA's Internal Control Program, advises the Administrator on the Statement of Assurance. The Senior Assessment Team (SAT), which is an arm of the MSC, helps guide the internal control evaluation and reporting process.

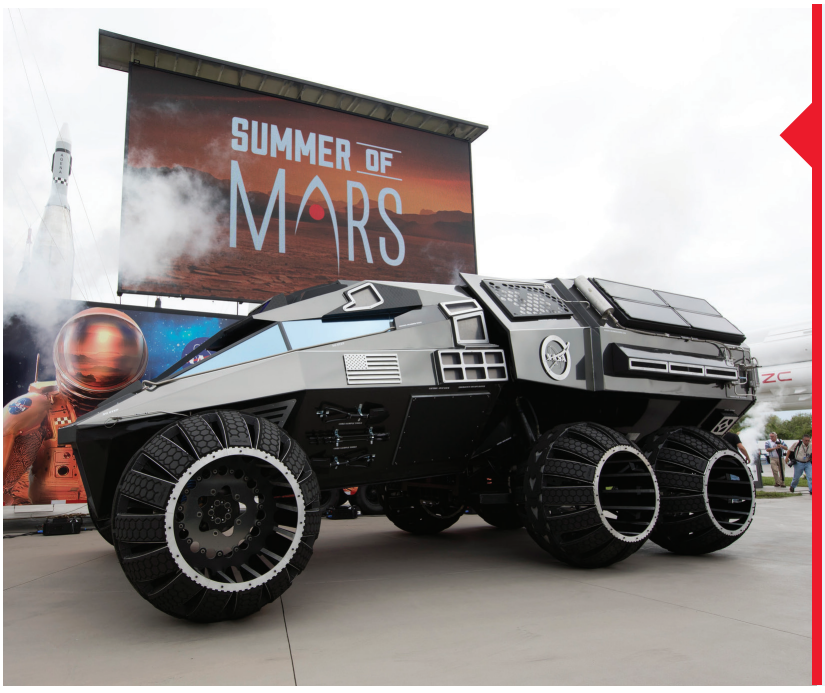
The Management System Working Group (MSWG) performs the first level evaluation of annual results and serves as the primary advisory body for NASA internal control activities. The MSWG analyzes the annual assessment results and reports issues that may significantly impact the effective design and operation of internal controls to the SAT. The graphic on the following page depicts the Agency's Annual Statement of Assurance process and organizational players.

[a] The Federal Managers' Financial Integrity Act (FMFIA)
https://obamawhitehouse.archives.gov/omb/financial_fmfia1982

[b] OMB Circular No. A-123, *Management's Responsibility for Enterprise Risk Management and Internal Control*
https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/memoranda/2016/m-16-17.pdf

[c] Green Book
http://www.gao.gov/assets/670/665712.pdf

NASA FMFIA Annual Statement of Assurance Process



The scientifically-themed Mars rover concept vehicle operates on an electric motor, powered by solar panels and a 700-volt battery. The rover separates in the middle with the front area designed for scouting and equipped with a radio and navigation provided by the Global Positioning System. The back section serves as a full laboratory that can disconnect for autonomous research. The "Summer of Mars" promotion was designed to provide guests with a better understanding of NASA's studies of the Red Planet. The builders of the rover, Parker Brothers Concepts of Port Canaveral, Florida, incorporated input into its design from NASA subject-matter experts. Photo credit: NASA/Kim Shiflett

MANAGEMENT ASSURANCES

Administrator's Statement of Assurance

November 15, 2017

The National Aeronautics and Space Administration (NASA) management is responsible for establishing and maintaining effective internal control that meets the objectives of the Federal Managers' Financial Integrity Act (FMFIA) in accordance with the Government Accountability Office's (GAO) Standards for Internal Control in the Federal Government and NASA policy. NASA's Certification of Reasonable Assurance is based upon management's knowledge gained from daily operations, monitoring activities, self-assessments, and other internal controls over the effectiveness and efficiency of operations and compliance with applicable laws and regulations in accordance with the Office of Management and Budget (OMB) Circular A-123, Management's Responsibility for Enterprise Risk Management and Internal Control, and NASA requirements. GAO and OMB added requirements to integrate Enterprise Risk Management (ERM) and internal control in Federal agencies in 2015 and 2016, respectively: this includes annually reporting on ERM and requires considering risk activities, risk profile, and fraud risk along with providing assurance on internal control. As a result, managers and employees throughout the Agency are actively engaged in identifying or updating key control objectives, assessing risks, implementing controls or other mitigating strategies, conducting reviews, and taking corrective actions as necessary.

NASA conducted its fiscal year (FY) 2017 annual assessment of the effectiveness of management's internal controls over financial reporting and operations and compliance with applicable laws and regulations in accordance with FMFIA and OMB's A-123. Based on the results of this evaluation, NASA provides reasonable assurance that its system of internal control over the effectiveness and efficiency of operations and compliance with laws and regulations as of September 30, 2017, was operating effectively and no material weaknesses were found in the design or implementation of internal controls.

In addition, NASA conducted a review of its risk activities, risk profile, and fraud risk in considering an overall assessment over NASA's Enterprise Risk Management. Through this assessment, NASA did not identify any material weaknesses.

In conclusion, NASA makes an unmodified statement of assurance that its internal controls for FY 2017 were operating effectively.

NASA remains committed to ensuring a sound system of internal control exists over operations, reporting, and financial management systems and will continue to monitor and enhance its quality assurance activities.

Sincerely,

Robert M. Lightfoot, Jr.
Administrator (Acting)

FINANCIAL SYSTEMS STRATEGIES

NASA's financial system strategy is to establish an overarching roadmap that aligns with the Agency's mission and the strategic goal to "serve the American public and accomplish our Mission by effectively managing our people, technical capabilities, and infrastructure". This alignment is accomplished by utilizing a standard software development model with release planning and providing oversight/understanding of new external and internal requirements from stakeholders. The goal is to lead innovative financial systems initiatives that improve and enable integrated solutions while seeking opportunities to enhance business processes and system efficiencies. Since initial implementations, all of the tools below have been enhanced and expanded for changing policies, standards, OMB requirements, and internal assessments to ensure sound internal and system controls. As a result of NASA's efforts to continually enhance Financial and Budgetary tools/systems, an unmodified audit opinion on the financial statements has been achieved for the last seven years, and resulted in improved budgetary deliverables in accordance with previously utilized Congressional direction.

NASA's Core Financial (CF) and budget management systems include the Systems Applications & Products (SAP) Enterprise Resource Planning (ERP) and the e-budget suite of tools. The CF system has served as NASA's financial accounting system of record since 2003, and the e-budget tools have supported budget formulation and Congressional presentation/justification since 2007. To accomplish supporting mission success, NASA replaced PRISM with SAP's end-to-end Procurement for Public Sector (PPS) module in June 2017. PRISM was near end-of-life support and contained inefficient functionality gaps, so NASA integrated a contract writing application (PPS) as part of the SAP application, which provides the foundation for NASA's ability to achieve its financial management objectives and management of our budget. PPS brings a contract management solution providing an Agency tool supporting paperless contracting, contract writing, data management, and procurement workload management. Transactions within the integrated modules and interfaces are recorded on a real-time basis. The CF system is supported by other commercial off-the-shelf (COTS) software, NASA developed applications, and interfaces with systems managed by other Federal agencies. NASA's goal is also to transform the IT infrastructure and application capabilities and services to meet evolving stakeholder needs and support mission success. To accomplish meeting stakeholder needs, NASA continues efforts to expand implementation of eInvoicing capabilities to meet OMB's directive M-15-19, *Improving Government Efficiency and Saving Taxpayer Dollars Through Electronic Invoicing*.

This nighttime photo of Florida was taken from the International Space Station (ISS) by Expedition 51 Flight Engineer Thomas Pesquet of the European Space Agency, in March 2017. Bright lights of cities stand out, including the Miami-Fort Lauderdale metropolitan area, the Tampa Bay region along the GulfCoast, and in the middle, Orlando.

Visible on Florida's Atlantic coast is the Cape Canaveral area where SpaceX cargo resupply missions launch at NASA's Kennedy Space Center. These resupply missions provide ISS with supplies, science experiments, and new equipment for technology research. Photo credit: ESA/NASA

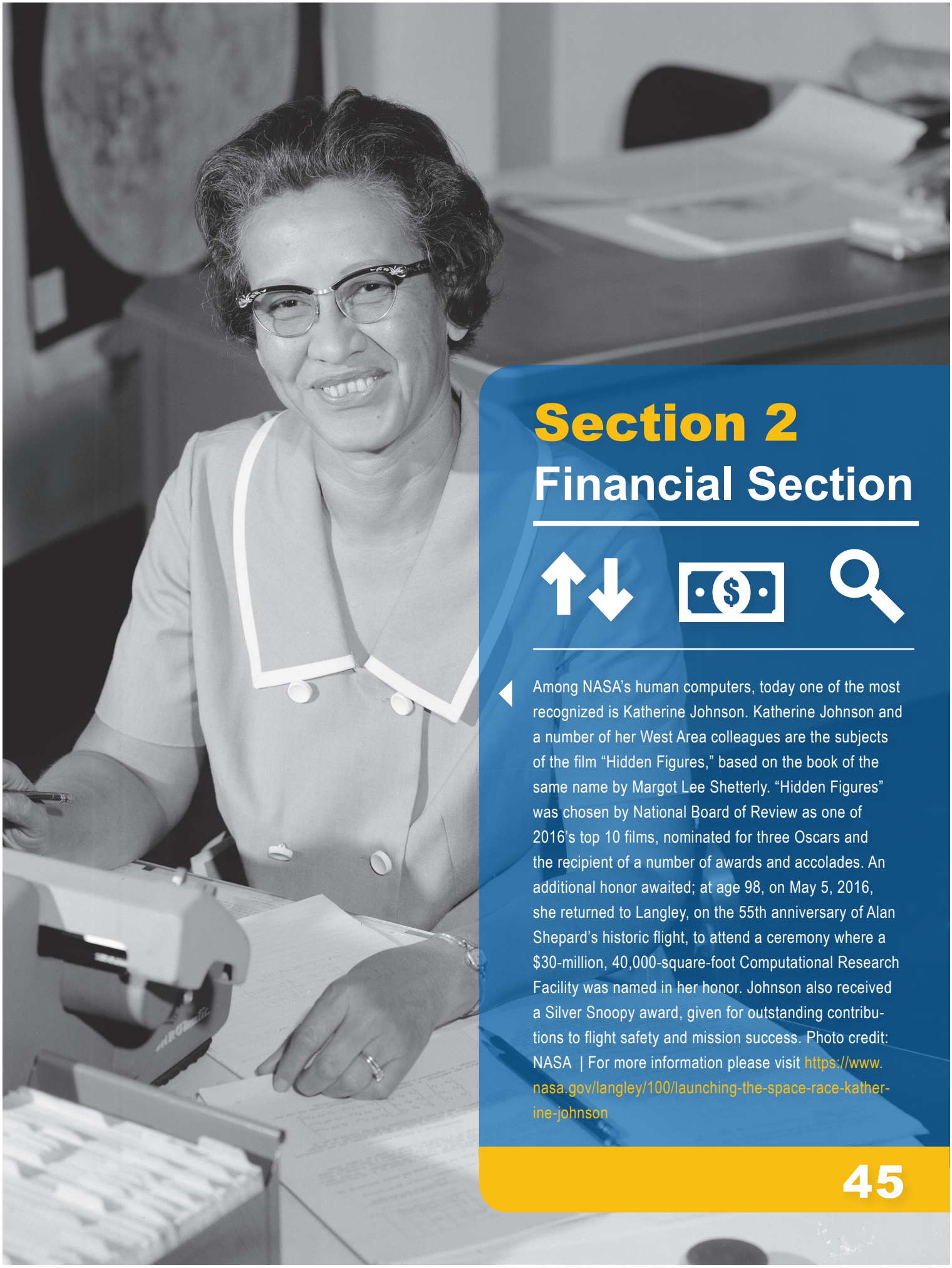
This expansion includes improved accounts payable business processes, a single Agency-wide electronic solution, and significantly reduced manual invoice data entry. NASA is on target to meet the FY 2018 timeline to implement expanded eInvoicing.

NASA has developed and implemented a process to generate and deliver the data required by the Digital Accountability and Transparency Act of 2014 (DATA Act). This process was developed in accordance with the Treasury DATA Act Schema. The three financial data files required by the DATA Act for second quarter fiscal year 2017, in addition to the award data required under the Federal Funding Accountability and Transparency Act (FFATA), were successfully submitted and certified by NASA in accordance with Treasury's first established deadline of April 30, 2017. Treasury has communicated that quarterly data is required after the close of the Government-wide Treasury Account Symbol Adjusted Trial Balance System (GTAS) reporting window going forward, but has not published an official reporting schedule. NASA's DATA Act reporting and certification process will be executed at the close of each quarterly GTAS reporting window going forward until directed otherwise. NASA had the lowest data caution warnings of any Agency in the first official submission.

Further, NASA met and supported a variety of reporting requirements mandated by the GPRAMA, Congress, the Office of Management and Budget (OMB), and the Government Accountability Office (GAO). The Strategic Objective Annual Review (SOAR) dashboard was upgraded to increase the integration and aggregation of critical Agency data. Highlights include integrated budget data, improved automated performance reports, as well as investigating ways to increase systems interoperability, 508 compliance, and preparations for the eventual rollout of the Agency's upcoming 2018 Strategic Plan.

Additionally, NASA collected information on standalone Budget and Financial systems and applications portfolios. The objective was to collect information about these unique financial applications and systems so their capabilities could be leveraged to improve business and management practices. This continuing initiative has reduced systems and applications footprint, improved efficiencies, and provided cost savings to the Agency.

NASA also continues to automate the Continuous Monitoring Program (CMP), which provides the overall framework of management controls used to assess and evaluate internal controls, compliance with generally accepted accounting principles (GAAP), and evidence that balances and activities reported in the financial statements are auditable, accurate and complete. Automating the CMP provided centralized development, maintenance, and standardization across NASA and led to improved efficiency.



Section 2
Financial Section

Among NASA's human computers, today one of the most recognized is Katherine Johnson. Katherine Johnson and a number of her West Area colleagues are the subjects of the film "Hidden Figures," based on the book of the same name by Margot Lee Shetterly. "Hidden Figures" was chosen by National Board of Review as one of 2016's top 10 films, nominated for three Oscars and the recipient of a number of awards and accolades. An additional honor awaited; at age 98, on May 5, 2016, she returned to Langley, on the 55th anniversary of Alan Shepard's historic flight, to attend a ceremony where a $30-million, 40,000-square-foot Computational Research Facility was named in her honor. Johnson also received a Silver Snoopy award, given for outstanding contributions to flight safety and mission success. Photo credit: NASA | For more information please visit https://www.nasa.gov/langley/100/launching-the-space-race-katherine-johnson

INTRODUCTION TO THE PRINCIPAL FINANCIAL STATEMENTS

The principal financial statements are prepared to report the financial position and results of operations of the National Aeronautics and Space Administration (NASA), pursuant to the requirements of 31 U.S.C. 3515 (b). The statements are prepared from the records of NASA in accordance with Generally Accepted Accounting Principles (GAAP) and the formats prescribed by the OMB Circular No. A-136, *Financial Reporting Requirements, Revised* (August 2017). The statements are in addition to financial reports prepared by NASA in accordance with OMB and U.S. Department of the Treasury (Treasury) directives to monitor and control the status and use of budgetary resources, which are prepared from the same records. The statements should be read with the understanding that they are for a component of the U.S. Government, a sovereign entity. One important implication of this is that NASA has no authority to pay liabilities not covered by budgetary resources. Liquidation of such liabilities requires enactment of an appropriation. Comparative data for fiscal year (FY) 2016 is included where applicable. The principal financial statements, which include the following, are the responsibility of management:

Consolidated Balance Sheet provides information on assets, liabilities, and net position as of the end of the reporting period. Net position is the difference between assets and liabilities. It is a summary measure of the Agency's financial condition at the end of the reporting period.

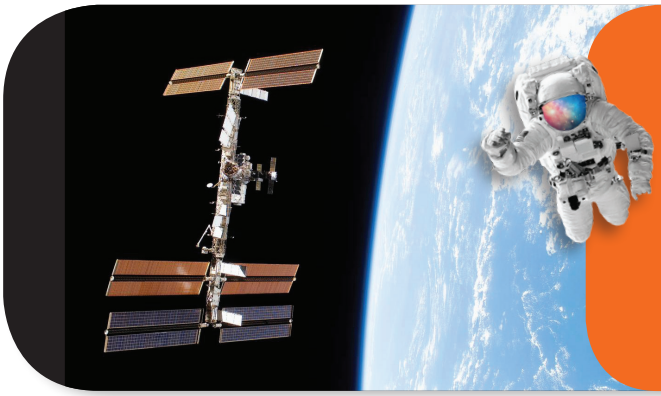
Consolidated Statement of Net Cost reports net cost of operations during the reporting periods by strategic goal and at the entity level. It is a measure of gross costs of operations less earned revenue, and represents cost to taxpayers for achieving each strategic goal and Agency mission at the entity level.

Consolidated Statement of Changes in Net Position reports the beginning balance of net position, current financing sources and use of resources, unexpended resources for the reporting period, and ending net position for the current period.

Combined Statement of Budgetary Resources reports information on sources and status of budgetary resources for the reporting period. Information in this statement is reported on the budgetary basis of accounting, which supports compliance with budgetary controls and controlling legislation.

Required Supplementary Stewardship Information provides information on NASA's Research and Development (R&D) costs by strategic goal.

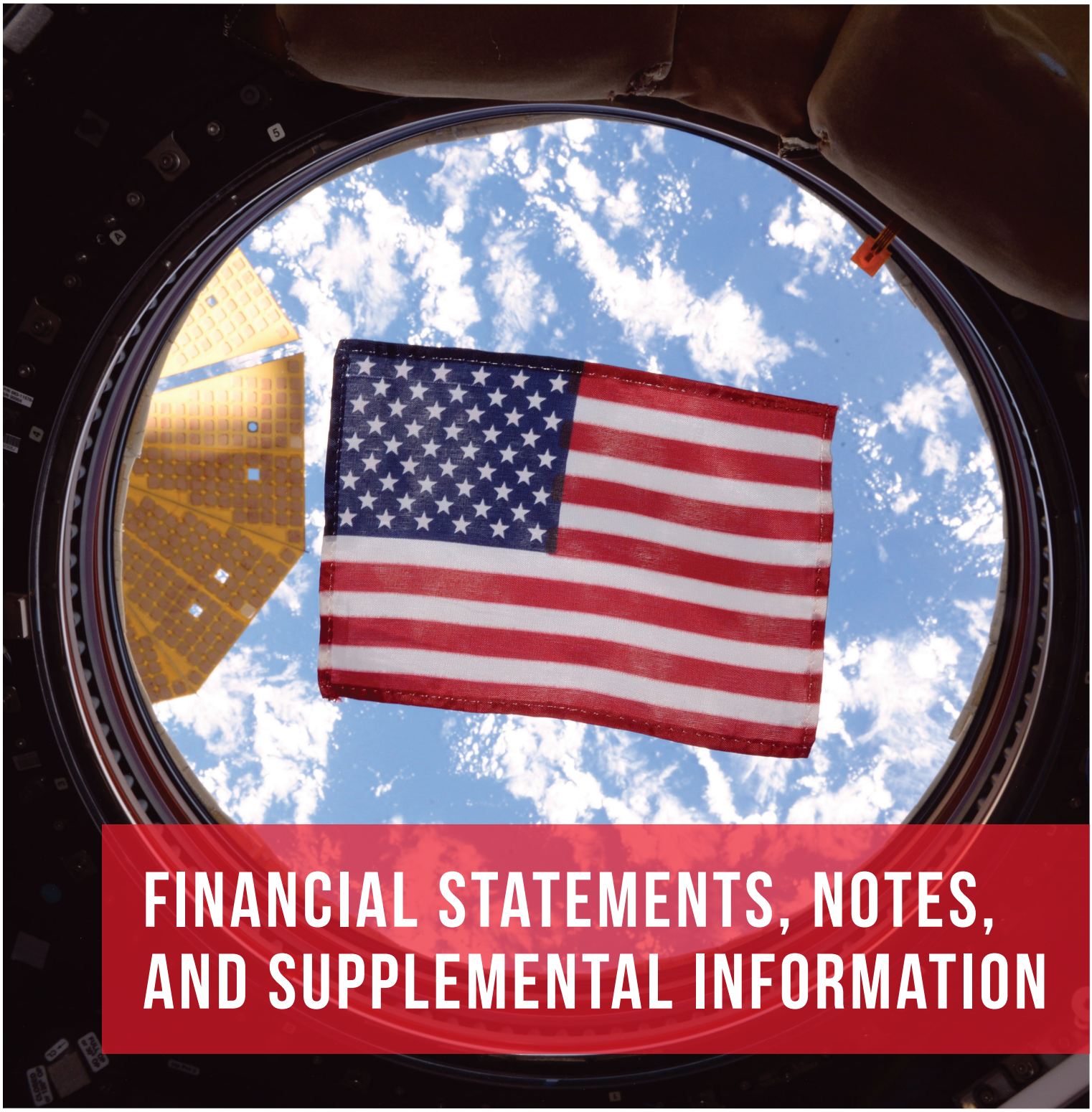
Required Supplementary Information contains a Combining Statement of Budgetary Resources and information on Deferred Maintenance.



Did you know?

The International Space Station (ISS) is the 3rd brightest object in the night sky. You can watch the ISS pass overhead from several thousand worldwide locations. It's easy to spot if you know when to look up!

Visit https://spotthestation.nasa.gov/ to find the next sighting opportunity in your neighborhood. Photo credit: NASA



FINANCIAL STATEMENTS, NOTES, AND SUPPLEMENTAL INFORMATION

NASA astronaut Jack Fischer took this photograph of an American flag in one of the windows of the International Space Station's cupola, a dome-shaped module through which operations on the outside of the station can be observed and guided. Throughout NASA's history, spacecraft and launch vehicles have always been decorated with flags. When Ed White became the first American astronaut to perform a spacewalk on June 3, 1965, his spacesuit was one of the first to be adorned with a flag patch. White's crewmate Jim McDivitt also wore a flag on his suit. The astronauts purchased the flags themselves, but following their flight, NASA made the flag patch a regular feature on the spacesuits. NASA astronauts still wear them today. Photo credit: NASA

National Aeronautics and Space Administration
Consolidated Balance Sheet
As of September 30, 2017 and 2016

(In Millions of Dollars)

	2017	2016
Assets (Note 2):		
Intragovernmental:		
Fund Balance with Treasury (Note 3)	$ 11,537	$ 10,408
Investments (Note 4)	17	18
Accounts Receivable (Note 5)	166	146
Other Assets (Note 8)	—	2
Total Intragovernmental	11,720	10,574
Accounts Receivable, Net (Note 5)	1	1
General Property, Plant and Equipment, Net (Note 6)	6,127	6,262
Other Assets (Note 8)	11	1
Total Assets	**$ 17,859**	**$ 16,838**
Stewardship PP&E (Note 7)		
Liabilities (Note 9):		
Intragovernmental:		
Accounts Payable	$ 32	$ 39
Other Liabilities (Note 11)	160	109
Total Intragovernmental	192	148
Accounts Payable	1,364	1,284
Federal Employee and Veteran Benefits (Note 9)	38	38
Environmental and Disposal Liabilities (Note 10)	1,691	1,599
Other Accrued Liabilities (Note 11)	1,478	1,316
Other Liabilities (Note 11)	493	468
Total Liabilities	**5,256**	**4,853**
Commitments and Contingencies (Note 12)		
Net Position:		
Unexpended Appropriations	8,428	7,519
Cumulative Results of Operations	4,175	4,466
Total Net Position	**12,603**	**11,985**
Total Liabilities and Net Position	**$ 17,859**	**$ 16,838**

The accompanying notes are an integral part of these financial statements.

National Aeronautics and Space Administration
Consolidated Statement of Net Cost
For the Fiscal Years Ended September 30, 2017 and 2016

(In Millions of Dollars)

	2017	2016
Cost by Strategic Goal (Note 13)		
Strategic Goal 1 – Expand the frontiers of knowledge, capability, and opportunity in space:		
Gross Costs	$ 12,313	$ 12,652
Less: Earned Revenue	377	317
Net Cost	11,936	12,335
Strategic Goal 2 – Advance understanding of Earth and develop technologies to improve the quality of life on our home planet:		
Gross Costs	$ 4,068	$ 3,841
Less: Earned Revenue	1,808	1,779
Net Cost	2,260	2,062
Strategic Goal 3 – Serve the American public and accomplish our Mission by effectively managing our people, technical capabilities, and infrastructure:		
Gross Costs	$ 5,343	$ 5,318
Less: Earned Revenue	128	121
Net Cost	5,215	5,197
Net Cost of Operations		
Total Gross Costs	$ 21,724	$ 21,811
Less: Total Earned Revenue	2,313	2,217
Net Cost	**$ 19,411**	**$ 19,594**

The accompanying notes are an integral part of these financial statements.

National Aeronautics and Space Administration
Consolidated Statement of Changes in Net Position
For the Fiscal Years Ended September 30, 2017 and 2016

(In Millions of Dollars)

	2017	2016
Cumulative Results of Operations:		
Beginning Balances	$ 4,466	$ 5,180
Budgetary Financing Sources:		
Appropriations Used	18,918	18,727
Nonexchange Revenue	6	7
Other Financing Sources:		
Donations and Forfeitures of Property	67	2
Transfers In/Out Without Reimbursement	1	1
Imputed Financing	132	149
Other	(4)	(6)
Total Financing Sources	19,120	18,880
Net Cost of Operations	(19,411)	(19,594)
Net Change	(291)	(714)
Cumulative Results of Operations	**4,175**	**4,466**
Unexpended Appropriations:		
Beginning Balance	7,519	6,988
Budgetary Financing Sources:		
Appropriations Received	19,837	19,285
Other Adjustments	(10)	(27)
Appropriations Used	(18,918)	(18,727)
Total Budgetary Financing Sources	909	531
Unexpended Appropriations	**8,428**	**7,519**
Net Position	**$ 12,603**	**$ 11,985**

The accompanying notes are an integral part of these financial statements.

National Aeronautics and Space Administration
Combined Statement of Budgetary Resources
For the Fiscal Years Ended September 30, 2017 and 2016

(In Millions of Dollars)

	2017	2016
Budgetary Resources:		
Unobligated Balance, Brought Forward, October 1	$ 1,092	$ 1,104
Recoveries of Prior Year Unpaid Obligations	206	243
Other Changes in Unobligated Balance	—	(16)
Unobligated Balance from Prior Year Budget Authority, Net	1,298	1,331
Appropriations	19,838	19,286
Spending Authority from Offsetting Collections	2,923	3,002
Total Budgetary Resources	**$ 24,059**	**$ 23,619**
Status of Budgetary Resources:		
New Obligations and Upward Adjustments (Total) (Note 14)	$ 22,678	$ 22,527
Unobligated Balance, End of Year:		
Apportioned, Unexpired Accounts	1,234	994
Unapportioned, Unexpired Accounts	37	2
Unexpired Unobligated Balance, End of Year	1,271	996
Expired Unobligated Balance, End of Year	110	96
Unobligated Balance, End of Year (Total)	1,381	1,092
Total Status of Budgetary Resources	**$ 24,059**	**$ 23,619**
Change in Obligated Balance:		
Unpaid Obligations:		
Unpaid Obligations, Brought Forward, October 1	$ 10,745	$ 9,969
New Obligations and Upward Adjustments (Total) (Note 14)	22,678	22,527
Outlays (Gross) (-)	(21,465)	(21,508)
Recoveries of Prior Year Unpaid Obligations (-)	(206)	(243)
Unpaid Obligations, End of Year	11,752	10,745
Uncollected Payments:		
Uncollected Payments, Federal Sources, Brought Forward, October 1 (-)	(1,444)	(1,105)
Change in Uncollected Payments, Federal Sources	(169)	(339)
Uncollected Payments, Federal Sources, End of Year (-)	(1,613)	(1,444)
Memorandum (Non-Add) Entries		
Obligated Balance, Start of Year	**9,301**	**8,864**
Obligated Balance, End of Year	**$ 10,139**	**$ 9,301**
Budget Authority and Outlays, Net:		
Budget Authority, Gross	$ 22,761	$ 22,288
Actual Offsetting Collections (-)	(2,763)	(2,674)
Change in Uncollected Payments, Federal Sources	(169)	(339)
Recoveries of Prior Year Paid Obligations	9	11
Budget Authority, Net (Total)	**$ 19,838**	**$ 19,286**
Outlays, Gross	$ 21,465	$ 21,508
Actual Offsetting Collections (-)	(2,763)	(2,674)
Outlays, Net (Total)	18,702	18,834
Distributed Offsetting Receipts (-)	(4)	(5)
Agency Outlays, Net	**$ 18,698**	**$ 18,829**

The accompanying notes are an integral part of these financial statements.

Note 1: Summary of Significant Accounting Policies

Reporting Entity

The National Aeronautics and Space Administration (NASA) is an independent agency established by Congress on October 1, 1958 by the National Aeronautics and Space Act of 1958. NASA was incorporated from its predecessor agency, the National Advisory Committee for Aeronautics, which provided technical advice to the United States (U.S.) aviation industry and performed aeronautics research. Today, NASA serves as the principal agency of the U.S. Government for initiatives in civil space and aviation.

NASA is organized into four Mission Directorates supported by one Mission Support Directorate (see Organization on page 7):

- Aeronautics Research: conducts research which enhances aircraft performance, environmental compatibility, capacity, flexibility, and safety of the future air transportation system;

- Human Exploration and Operations: develops new capabilities, supporting technologies and foundational research for affordable, sustainable human and robotic exploration;

- Science: explores the Earth, Moon, Mars, and beyond; charts the best route of discovery, and obtains the benefits of Earth and space exploration for society; and

- Space Technology: develops new technologies needed to support current and future NASA missions, other agencies, and the aerospace industry.

The Agency's administrative structure includes the Strategic Management Council, Executive Council, Mission Support Council, Program Management Council, and other Committees to integrate strategic, tactical, and operational decisions in support of strategic focus and direction.

Operationally, NASA is organized into nine Centers and other facilities across the country, the Headquarters Office, the NASA Shared Services Center (NSSC), and the Jet Propulsion Laboratory (JPL). JPL is a Federally Funded Research and Development Center (FFRDC), operated for NASA by a contractor, California Institute of Technology (Caltech), staffed by Caltech employees in NASA-owned facilities.

The Agency's consolidated financial statements present the accounts of all funds that have been established and maintained to account for the resources under the control of NASA management.

Basis of Accounting and Presentation

These consolidated financial statements are prepared in accordance with the Federal Accounting Standards Advisory Board (FASAB) standards in the format prescribed by the OMB Circular No. A-136, *Financial Reporting Requirements, Revised* (August 2017). FASAB authority to set Federal Government accounting standards is recognized by the American Institute of Certified Public Accountants (AICPA). The financial statements present the financial position, net cost of operations, changes in net position, and budgetary resources of NASA, as required by the Chief Financial Officers Act of 1990, Public Law (P.L.) 101-576, and the Government Management Reform Act P.L. 103-356.

The financial statements should be read with the realization that they are for a component of the U.S. Government, a sovereign entity. One important implication of this is that liabilities cannot be liquidated without legislation providing resources and legal authority to do so. The accounting structure of Federal agencies is designed to reflect proprietary and budgetary accounting. Proprietary accounting uses the accrual method of accounting. Under the accrual method of accounting, revenues are recognized when earned and expenses are recognized when incurred, without regard to the timing of receipt or payment of cash. Budgetary accounting does not use the accrual method of accounting; it accounts for the sources and status of funds to facilitate compliance with legal controls over the use of Federal funds.

Material intra-agency transactions and balances have been eliminated from the principal statements for presentation on a consolidated basis, except for the Statement of Budgetary Resources, which is presented on a combined basis in accordance with OMB Circular No. A-136.

Note 1: Summary of Significant Accounting Policies
(continued)

Budgets and Budgetary Accounting

NASA complies with Federal budgetary accounting guidelines of OMB Circular No. A-11, *Preparation, Submission and Execution of the Budget, Revised* (August 2017). Congress funds NASA's operations through nine main appropriations: Science; Aeronautics; Exploration; Space Operations; Education; Safety, Security and Mission Services; Space Technology; Office of Inspector General; and Construction and Environmental Compliance and Restoration. NASA also receives reimbursements from reimbursable service agreements that cover the cost of goods and services NASA provides to other Federal entities or non-Federal entities. The reimbursable agreement price is based on cost principles to reasonably reflect the actual cost for the goods and services provided to the customer.

Research and Development, Other Initiatives and Similar Costs

NASA makes substantial Research and Development (R&D) investments for the benefit of the U.S. The R&D programs include activities to extend our knowledge of Earth, its space environment, and the universe; and to invest in new aeronautics and advanced space transportation technologies supporting the development and application of technologies. Following guidance outlined in the FASAB Technical Release No. 7, *Clarification of Standards Relating to the National Aeronautics and Space Administration's Space Exploration Equipment*, NASA applies the Financial Accounting Standards Board's (FASB) Accounting Standards Codification (ASC) 730-10-25, *Research and Development - Recognition*, and FASB ASC 730-10-50 *Research and Development - Disclosure*, to its R&D projects. Consistent with the above guidance, costs to acquire PP&E that is expected to be used only for a specific R&D project are expensed in the period they are incurred.

Application of Critical Accounting Estimates

The preparation of financial statements requires management to make assumptions and reasonable estimates affecting the reported amounts of assets and liabilities and disclosures of contingent liabilities as of the date of the financial statements and the reported amounts of revenues and expenses for the reporting period. Accordingly, actual results may differ from those estimates.

Fund Balance with Treasury

The U.S. Department of the Treasury collects and disburses cash on behalf of Federal agencies during the fiscal year. The collections include funds appropriated by Congress to fund the Agency's operations and revenues earned for services provided to other Federal agencies or the public. The disbursements are for goods and services received in support of NASA's operations and other liabilities. Fund Balance with Treasury (FBWT) is the balance of cash NASA has in its account with Treasury.

Investments in U.S. Government Securities

NASA investments include the following intragovernmental non-marketable securities:

(1) The Endeavor Teacher Fellowship Trust Fund (Endeavor Trust Fund) was established from public donations in tribute to the crew of the Space Shuttle Challenger. The Endeavor Trust Fund biannual interest earned is reinvested in short-term bills. P.L. 102-195 requires the interest earned from the Endeavor Trust Fund investments be used to create the Endeavor Teacher Fellowship Program.

(2) The Science, Space and Technology Education Trust Fund (Challenger Trust Fund) was established to advance science and technology education. The Challenger Trust Fund balance is invested in short-term bills and long-term bonds. P.L. 100-404 requires that a quarterly payment of $250,000 be sent to the Challenger Center from interest earned on the Challenger Trust Fund investments. In order to meet the requirement of providing funds to the Challenger Center, NASA invests the bi-annual interest earned in short-term bills with maturity that coincides with quarterly payments of $250,000 to beneficiaries. Interest received in excess of the amount needed for quarterly payment to beneficiaries is invested in long-term bonds.

Note 1: Summary of Significant Accounting Policies
(continued)

Accounts Receivable

Most of NASA's Accounts Receivable are for intra-governmental reimbursements for cost of goods and services provided to other Federal agencies; the rest is for debts to NASA by employees and non-Federal vendors. Allowances for delinquent non-Federal accounts receivable are based on factors such as: aging of accounts receivable, debtors' ability to pay, payment history, and other relevant factors. Delinquent non-Federal accounts receivable over 120 days are referred to Treasury for collection, wage garnishment or cross-servicing in accordance with the Debt Collection Improvement Act (DCIA), as amended.

Operating Materials and Supplies

The Agency follows the purchases method of accounting for operating materials and supplies under which it expenses operating materials and supplies when purchased, not when used.

General Property, Plant and Equipment

NASA reports depreciation and amortization expense using the straight-line method over an asset's estimated useful life, beginning with the month the asset is placed in service. General Property, Plant and Equipment (G-PP&E) are assets with acquisition costs of $500,000 or more, a useful life of 2 years or more, and R&D assets that are determined at the time of acquisition to have alternative future use. Assets that do not meet these capitalization criteria are expensed. Capitalized costs include costs incurred by NASA to bring the property to a form and location suitable for its intended use. Certain NASA assets are held by government contractors. Under provisions of the Federal Acquisition Regulation (FAR), the contractors are responsible for the control and accountability of the assets in their possession. These government-owned, contractor-held assets are included within the balances reported in NASA's financial statements.

NASA has barter agreements with international entities; the assets and services received under these barter agreements are unique, with limited easement to only a few countries, as these assets are on the International Space Station (ISS). The intergovernmental agreements state that the parties will seek to minimize the exchange of funds in the cooperative program, including the use of barters to provide goods and services. NASA has received some assets from these parties in exchange for future services. The fair value is indeterminable; therefore, no value was ascribed to these transactions in accordance with FASB ASC 845-10-25, *Non-Monetary Transactions – Recognition*, and ASC 845-10-50, *Non-Monetary Transactions – Disclosure*. The amounts reflected in NASA's financial reports for the ISS exclude components of the ISS owned or provided by other participants in the ISS.

Statement of Federal Financial Accounting Standards (SFFAS) No. 10, *Accounting for Internal Use Software*, requires the capitalization of internally developed, contractor developed, and commercial off the shelf software. Capitalized costs for internally developed software include the full costs (direct and indirect) incurred during the software development stage only. For purchased software, capitalized costs include amounts paid to vendors for the software and other material costs incurred by NASA to implement and make the software ready for use through acceptance testing. NASA capitalizes costs for internal use software when the total projected cost is $1 million or more and the expected useful life of the software is 2 years or more.

Liabilities Covered by Budgetary Resources

As a component of a sovereign entity, NASA cannot pay for liabilities unless authorized by law and covered by budgetary resources. Liabilities Covered by Budgetary Resources are those for which appropriated funds are available as of the balance sheet date. Budgetary resources include: new budget authority, unobligated balances of budgetary resources at the beginning of the year or net transfer of prior year balances during the year, spending authority from offsetting collections (credited to an appropriation or fund account), and recoveries of unexpired budget authority through downward adjustments of prior year obligations.

Note 1: Summary of Significant Accounting Policies
(continued)

Liabilities and Contingencies Not Covered by Budgetary Resources

Liabilities Not Covered by Budgetary Resources include future environmental cleanup liability, legal claims, pensions and other retirement benefits, workers' compensation, annual leave, and payables related to cancelled appropriations.

Federal Employee and Veterans Benefits

A liability is recorded for workers' compensation claims related to the Federal Employees' Compensation Act (FECA), administered by the U.S. Department of Labor. The FECA provides income and medical cost protection to covered Federal civilian employees injured on the job, employees who have incurred a work-related occupational disease, and beneficiaries of employees whose death is attributable to a job-related injury or occupational disease. The FECA program initially pays valid claims and subsequently seeks reimbursement from the Federal agencies employing the claimants. The FECA liability includes the actuarial liability for estimated future costs of death benefits, workers' compensation, and medical and miscellaneous costs for approved compensation cases.

Personnel Compensation and Benefits

Annual, Sick and Other Leave

Annual leave is accrued as it is earned; the accrual is reduced as leave is taken. Each year, the balance in the accrued annual leave account is adjusted to reflect current pay rates. To the extent current or prior year appropriations are not available to fund annual leave earned but not taken, funding will be obtained from future financing sources. Sick leave and other types of non-vested leave are expensed as taken.

Retirement Benefits

NASA employees participate in the Civil Service Retirement System (CSRS), a defined benefit plan, or the Federal Employees Retirement System (FERS), a defined benefit and contribution plan. For CSRS employees, NASA makes contributions of 7.0 percent of gross pay. For FERS employees, NASA makes contributions of gross pay of 13.7 percent to the defined benefit plan, 1.0 percent to a thrift savings plan (contribution plan) automatically established, and matches employee contributions up to an additional 4.0 percent of gross pay.

Insurance Benefits

SFFAS No. 5, *Accounting for Liabilities of the Federal Government*, requires Government agencies to report the full cost of Federal Employee Health Benefits (FEHB) and the Federal Employees Group Life Insurance (FEGLI) Programs. NASA uses the applicable cost factors and data provided by the Office of Personnel Management to value these liabilities.

Subsequent Events

Subsequent events have been evaluated through the auditors' report date, which is the date the financial statements were available to be issued, and management determined that there are no other items to disclose.

Note 2: Non-Entity Assets

Non-entity assets are assets held by NASA but not available for obligation. NASA's non-entity assets comprise of receipts from the Freedom of Information Act (FOIA) requests, Civil Monetary Penalties, Interest, and Penalty and Administration Fees. Total non-entity assets during FY 2017 and FY 2016 are less than one-half million dollars.

(In Millions of Dollars)	2017	2016
Total Non-Entity Assets	$ —	$ —
Total Entity Assets	17,859	16,838
Total Assets	**$ 17,859**	**$ 16,838**

Note 3: Fund Balance with Treasury

NASA's cash receipts and disbursements reported by Treasury are reconciled against NASA's records. The FBWT is comprised of balances in general funds, trust funds, working capital fund, and other types of funds. General funds primarily consist of appropriated funds for NASA. Trust funds include balances in the Endeavor Trust Fund, Challenger Trust Fund, and gifts and donations. The Working Capital Fund (WCF) consists of balances related to NSSC, IT Infrastructure Integration Program (I3P) and Solutions for Enterprise-Wide Procurement (SEWP). Other fund types include deposit funds and budget clearing funds.

(In Millions of Dollars)	2017	2016
Fund Balances:		
General Funds	$ 11,321	$ 10,211
Trust Funds	1	1
Working Capital Fund	197	180
Other Fund Types	18	16
Total	**$ 11,537**	**$ 10,408**

The status of FBWT represents the total fund balance recorded in the general ledger for unobligated and obligated balances. Unobligated balances — available is the amount remaining in appropriation funds available for obligation. Unobligated balances — unavailable is the amount remaining in appropriated funds used only for adjustments to previously recorded obligations. Obligated balances not yet disbursed is the cumulative amount of obligations incurred for which outlays have not been made. Non-budgetary FBWT is comprised of amounts in other types of funds.

(In Millions of Dollars)	2017	2016
Status of Fund Balances with Treasury:		
Unobligated Balances		
Available	$ 1,234	$ 994
Unavailable	147	98
Obligated Balance Not Yet Disbursed	10,139	9,301
Non-Budgetary FBWT	17	15
Total	**$ 11,537**	**$ 10,408**

Note 4: Investments

Investments consist of non-marketable par value intragovernmental securities issued by Treasury's Bureau of the Fiscal Service. Trust fund balances are invested in Treasury securities, which are purchased at either a premium or discount, and redeemed at par value exclusively through Treasury's Federal Investment Branch. The effective-interest method is used to amortize premiums on bonds, and the straight-line method is used to amortize discounts on bills.

Interest receivable on investments was less than one-half million dollars. In addition, NASA did not have any adjustments resulting from the sale of securities prior to maturity or any change in value that was more than temporary.

Note 4: Investments (continued)

2017							
(In Millions of Dollars)	Cost	Amortization Method	Amortized (Premium) Discount	Interest Receivable	Investments, Net	Other Adjustments	Market Value Disclosure
Intragovernmental Securities:							
Non-Marketable:		Straight-Line					
Par value	$ 21	Effective-interest 0.724 - 6.602%	$ (4)	$ —	$ 17	$ —	$ 17
Total	**$ 21**		**$ (4)**	**$ —**	**$ 17**	**$ —**	**$ 17**

2016							
(In Millions of Dollars)	Cost	Amortization Method	Amortized (Premium) Discount	Interest Receivable	Investments, Net	Other Adjustments	Market Value Disclosure
Intragovernmental Securities:							
Non-Marketable:		Straight-Line					
Par value	$ 21	Effective-interest 0.476 - 6.602%	$ (3)	$ —	$ 18	$ —	$ 18
Total	**$ 21**		**$ (3)**	**$ —**	**$ 18**	**$ —**	**$ 18**

Note 5: Accounts Receivable, Net

The Accounts Receivable balance represents net valid claims by NASA to cash or other assets of other entities. Intragovernmental Accounts Receivable represents reimbursements due from other Federal entities for goods and services provided by NASA on a reimbursable basis. Accounts Receivable Due from the Public is the total of miscellaneous debts owed to NASA from employees and/or smaller reimbursements from other non-Federal entities. A periodic evaluation of public accounts receivable is performed to estimate any uncollectible amounts based on current status, financial and other relevant characteristics of debtors, and the overall relationship with the debtor. An allowance for doubtful accounts is recorded for Accounts Receivable Due from the Public in order to reduce Accounts Receivable to its net realizable value in accordance with SFFAS No. 1, *Accounting for Selected Assets and Liabilities*. The total allowance for doubtful accounts during FY 2017 and FY 2016 is one million and less than one–half million dollars, respectively.

2017			
(In Millions of Dollars)	Accounts Receivable	Allowance for Uncollectible Accounts	Net Amount Due
Intragovernmental	$ 166	$ —	$ 166
Public	2	(1)	1
Total	**$ 168**	**$ (1)**	**$ 167**

Note 5: Accounts Receivable, Net (continued)

2016			
(In Millions of Dollars)	Accounts Receivable	Allowance for Uncollectible Accounts	Net Amount Due
Intragovernmental	$ 146	$ —	$ 146
Public	1	—	1
Total	**$ 147**	**$ —**	**$ 147**

Note 6: General Property, Plant and Equipment, Net

The composition of NASA G-PP&E as of September 30, 2017 and 2016 is presented in the table below. There are no known restrictions to the use or convertibility of NASA G-PP&E.

2017					
(In Millions of Dollars)	Method	Useful Life	Cost	Accumulated Depreciation	Book Value
General PP&E					
International Space Station and Equipment	Straight-line	5–20 years	$ 12,846	$ (12,572)	$ 274
Structures, Facilities and Leasehold Improvements	Straight-line	15-40 years	10,636	(7,661)	2,975
Equipment	Straight-line	5–20 years	3,140	(2,157)	983
Construction In Progress - Personal Property	N/A	N/A	900	—	900
Construction In Progress - Real Property	N/A	N/A	859	—	859
Internal Use Software	Straight-line	5 years	258	(248)	10
Land	N/A	N/A	124	—	124
Internal Use Software In Development	N/A	N/A	2	—	2
Total			**$ 28,765**	**$ (22,638)**	**$ 6,127**

2016					
(In Millions of Dollars)	Method	Useful Life	Cost	Accumulated Depreciation	Book Value
General PP&E					
International Space Station and Equipment	Straight-line	5–20 years	$ 12,773	$ (12,582)	$ 191
Structures, Facilities and Leasehold Improvements	Straight-line	15-40 years	10,232	(7,419)	2,813
Equipment	Straight-line	5–20 years	3,162	(2,070)	1,092
Construction In Progress - Personal Property	N/A	N/A	1,210	—	1,210
Construction In Progress - Real Property	N/A	N/A	823	—	823
Internal Use Software	Straight-line	5 years	280	(271)	9
Land	N/A	N/A	124	—	124
Internal Use Software In Development	N/A	N/A	—	—	—
Total			**$ 28,604**	**$ (22,342)**	**$ 6,262**

Note 7: Stewardship PP&E

Federal agencies are required to classify and report heritage assets, multi-use heritage assets, and stewardship land in accordance with SFFAS No. 29, *Heritage Assets and Stewardship Land*. Stewardship PP&E have physical characteristics similar to those of G-PP&E but differ from G-PP&E because their value is more intrinsic and not easily determinable in dollars. The only type of stewardship PP&E owned by NASA are heritage assets.

Heritage assets are PP&E that possess one or more of the following characteristics:

- Historical or natural significance
- Cultural, educational or aesthetic value
- Significant architectural characteristics

Dollar value and useful life of heritage assets are not easily determinable. There is no minimum dollar threshold for designating PP&E as a heritage asset, and depreciation expense is not taken on these assets. For these reasons, heritage assets (other than multi-use heritage assets) are reported in physical units, rather than with assigned dollar values. In accordance with SFFAS No. 29, the cost of acquisition, improvement, reconstruction, or renovation of heritage assets is expensed in the period incurred.

Assets that are used in day-to-day Government operations and have a heritage function are considered multi-use heritage assets. Such assets are accounted for as G-PP&E and are capitalized and depreciated in the same manner as other G-PP&E. Multi-use heritage assets at the end of the period totaled 70 buildings and structures as of September 30, 2017 and September 30, 2016. The value associated with these multi-use heritage assets is reflected in the G-PP&E values reported in Note 6.

When a G-PP&E has no use in operations, but is designated as a heritage asset, its cost and accumulated depreciation are removed from the books. They remain on the record as heritage assets, except where there is legal authority for transfer or sale at which time they are removed from the heritage asset record. Heritage assets are withdrawn when they are disposed or reclassified as multi-use heritage assets. Heritage assets are generally in fair condition suitable for display. NASA currently has three major classes of heritage assets: Buildings and Structures; Air and Space Displays and Artifacts; and Art and Miscellaneous Items. The first two categories of heritage assets support NASA's mission by providing the public with tangible examples of assets which were built and deployed to support NASA's mission. These real life assets enhance the public's understanding of NASA's numerous programs. Typically, the Buildings and Structures have been designated as National Historic Landmarks.

The third category of heritage assets, Art and Miscellaneous Items, is mainly comprised of items created by artists who have contributed their time and talent to record their impressions of the U.S. Aerospace Program in paintings, drawings, and other media. These works of art not only provide a historic record of NASA projects, but they support NASA's mission by giving the public a new and fuller understanding of advancements in aerospace.

Heritage Assets *(In Physical Units)*	**FY2016**	**Additions**	**Withdrawals**	**FY2017**
Buildings and Structures	11	—	1	10
Air and Space Displays and Artifacts	690	2	20	672
Art and Miscellaneous Items	1,047	2	1	1,048
Total Heritage Assets	**1,748**	4	22	**1,730**

Note 8: Other Assets

NASA's Other Assets consist of Advances and G-PP&E that NASA has determined are no longer needed and are awaiting disposal, retirement, or removal from services. The Advances primarily represent the payments made to an energy service company for the Energy Savings Performance Contract at Glenn Research Center. The G-PP&E Other Assets are recorded at estimated net realizable value.

(In Millions of Dollars)	2017	2016
Intragovernmental Assets		
Other Advances	$ —	$ 2
Non-Intragovernmental Assets		
Other Advances	1	—
G-PP&E - Removed from Service and Pending Disposal	10	1
Total Other Assets	**$ 11**	**$ 3**

Note 9: Liabilities Not Covered by Budgetary Resources

Liabilities not covered by budgetary resources include certain environmental matters (see Note 10, Environmental and Disposal Liabilities for more information), annual leave, workers' compensation under FECA, Accounts Payable related to cancelled appropriations, legal claims, energy savings performance contracts, and pensions and other retirement benefits.

The present value of the FECA actuarial liability estimate at year-end was calculated by the Department of Labor using a discount rate of 2.68 percent in FY 2017 and 2.78 percent in FY 2016. This liability includes the estimated future costs for claims incurred but not reported or approved as of the end of each year. NASA has recorded Accounts Payable related to cancelled appropriations for which there are contractual commitments to pay. These payables will be funded from appropriations available for obligation at the time a bill is processed, in accordance with P.L. 101-510, National Defense Authorization Act.

Continued on next page →

Note 9: Liabilities Not Covered by Budgetary Resources (continued)

(In Millions of Dollars)	2017	2016
Intragovernmental Liabilities:		
Other Liabilities		
Workers' Compensation	$ 8	$ 9
Total Intragovernmental	8	9
Public Liabilities:		
Accounts Payable		
Accounts Payable for Cancelled Appropriations	58	56
Federal Employee and Veteran Benefits		
Actuarial FECA Liability	38	38
Environmental and Disposal Liabilities	1,691	1,599
Less: Environmental and Disposal Liabilities - Funded	86	87
Other Liabilities		
Unfunded Annual Leave	212	211
Contingent Liabilities	43	40
Total Liabilities Not Covered by Budgetary Resources	**1,964**	**1,866**
Total Liabilities Covered by Budgetary Resources	**3,292**	**2,987**
Total Liabilities	**$ 5,256**	**$ 4,853**

Note 10: Environmental and Disposal Liabilities

In accordance with guidance issued by FASAB, if an agency is required by Federal, state, and local statutes and regulation to clean up hazardous waste resulting from Federal operations, the amount of cleanup cost, if estimable, must be reported and/or disclosed in the financial statements.

The statutes and regulations most applicable to NASA covering environmental response, clean-up, and monitoring include: the Comprehensive Environmental Response, Compensation and Liability Act; the Resource Conservation and Recovery Act; the Nuclear Waste Policy Act of 1982; and applicable state and local laws.

NASA assesses the likelihood of required cleanup as probable (more likely than not to occur), reasonably possible (less likely than not to occur), or remote (slight chance of occurring). If the likelihood of required cleanup is probable and the cost can be reasonably estimated, a liability is recorded in the financial statements. If the likelihood of required cleanup is reasonably possible, the estimated cost of cleanup is disclosed in the notes to the financial statements. If the likelihood of required cleanup is remote, no liability or estimate is recorded or disclosed.

Environmental and Disposal Liabilities Represent Cleanup Costs Resulting From:

- Operations, including facilities obtained from other governmental entities, that have resulted in contamination from waste disposal methods, leaks and spills;
- Other past activity that created a public health or environmental risk, including identifiable costs associated with asbestos abatement; and
- Total cleanup costs associated with the removal, containment, and/or disposal of hazardous wastes or material and/or property at permanent or temporary closure or shutdown of associated PP&E.

Note 10: Environmental and Disposal Liabilities (continued)

(In Millions of Dollars)	2017	2016
Environmental Liabilities		
Restoration Projects	$ 1,429	$ 1,402
Asbestos	190	128
End of Life Disposal of Property, Plant & Equipment	72	69
Total Environmental and Disposal Liabilities	**$ 1,691**	**$ 1,599**

Restoration Projects

NASA recorded a total estimated liability for known restoration projects of $1.429 billion in FY 2017. This was an increase of $27 million over the $1.402 billion recorded in FY 2016. The increase in this liability is primarily due to the availability of new or updated information on the extent of contamination and refinements to the estimation methodology. The liability for each restoration project is estimated for a duration of no more than 30 years, except where required by state statutes, regulations, or an agreement.

In addition to the probable cleanup costs for known hazardous conditions recognized in the financial statements, there are other remediation sites where the likelihood of required cleanup for known hazardous conditions is reasonably possible. Remediation costs at certain sites classified as reasonably possible were estimated to be $156 million for FY 2017 and $1 million for FY 2016. The increase in this estimate is primarily due to the potential increase in soil cleanup volumes if required to perform a strict cleanup.

With respect to environmental remediation that NASA considers probable or reasonably possible but not estimable, NASA concluded that either the likelihood of a NASA liability is less than probable but more than remote or the regulatory drivers and/or technical data that exist are not reliable enough to calculate an estimate.

Asbestos

NASA maintains numerous structures and facilities across each of its Centers that are known to contain asbestos. In accordance with FASAB Technical Bulletin 2006-1, *Recognition and Measurement of Asbestos Related Cleanup Costs*, NASA and other Federal entities are required to recognize a liability for probable asbestos cleanup costs. FASAB Technical Release 10, *Implementation Guidance on Asbestos Cleanup Costs Associated with Facilities and Installed Equipment*, allows for an extrapolation of asbestos cleanup cost estimates for similar properties to develop an Agency-wide cleanup estimate.

In FY 2017, NASA updated its methodology for estimating the asbestos liability by using actual costs incurred to clean up asbestos in NASA structures and facilities that were recently demolished or fully renovated. Agency-wide asbestos cleanup cost factors were developed for those structures and facilities measured in square feet and for those not measured in square feet. These cost factors were extrapolated across applicable NASA structures and facilities. The FY 2017 asbestos cleanup cost liability of $190 million represents an increase of $62 million over the $128 million recorded in FY 2016. The increase is primarily due to the new estimation methodology, which was recorded prospectively as a change in estimate.

End of Life Disposal of Property, Plant & Equipment

Consistent with SFFAS No. 5, *Accounting for Liabilities of the Federal Government* and with SFFAS No. 6, *Accounting for Property, Plant, and Equipment*, NASA estimates the anticipated environmental disposal cleanup costs for PP&E. NASA recognizes and records in its financial statements an environmental cleanup liability for end-of-life disposal of PP&E that is probable and measurable.

NASA recorded a total estimated liability for the end of life disposal of PP&E of $72 million in FY 2017. This was an increase of $3 million over the $69 mil-

lion recorded in FY 2016. This estimate includes both facilities with permits that require cleanup and an estimate for all remaining PP&E. As described below, this estimate also considers end-of-life disposal costs for assets in space, including the ISS and satellites.

The current proposed decommissioning approach for the ISS is to execute a controlled targeted deorbit to a remote ocean location. This is consistent with the approach used to deorbit other space vehicles such as Russia's Progress, Europe's Automated Transfer Vehicle (ATV) and Japan's H-II Transfer Vehicle (HTV). The documented target reliability for this decommissioning approach is 99 percent. Prior to decommissioning the ISS, any hazardous materials on board the ISS would be removed or jettisoned. As a result, only residual quantities of hazardous, toxic, and radioactive materials would remain prior to the decommissioning.

Based on past experience with the re-entry of satellites, larger portions or fragments of the ISS would be expected to survive the thermal and aerodynamic stresses of re-entry. However, the historical disposal of satellites and vehicles into broad ocean areas with a controlled deorbit has left little evidence of their re-entry. Any remaining contamination in the ISS debris field would not be expected to have a substantive impact on marine life. Therefore, the probability of NASA incurring environmental cleanup costs related to the ISS is remote and no estimate for such costs has been developed or reported in these financial statements.

Note 11: Other Liabilities and Other Accrued Liabilities

Intragovernmental Other Liabilities primarily represent accrued cost estimates for goods and services performed by Federal trading partners, and Advances from Others relates to agreements for services between NASA and Federal trading partners for reimbursable services performed.

Other Liabilities with public entities primarily represents unfunded annual leave and funded sick leave that have been earned but not taken by NASA employees, and Advances from Others primarily consists of payments received from non-Federal entities in advance of NASA's performance of services under reimbursable agreements.

Other Accrued Liabilities primarily consist of the accrual of contractor costs for goods and services performed. The period of performance for contractor contracts typically spans the duration of NASA programs, which could be for a number of years prior to final delivery of the product. In such cases, NASA records a cost accrual throughout the fiscal year as the work is performed. Other Accrued Liabilities also include the accrual of incurred but not reported (IBNR) grant program costs incurred in support of NASA's research and development and other related activities.

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Note 11: Other Liabilities and Other Accrued Liabilities (continued)

(In Millions of Dollars)	2017 Current	2017 Non-Current	2017 Total	2016 Current	2016 Non-Current	2016 Total
Intragovernmental Liabilities:						
Advances from Others	$ 54	$ —	$ 54	$ 25	$ —	$ 25
Workers' Compensation	3	5	8	4	5	9
Employer Contributions and Payroll Taxes	17	—	17	16	—	16
Total Other Liabilities	74	5	79	45	5	50
Other Accrued Liabilities	81	—	81	59	—	59
Total Intragovernmental	**155**	**5**	**160**	**104**	**5**	**109**
Public Liabilities:						
Unfunded Annual Leave	—	212	212	—	211	211
Accrued Funded Payroll	84	—	84	81	—	81
Advances from Others	113	—	113	112	—	112
Employer Contributions and Payroll Taxes	8	—	8	8	—	8
Liability for Deposit and Clearing Funds	18	—	18	16	—	16
Contingent Liabilities	—	43	43	—	40	40
Capital Lease Liabilities	2	—	2	—	—	—
Other Liabilities	13	—	13	—	—	—
Total Other Liabilities	238	255	493	217	251	468
Other Accrued Liabilities	1,478	—	1,478	1,316	—	1,316
Total Public	**1,716**	**255**	**1,971**	**1,533**	**251**	**1,784**
Total Other Liabilities and Other Accrued Liabilities	**$ 1,871**	**$ 260**	**$ 2,131**	**$ 1,637**	**$ 256**	**$ 1,893**

Note 12: Commitments and Contingencies

NASA is a party in various administrative proceedings, court actions (including tort suits), and claims. For cases in which management and legal counsel believe it is probable that the outcomes will result in a loss to NASA, contingent liabilities are recorded.

There were cases reviewed by legal counsel where the probable future measurable loss is remote, and as such no contingent liability has been recorded in connection with these cases.

There are certain cases where the likelihood of loss is reasonably possible, with the loss estimated up to $30 million for September 30, 2017.

(In Millions of Dollars)	2017	2016
Contingent Liabilities	$ 43	$ 40
Total Contingent Liabilities	**$ 43**	**$ 40**

Note 13: Intragovernmental Cost and Exchange Revenue

Intragovernmental costs and revenue are exchange transactions made between NASA and other Federal government entities. Costs and revenue with the public result from transactions between NASA and non-Federal entities primarily through reimbursable agreements, which are priced based on cost principles to reasonably reflect the actual cost for the goods and services provided to the customer.

(In Millions of Dollars)	2017	2016
Strategic Goal 1 – Expand the frontiers of knowledge, capability, and opportunity in space		
Intragovernmental Costs	$ 415	$ 400
Public Costs	11,898	12,252
Total Gross Costs	12,313	12,652
Less:		
Intragovernmental Earned Revenue	273	204
Public Earned Revenue	104	113
Total Earned Revenue	377	317
Net Cost	**$ 11,936**	**$ 12,335**
Strategic Goal 2 – Advance understanding of Earth and develop technologies to improve the quality of life on our home planet		
Intragovernmental Costs	$ 159	$ 148
Public Costs	3,909	3,693
Total Gross Costs	4,068	3,841
Less:		
Intragovernmental Earned Revenue	1,780	1,742
Public Earned Revenue	28	37
Total Earned Revenue	1,808	1,779
Net Cost	**2,260**	**2,062**
Strategic Goal 3 – Serve the American public and accomplish our Mission by effectively managing our people, technical capabilities, and infrastructure		
Intragovernmental Costs	$ 557	$ 544
Public Costs	4,786	4,774
Total Gross Costs	5,343	5,318
Less:		
Intragovernmental Earned Revenue	48	39
Public Earned Revenue	80	82
Total Earned Revenue	128	121
Net Cost	**$ 5,215**	**$ 5,197**
Net Cost of Operations	**$ 19,411**	**$ 19,594**

Note 14: Apportionment Categories of Obligations Incurred: Direct vs. Reimbursable Obligations

Category A obligations consist of amounts requested to be apportioned annually and distributed for each calendar quarter in the fiscal year. Category B obligations consist of amounts requested to be apportioned on a basis other than calendar quarters, such as time periods other than quarters, activities, projects, objects, or a combination thereof.

(In Millions of Dollars)	2017	2016
Direct New Obligations and Upward Adjustments:		
Category A	$ 1	$ 1
Category B	19,876	19,565
Reimbursable New Obligations and Upward Adjustments:		
Category B	2,801	2,961
Total New Obligations and Upward Adjustments:	**$ 22,678**	**$ 22,527**

Note 15: Explanation of Differences Between the SBR and the Budget of the U.S. Government

The FY 2019 Budget of the United States Government (President's Budget), which presents the actual amounts for the year ended September 30, 2017, has not been published as of the issue date of these financial statements. Upon approval of the Administration, NASA will publish its FY 2019 President's Budget Request on the NASA Website at http://www.nasa.gov/news/budget.

NASA reconciled the amounts of the FY 2016 column on the SBR to the actual amounts for FY 2016 in the FY 2018 President's Budget for budgetary resources, obligations incurred, distributed offsetting receipts, and net outlays as presented below.

(In Millions of Dollars)	Budgetary Resources	Obligations	Distributed Offsetting Receipts	Net Outlays
Combined Statement of Budgetary Resources	$ 23,619	$ 22,527	$ (5)	$ 18,829
Included on SBR, not in President's Budget				
Expired Accounts	(139)	(43)	—	—
Distributed Offsetting Receipts	—	—	5	—
Budget of the United States Government	**$ 23,480**	**$ 22,484**	**$ —**	**$ 18,829**

The difference between the SBR and the President's Budget represents expired accounts and distributed offsetting receipts reported on the SBR but not in the President's Budget.

Note 16: Undelivered Orders at the End of the Period

Undelivered Orders represent the amount of goods and/or services ordered to perform NASA's mission objectives, which have not been received. The total Undelivered Orders at the end of the period totaled $8.8 billion and $8.1 billion as of September 30, 2017 and September 30, 2016, respectively.

Note 17: Reconciliation of Net Cost to Budget

SFFAS No. 7, *Accounting for Revenue and Other Financing Sources and Concepts for Reconciling Budgetary and Financial Accounting*, requires a reconciliation of proprietary and budgetary accounting information. Accrual based measures used in the Statement of Net Cost differ from the obligation based measures used in the Statement of Budgetary Resources. This reconciliation shows the relationship between the net obligations derived from the Statement of Budgetary Resources and net costs of operations derived from the Statement of Net Cost by identifying and explaining key items that affect one statement but not the other.

Note 17: Reconciliation of Net Cost to Budget (continued)

(In Millions of Dollars)	2017	2016
Resources Used to Finance Activities		
Budgetary Resources Obligated		
New Obligations and Upward Adjustments	$ 22,678	$ 22,527
Less: Spending Authority from Offsetting Collections and Recoveries	3,138	3,255
Obligations Net of Offsetting Collections and Recoveries	19,540	19,272
Less: Offsetting Receipts	—	—
Net Obligations	19,540	19,272
Other Resources		
Donations & Forfeitures of Property	67	2
Transfers In/Out Without Reimbursements	1	1
Imputed Financing from Costs Absorbed by Others	132	149
Net Other Resources Used to Finance Activities	200	152
Total Resources Used to Finance Activities	**19,740**	**19,424**
Resources Used to Finance Items Not Part of the Net Cost of Operations		
Change in Budgetary Resources Obligated for Goods, Services, and Benefits Ordered But Not Yet Provided	(567)	(582)
Resources that Fund Expenses Recognized in Prior Periods	—	(5)
Resources that Finance the Acquisition of Assets	(696)	(625)
Other Resources or Adjustments to Net Obligated Resources that Do Not Affect Net Cost of Operations	(68)	(3)
Total Resources Used to Finance Items Not Part of the Net Cost of Operations	**(1,331)**	**(1,215)**
Total Resources Used to Finance the Net Cost of Operations	**$ 18,409**	**$ 18,209**
Components of Net Cost that Will Not Require or Generate Resources in the Current Period		
Components Requiring or Generating Resources in Future Periods		
Increases in Annual Leave Liability	$ 1	$ 3
Increases in Environmental and Disposal Liability	92	187
Other	18	46
Total Components of Net Cost that Will Require or Generate Resources in Future Periods	111	236
Components Not Requiring or Generating Resources		
Depreciation	520	990
Revaluation of Assets or Liabilities	6	11
Other	365	148
Total Components of Net Cost of Operations that Will Not Require or Generate Resources	891	1,149
Total Components of Net Cost of Operations that Will Not Require or Generate Resources in the Current Period	**1,002**	**1,385**
Net Cost of Operations	**$ 19,411**	**$ 19,594**

REQUIRED SUPPLEMENTARY STEWARDSHIP INFORMATION

NASA's strategic goals and outcomes are the basis of the Agency's performance framework and are executed to support its strategic plan. To provide a complete analysis of NASA's costs, both Research and Development (R&D) and non-R&D costs are presented. Descriptions for the strategic goals and outcomes associated with these costs are below.

Research and Development Costs by Strategic Goal

(In Millions of Dollars)	2017	2016	2015	2014	2013
Research and Development Costs					
Basic					
Strategic Goal 1	$ 2,114	$ 2,227	$ 2,005	$ 2,020	$ 1,728
Strategic Goal 2	1,149	1,086	1,088	970	1,147
Strategic Goal 3	—	—	(1)	—	—
Total Basic Expenses	**$ 3,263**	**$ 3,313**	**$ 3,092**	**$ 2,990**	**$ 2,875**
Applied					
Strategic Goal 1	$ 1,780	$ 2,347	$ 1,729	$ 1,828	$ 1,993
Strategic Goal 2	553	546	622	578	597
Strategic Goal 3	2	23	—	6	—
Total Applied Expenses	**$ 2,335**	**$ 2,916**	**$ 2,351**	**$ 2,412**	**$ 2,590**
Development					
Strategic Goal 1	$ 5,503	$ 5,746	$ 5,867	$ 4,980	$ 5,005
Strategic Goal 2	503	502	341	434	177
Strategic Goal 3	603	532	32	8	33
Total Development Expenses	**$ 6,609**	**$ 6,780**	**$ 6,240**	**$ 5,422**	**$ 5,215**
Total Research and Development	**$ 12,207**	**$ 13,009**	**$ 11,683**	**$ 10,824**	**$ 10,680**
Non-Research and Development Cost					
Strategic Goal 1	$ 2,916	$ 2,331	$ 3,361	$ 2,960	$ 2,770
Strategic Goal 2	1,863	1,707	1,690	1,664	1,742
Strategic Goal 3	4,738	4,764	5,127	4,881	5,027
Total Non-Research and Development Expenses	**$ 9,517**	**$ 8,802**	**$ 10,178**	**$ 9,505**	**$ 9,539**
Total Expenses	**$ 21,724**	**$ 21,811**	**$ 21,861**	**$ 20,329**	**$ 20,219**

NASA makes substantial R&D investments for the benefit of the Nation. These amounts are expensed as incurred in determining the gross costs of operations.

NASA's R&D programs include activities to extend our knowledge of Earth, its space environment, and the Universe. The investments in new aeronautics and advanced space transportation technologies supports the development and application of critical activities related to economic, scientific and technical competitiveness of the U.S.

Investment in R&D refers to those expenses incurred to support the search for and application of new or refined knowledge and ideas. The knowledge and ideas is utilized to support the development of new or improved products and processes with the expectation of yielding future benefits.

REQUIRED SUPPLEMENTARY STEWARDSHIP INFORMATION (continued)

Strategic Goals and Outcomes

Strategic Goal 1: Expand the frontiers of knowledge, capability, and opportunity in space.

Outcomes:

• Achieve critical milestones in development of new systems for the human exploration of deep space.

• Develop a new transportation system that includes a crew capsule, a heavy-lift launch vehicle, and supporting ground facilities and systems.

• Develop the technologies and capabilities for in-space propulsion, in-space operations, long-duration habitation, and other systems to support humans in hostile environments.

• 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.

• Advance benefits to humanity through research.

• Enable a commercial demand-driven market in low Earth orbit (LEO).

• Enable long-duration human spaceflight beyond LEO.

• Provide a basis for international exploration partnerships.

• Increase understanding of the heliosphere (the extended atmosphere of the Sun), including what causes the Sun to vary, how do the geo-space, planetary space environments, and heliosphere respond, and what are the impacts on humanity.

• U.S. commercial space transportation capabilities will provide safe, reliable, and cost effective access to and from LEO and the ISS for crew and cargo.

• Continue to expand knowledge of the solar system, seeking to answer fundamental questions: How did our solar system form and evolve? Is there life beyond Earth? What are the hazards to life on Earth?

• Further understanding of the universe and how it works, its history, as well as the continued search for life beyond our solar system.

• Develop new pioneering technologies, increasing the Nation's capability to perform space science, operate in space, and enable deep space exploration.

• Strengthen our Nation's leadership in space-related science, technology, and industrial base.

• Foster a technology-based U.S. economy.

Strategic Goal 2: Advance understanding of Earth and develop technologies to improve the quality of life on our home planet.

Outcomes:

• Enable a revolutionary transformation of the aviation system to improve our quality of life and productivity on Earth.

• Contribute unique innovations to aviation through research activities. These innovations serve as key enablers for the role of U.S. commercial aviation in sustaining American commerce and safe, environmentally sustainable mobility, and hence the Nation's economic well-being.

• Shape an interdisciplinary view of Earth, exploring the interaction among the atmosphere, oceans, ice sheets, land surface interior, and life itself, which enables scientists to measure global and climate changes and to inform decisions by Government, organizations, and people.

• Optimize NASA's technology portfolio.

• Enable critical technology development and open innovation.

• Maximize the transfer of NASA's technology to U.S. partners.

REQUIRED SUPPLEMENTARY STEWARDSHIP INFORMATION (continued)

Strategic Goals and Outcomes (continued)

• Work together with Federal agencies to improve the quality of science, technology, engineering, and math (STEM) education in the U.S.

• Increase impact on the Nation's STEM education and workforce pipeline through the extension of STEM based internships, scholarships, and fellowships and the contribution of unique NASA mission and asset driven institution engagement, experiential learning, and professional development opportunities.

Strategic Goal 3: Serve the American public and accomplish our Mission by effectively managing our people, technical capabilities, and infrastructure.

Outcomes:

• Effectively manage human capital, finance, information technology, infrastructure, acquisitions, security, real and personal property, occupational health and safety, equal employment opportunity and diversity, small business programs, external relations, internal and external communications, stakeholder engagement, and other essential corporate functions.

• Manage NASA's infrastructure in a sustainable manner.

• NASA will maintain a diverse workforce.

• Maintain key capabilities and critical assets in support of NASA's missions

• Enable NASA's mission through IT resources and optimization.

• Create a seamless collaborative and mobile work environment that safeguards NASA's information assets.

• Protect the health and safety of the NASA workforce.

• Improve the likelihood that NASA's programs, projects, and operations are completed safely and successfully.

REQUIRED SUPPLEMENTARY INFORMATION

Combining Statement of Budgetary Resources For the Fiscal Year Ended September 30, 2017

(In Millions of Dollars)	Space Operations	Science	Exploration	Aeronautics	Safety, Security and Mission Services	Education
Budgetary Resources:						
Unobligated Balance, Brought Forward, October 1	$ 158	$ 316	$ 49	$ 13	$ 310	$ 14
Recoveries of Prior Year Unpaid Obligations	47	47	35	7	40	4
Other Changes in Unobligated Balance	4	(6)	—	(1)	2	—
Unobligated Balance from Prior Year Budget Authority, Net	209	357	84	19	352	18
Appropriations	4,942	5,763	4,324	656	2,768	100
Spending Authority from Offsetting Collections	—	—	—	—	2,479	—
Total Budgetary Resources	**$ 5,151**	**$ 6,120**	**$ 4,408**	**$ 675**	**$ 5,599**	**$ 118**
Status of Budgetary Resources:						
New Obligations and Upward Adjustments (Total)	$ 5,002	$ 5,807	$ 4,319	$ 660	$ 5,143	$ 106
Unobligated Balance, End of Year:						
Apportioned, Unexpired Accounts	90	298	53	13	451	8
Unapportioned, Unexpired Accounts	—	—	28	—	—	—
Unexpired Unobligated Balance, End of Year	90	298	81	13	451	8
Expired Unobligated Balance, End of Year	59	15	8	2	5	4
Unobligated Balance, End of Year (Total)	149	313	89	15	456	12
Total Status of Budgetary Resources	**$ 5,151**	**$ 6,120**	**$ 4,408**	**$ 675**	**$ 5,599**	**$ 118**
Change in Obligated Balance:						
Unpaid Obligations:						
Unpaid Obligations, Brought Forward, October 1	$ 1,718	$ 3,622	$ 1,270	$ 344	$ 2,227	$ 180
New Obligations and Upward Adjustments (Total)	5,002	5,807	4,319	660	5,143	106
Outlays (Gross) (-)	(4,241)	(5,524)	(4,151)	(629)	(5,145)	(124)
Recoveries of Prior Year Unpaid Obligations (-)	(47)	(47)	(35)	(7)	(40)	(4)
Unpaid Obligations, End of Year	2,432	3,858	$ 1,403	368	$ 2,185	158
Uncollected payments:						
Uncollected Payments, Federal Sources, Brought Forward, October 1 (-)	—	—	—	—	(1,444)	—
Change in Uncollected Payments, Federal Sources	—	—	—	—	(169)	—
Uncollected Payments, Federal Sources, End of Year (-)	—	—	—	—	(1,613)	—
Memorandum (Non-Add) Entries:						
Obligated Balance, Start of Year	**1,718**	**3,622**	**1,270**	**344**	**783**	**180**
Obligated Balance, End of Year	**$ 2,432**	**$ 3,858**	**$ 1,403**	**$ 368**	**$ 572**	**$ 158**
Budget Authority and Outlays, Net:						
Budget Authority, Gross	$ 4,942	$ 5,763	$ 4,324	$ 656	$ 5,247	$ 100
Actual Offsetting Collections (-)	(4)	(2)	—	—	(2,312)	—
Change in Uncollected Payments, Federal Sources	—	—	—	—	(169)	—
Recoveries of Prior Year Paid Obligations	4	2	—	—	2	—
Budget Authority, Net (Total)	**4,942**	**5,763**	**4,324**	**656**	**2,768**	**100**
Outlays, Gross	4,241	5,524	4,151	629	5,145	124
Actual Offsetting Collections (-)	(4)	(2)	—	—	(2,312)	—
Outlays, Net (Total)	4,237	5,522	4,151	629	2,833	124
Distributed Offsetting Receipts (-)	—	—	—	—	—	—
Agency Outlays, Net	**$ 4,237**	**$ 5,522**	**$ 4,151**	**$ 629**	**$ 2,833**	**$ 124**

REQUIRED SUPPLEMENTARY INFORMATION (continued)

Combining Statement of Budgetary Resources
For the Fiscal Year Ended September 30, 2017 (continued)

(In Millions of Dollars)	Office of Inspector General	Space Technology	Construction and Environmental Compliance and Restoration	Other	Total
Budgetary Resources:					
Unobligated Balance, Brought Forward, October 1	$ 2	$ 74	$ 134	$ 22	$ 1,092
Recoveries of Prior Year Unpaid Obligations	1	6	14	5	206
Other Changes in Unobligated Balance	—	1	—	—	—
Unobligated Balance from Prior Year Budget Authority, Net	3	81	148	27	1,298
Appropriations	38	686	559	2	19,838
Spending Authority from Offsetting Collections	1	—	6	437	2,923
Total Budgetary Resources	**$ 42**	**$ 767**	**$ 713**	**$ 466**	**$ 24,059**
Status of Budgetary Resources:					
New Obligations and Upward Adjustments (Total)	$ 40	$ 720	$ 443	$ 438	$ 22,678
Unobligated Balance, End of Year:					
Apportioned, Unexpired Accounts	—	42	262	17	1,234
Unapportioned, Unexpired Accounts	—	—	8	1	37
Unexpired Unobligated Balance, End of Year	—	42	270	18	1,271
Expired Unobligated Balance, End of Year	2	5	—	10	110
Unobligated Balance, End of Year (Total)	2	47	270	28	1,381
Total Status of Budgetary Resources	**$ 42**	**$ 767**	**$ 713**	**$ 466**	**$ 24,059**
Change in Obligated Balance:					
Unpaid Obligations:					
Unpaid Obligations, Brought Forward, October 1	$ 4	$ 485	$ 719	$ 176	$ 10,745
New Obligations and Upward Adjustments (Total)	40	720	443	438	22,678
Outlays (Gross) (-)	(39)	(699)	(490)	(423)	(21,465)
Recoveries of Prior Year Unpaid Obligations (-)	(1)	(6)	(14)	(5)	(206)
Unpaid Obligations, End of Year	4	500	658	186	11,752
Uncollected payments:					
Uncollected Payments, Federal Sources, Brought Forward, October 1 (-)	—	—	—	—	(1,444)
Change in Uncollected Payments, Federal Sources	—	—	—	—	(169)
Uncollected Payments, Federal Sources, End of Year (-)	—	—	—	—	(1,613)
Memorandum (Non-Add) Entries:					
Obligated Balance, Start of Year	**4**	**485**	**719**	**176**	**9,301**
Obligated Balance, End of Year	**$ 4**	**$ 500**	**$ 658**	**$ 186**	**$ 10,139**
Budget Authority and Outlays, Net:					
Budget Authority, Gross	$ 39	$ 686	$ 565	$ 439	$ 22,761
Actual Offsetting Collections (-)	(1)	(1)	(6)	(437)	(2,763)
Change in Uncollected Payments, Federal Sources	—	—	—	—	(169)
Recoveries of Prior Year Paid Obligations	—	1	—	—	9
Budget Authority, Net (Total)	**38**	**686**	**559**	**2**	**$ 19,838**
Outlays, Gross	39	699	490	$ 423	21,465
Actual Offsetting Collections (-)	(1)	(1)	(6)	(437)	(2,763)
Outlays, Net (Total)	38	698	484	(14)	18,702
Distributed Offsetting Receipts (-)	—	—	—	(4)	(4)
Agency Outlays, Net	**$ 38**	**$ 698**	**$ 484**	**$ (18)**	**$ 18,698**

REQUIRED SUPPLEMENTARY INFORMATION (continued)

Combining Statement of Budgetary Resources
For the Fiscal Year Ended September 30, 2016

(In Millions of Dollars)	Space Operations	Science	Exploration	Aeronautics	Safety, Security and Mission Services	Education
Budgetary Resources:						
Unobligated Balance, Brought Forward, October 1	$ 220	$ 284	$ 60	$ 14	$ 258	$ 35
Recoveries of Prior Year Unpaid Obligations	43	43	42	13	45	3
Other Changes in Unobligated Balance	2	(8)	(19)	(3)	(10)	(1)
Unobligated Balance from Prior Year Budget Authority, Net	265	319	83	24	293	37
Appropriations	5,015	5,584	4,014	634	2,772	115
Spending Authority from Offsetting Collections	—	—	—	—	2,581	—
Total Budgetary Resources	**$ 5,280**	**$ 5,903**	**$ 4,097**	**$ 658**	**$ 5,646**	**$ 152**
Status of Budgetary Resources:						
New Obligations and Upward Adjustments (Total)	$ 5,122	$ 5,587	$ 4,048	$ 645	$ 5,336	$ 138
Unobligated Balance, End of Year:						
Apportioned, Unexpired Accounts	104	301	44	12	303	11
Unapportioned, Unexpired Accounts	—	—	—	—	—	—
Unexpired Unobligated Balance, End of Year	104	301	44	12	303	11
Expired Unobligated Balance, End of Year	54	15	5	1	7	3
Unobligated Balance, End of Year (Total)	158	316	49	13	310	14
Total Status of Budgetary Resources	**$ 5,280**	**$ 5,903**	**$ 4,097**	**$ 658**	**$ 5,646**	**$ 152**
Change in Obligated Balance:						
Unpaid Obligations:						
Unpaid Obligations, Brought Forward, October 1	$ 1,589	$ 3,253	$ 1,501	$ 322	$ 1,859	$ 159
New Obligations and Upward Adjustments (Total)	5,122	5,587	4,048	645	5,336	138
Outlays (Gross) (-)	(4,950)	(5,175)	(4,237)	(610)	(4,923)	(114)
Recoveries of Prior Year Unpaid Obligations (-)	(43)	(43)	(42)	(13)	(45)	(3)
Unpaid Obligations, End of Year	1,718	3,622	$ 1,270	344	$ 2,227	180
Uncollected payments:						
Uncollected Payments, Federal Sources, Brought Forward, October 1 (-)	—	—	—	—	(1,105)	—
Change in Uncollected Payments, Federal Sources	—	—	—	—	(339)	—
Uncollected Payments, Federal Sources, End of Year (-)	—	—	—	—	(1,444)	—
Memorandum (Non-Add) Entries:						
Obligated Balance, Start of Year	**1,589**	**3,253**	**1,501**	**322**	**754**	**159**
Obligated Balance, End of Year	**$ 1,718**	**$ 3,622**	**$ 1,270**	**$ 344**	**$ 783**	**$ 180**
Budget Authority and Outlays, Net:						
Budget Authority, Gross	$ 5,015	$ 5,584	$ 4,014	$ 634	$ 5,353	$ 115
Actual Offsetting Collections (-)	(1)	(1)	(1)	—	(2,250)	—
Change in Uncollected Payments, Federal Sources	—	—	—	—	(339)	—
Recoveries of Prior Year Paid Obligations	1	1	1	—	8	—
Budget Authority, Net (Total)	**5,015**	**5,584**	**4,014**	**634**	**2,772**	**115**
Outlays, Gross	4,950	5,175	4,237	610	4,923	114
Actual Offsetting Collections (-)	(1)	(1)	(1)	—	(2,250)	—
Outlays, Net (Total)	4,949	5,174	4,236	610	2,673	114
Distributed Offsetting Receipts (-)	—	—	—	—	—	—
Agency Outlays, Net	**$ 4,949**	**$ 5,174**	**$ 4,236**	**$ 610**	**$ 2,673**	**$ 114**

REQUIRED SUPPLEMENTARY INFORMATION (continued)

Combining Statement of Budgetary Resources
For the Fiscal Year Ended September 30, 2016 (continued)

(In Millions of Dollars)	Office of Inspector General	Space Technology	Construction and Environmental Compliance and Restoration	Other	Total
Budgetary Resources:					
Unobligated Balance, Brought Forward, October 1	$ 2	$ 50	$ 162	$ 19	$ 1,104
Recoveries of Prior Year Unpaid Obligations	1	10	33	10	243
Other Changes in Unobligated Balance	—	4	19	—	(16)
Unobligated Balance from Prior Year Budget Authority, Net	3	64	214	29	1,331
Appropriations	37	687	427	1	19,286
Spending Authority from Offsetting Collections	1	—	6	414	3,002
Total Budgetary Resources	**$ 41**	**$ 751**	**$ 647**	**$ 444**	**$ 23,619**
Status of Budgetary Resources:					
New Obligations and Upward Adjustments (Total)	$ 39	$ 677	$ 513	$ 422	$ 22,527
Unobligated Balance, End of Year:					
Apportioned, Unexpired Accounts	—	70	134	15	994
Unapportioned, Unexpired Accounts	—	1	—	1	2
Unexpired Unobligated Balance, End of Year	—	71	134	16	996
Expired Unobligated Balance, End of Year	2	3	—	6	96
Unobligated Balance, End of Year (Total)	2	74	134	22	1,092
Total Status of Budgetary Resources	**$ 41**	**$ 751**	**$ 647**	**$ 444**	**$ 23,619**
Change in Obligated Balance:					
Unpaid Obligations:					
Unpaid Obligations, Brought Forward, October 1	$ 4	$ 378	$ 734	$ 170	$ 9,969
New Obligations and Upward Adjustments (Total)	39	677	513	422	22,527
Outlays (Gross) (-)	(38)	(560)	(495)	(406)	(21,508)
Recoveries of Prior Year Unpaid Obligations (-)	(1)	(10)	(33)	(10)	(243)
Unpaid Obligations, End of Year	4	485	719	176	10,745
Uncollected payments:					
Uncollected Payments, Federal Sources, Brought Forward, October 1 (-)	—	—	—	—	(1,105)
Change in Uncollected Payments, Federal Sources	—	—	—	—	(339)
Uncollected Payments, Federal Sources, End of Year (-)	—	—	—	—	(1,444)
Memorandum (Non-Add) Entries:					
Obligated Balance, Start of Year	**4**	**378**	**734**	**170**	**8,864**
Obligated Balance, End of Year	**$ 4**	**$ 485**	**$ 719**	**$ 176**	**$ 9,301**
Budget Authority and Outlays, Net:					
Budget Authority, Gross	$ 38	$ 687	$ 433	$ 415	$ 22,288
Actual Offsetting Collections (-)	(1)	—	(6)	(414)	(2,674)
Change in Uncollected Payments, Federal Sources	—	—	—	—	(339)
Recoveries of Prior Year Paid Obligations	—	—	—	—	11
Budget Authority, Net (Total)	**37**	**687**	**427**	**1**	**$ 19,286**
Outlays, Gross	38	560	495	$ 406	21,508
Actual Offsetting Collections (-)	(1)	—	(6)	(414)	(2,674)
Outlays, Net (Total)	37	560	489	(8)	18,834
Distributed Offsetting Receipts (-)	—	—	—	(5)	(5)
Agency Outlays, Net	**$ 37**	**$ 560**	**$ 489**	**$ (13)**	**$ 18,829**

REQUIRED SUPPLEMENTARY INFORMATION (continued)

Deferred Maintenance and Repairs for FY 2017

Federal agencies are required to report information related to the estimated cost to remedy deferred maintenance of property, plant and equipment as required supplementary information in accordance with SFFAS No. 42, *Deferred Maintenance and Repairs*.

Maintenance and repairs (M&R) are activities directed toward keeping fixed assets in an acceptable condition. Activities include preventive maintenance; replacement of parts, systems, or components; and other activities needed to preserve or maintain the asset. M&R, as distinguished from capital improvements, excludes activities directed toward expanding the capacity of an asset or otherwise upgrading it to serve needs different from, or significantly greater than, its current use. Deferred maintenance and repairs (DM&R) are M&R activities that were not performed when they should have been or were scheduled to be and which, therefore, are put off or delayed for a future period. DM&R reporting enables the Government to be accountable to citizens for the proper administration and stewardship of its assets. Specifically, DM&R reporting assists users by providing an entity's realistic estimate of DM&R amounts and the effectiveness of asset maintenance practices the entities employ in fulfilling their missions.

Facilities, Buildings, and Other Structures

It is NASA's policy to ensure that NASA-owned and operated assets are properly aligned with the NASA mission and are safe, environmentally sound, affordable, the right type and size, and in acceptable operating condition. NASA's facilities are maintained in the most cost effective fashion to minimize risk to processes and products, protect the safety and health of personnel and the environment, protect and preserve capabilities and capital investments, provide quality work places for NASA employees, and enable the Agency's mission. Estimates reported herein include DM&R for all facilities on-site or off-site that are owned, leased, occupied, or used by NASA (NASA Programs or Contractors) including heritage assets without regard to capitalization thresholds or depreciation status. NASA does not assess DM&R on general land parcels.

Equipment

Pursuant to the cost/benefit considerations provided in SFFAS No. 6 and SFFAS No. 42, NASA has determined that it is not cost beneficial to report DM&R on personal property (capital equipment).

Defining and Implementing M&R Policies

NASA uses a Deferred Maintenance parametric estimating method (DM method) in order to conduct a consistent condition assessment of its facilities, buildings and other structures (including heritage assets). This method measures NASA's current real property asset condition and documents the extent of real property deterioration. The DM method produces both a cost estimate of DM&R, and a Facility Condition Index (FCI). Both measures are indicators of the overall condition of NASA's facilities. The facilities condition assessment methodology involves an independent, rapid visual assessment of nine different systems within each facility to include: structure, roof, exterior, interior finishes, heating, ventilating and air conditioning (HVAC) systems, electrical, plumbing, conveyance, and program support equipment. The DM method is designed for application to a large population of facilities; results are not necessarily applicable for individual facilities or small populations of facilities.

Ranking and Prioritizing M&R Activities

NASA typically prioritizes the M&R activities for health, safety, life safety, fire detection and protection, and environmental requirements. NASA also prioritizes the M&R projects with an emphasis on mission critical facilities, followed by mission support, then Center support. The evaluation of the facility conditions by building type indicates that NASA continues to focus M&R activities on direct mission-related facilities and infrastructure.

REQUIRED SUPPLEMENTARY INFORMATION (continued)

Deferred Maintenance and Repairs for FY 2017 (continued)

Factors Considered in Determining Acceptable Condition Standards

NASA applies industry accepted codes and standards or equipment manufacturer's recommendations to all facilities related work. The standard of condition depends on the intended use, the mission criticality, utilization or health and safety aspects of that use.

Changes from Prior Year

As of September 30, 2017, $2.43 billion of DM&R was estimated to be required to return real property assets to an acceptable operating condition. This is an overall increase of $42 million from September 30, 2016. The increase in the DM&R estimate can be attributed to various reasons, including changes to deterioration of HVAC and electrical systems due to age, diminished availability of replacement parts, and incompatibility with newer automated control systems.

In FY 2017, DM surveys were performed on half of NASA's Real Property Assets and the other half were escalated. Under this process, the other half of NASA's Real Property Assets will be assessed next year.

Deferred Maintenance and Repairs

(In Millions of Dollars)	2017	2016
Asset Category		
Real Property	$ 2,416	$ 2,374
Heritage Assets - Real Property	12	12
Total Deferred Maintenance and Repairs	**$ 2,428**	**$ 2,386**

NASA OFFICE OF INSPECTOR GENERAL

SUITE 8U37, 300 E ST SW
WASHINGTON, D.C. 20546-0001

November 15, 2017

TO: Robert M. Lightfoot Jr.
Acting Administrator

Andrew Hunter
Acting Chief Financial Officer

SUBJECT: *Audit of NASA's Fiscal Year 2017 Financial Statements* (Report No. IG-18-005; Assignment No. A-17-006-00)

Dear Acting Administrator Lightfoot and Mr. Hunter,

The Office of Inspector General contracted with the independent public accounting firm CliftonLarsonAllen LLP (CLA) to audit NASA's fiscal year (FY) 2017 financial statements. CLA performed the audit in accordance with the Government Accountability Office's (GAO) *Government Auditing Standards* and the Office of Management and Budget's Bulletin No. 17-03, "Audit Requirements for Federal Financial Statements."

This audit resulted in an unmodified opinion on NASA's FY 2017 financial statements (see attached Enclosure). An unmodified opinion means the financial statements present fairly, in all material respects, the financial position and results of NASA's operations in conformity with U.S. generally accepted accounting principles.

CLA also reported on NASA's internal control and compliance with laws and regulations. For FY 2017, CLA identified two significant deficiencies: (1) information technology management and (2) recording certain liabilities related to the Jet Propulsion Laboratory. Further, NASA resolved this year the previously reported noncompliance with the implementing guidance for the Single Audit Act, as amended (Uniform Guidance). CLA did not identify any new instances of noncompliance this year.

We monitored the progress of the audit, reviewed CLA's reports and related documentation, inquired of CLA's representatives, and ensured CLA met contractual requirements. Our review was not intended to enable us to express and we do not express an opinion on NASA's financial statements, conclusions about the effectiveness of internal controls over financial reporting, or conclusions on compliance with certain laws and regulations, including but not limited to the Federal Financial Management Improvement Act of 1996. Rather, CLA is responsible for the enclosed report and the conclusions expressed therein. That said, our review disclosed no instances where CLA did not comply in all material respects with GAO's *Government Auditing Standards.*

We appreciate the courtesies extended to our team during the audit. Please contact Jim Morrison, Assistant Inspector General for Audits, at 202-358-0378 or james.l.morrison@nasa.gov if you have any questions about the enclosed report.

Sincerely,

Paul K. Martin
Inspector General

CliftonLarsonAllen LLP
www.cliftonlarsonallen.com

INDEPENDENT AUDITORS' REPORT

Acting Administrator
National Aeronautics and Space Administration

Inspector General
National Aeronautics and Space Administration

Report on the Financial Statements

We have audited the accompanying consolidated financial statements of the National Aeronautics and Space Administration (NASA), which comprise the consolidated balance sheets as of September 30, 2017 and 2016, and the related consolidated statements of net cost and changes in net position, and the combined statements of budgetary resources for the years then ended, and the related notes to the consolidated financial statements (collectively referred to as financial statements).

Management's Responsibility for the Financial Statements

NASA management is responsible for the preparation and fair presentation of these financial statements in accordance with accounting principles generally accepted in the United States of America (U.S.); this includes the design, implementation, and maintenance of internal control relevant to the preparation and fair presentation of financial statements that are free from material misstatement, whether due to fraud or error.

Auditors' Responsibility

Our responsibility is to express an opinion on these financial statements based on our audits. We conducted our audits in accordance with auditing standards generally accepted in the U.S.; the standards applicable to financial audits contained in *Government Auditing Standards*, issued by the Comptroller General of the United States; and Office of Management and Budget (OMB) Bulletin No. 17-03*, Audit Requirements for Federal Financial Statements* (OMB Bulletin 17-03). Those standards and OMB Bulletin 17-03 require that we plan and perform the audits to obtain reasonable assurance about whether the financial statements are free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedures selected depend on the auditors' judgment, including the assessment of the risk of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers internal control relevant to the entity's preparation and fair presentation of the financial statements in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the entity's internal control.

INDEPENDENT AUDITORS' REPORT (Continued)

Accordingly, we express no such opinion. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of significant accounting estimates made by management, as well as evaluating the overall presentation of the financial statements.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

Opinion on the Financial Statements

In our opinion, the consolidated financial statements referred to above present fairly, in all material respects, the financial position of the National Aeronautics and Space Administration as of September 30, 2017 and 2016 and its net cost, changes in net position, and budgetary resources for the years then ended, in accordance with accounting principles generally accepted in the U.S.

Other Matters

Required Supplementary Information

Accounting principles generally accepted in the U.S. require that the information in NASA's Management Discussion and Analysis (MD&A), Required Supplementary Information (RSI), and Required Supplementary Stewardship Information (RSSI) sections be presented to supplement the financial statements. Such information, although not a part of the financial statements, is required by the Federal Accounting Standards Advisory Board, who considers it to be an essential part of financial reporting for placing the financial statements in an appropriate operational, economic, or historical context. We have applied certain limited procedures to the required supplementary information in accordance with auditing standards generally accepted in the U.S., which consisted of inquiries of management about the methods of preparing the information and comparing the information for consistency with management's responses to our inquiries, the financial statements, and other knowledge we obtained during our audits of the financial statements. We do not express an opinion or provide any assurance on this information because the limited procedures do not provide us with sufficient evidence to express an opinion or provide any assurance.

Other Information

Our audits were conducted for the purpose of forming an opinion on the financial statements as a whole. All other sections referred to in the Agency Financial Report (AFR) table of contents, exclusive of the MD&A; Financial Statements, Notes, and Supplemental Information; and Independent Auditors' Report, are presented for purposes of additional analysis and are not a required part of the financial statements. In addition, management has included references to information on websites or other data outside of the AFR. This information has not been subjected to the auditing procedures applied in the audits of the financial statements, and accordingly, we do not express an opinion or provide any assurance on it.

INDEPENDENT AUDITORS' REPORT (Continued)

Report on Internal Control over Financial Reporting and on Compliance and Other Matters Based on an Audit of Financial Statements Performed in Accordance with *Government Auditing Standards*

Internal Control over Financial Reporting

In planning and performing our audit of the consolidated financial statements as of and for the year ended September 30, 2017, we considered NASA's internal control over financial reporting (internal control) to determine the audit procedures that are appropriate in the circumstances for the purpose of expressing our opinion on the financial statements, but not for the purpose of expressing an opinion on the effectiveness of NASA's internal control. Accordingly, we do not express an opinion on the effectiveness of NASA's internal control.

A *deficiency* in internal control exists when the design or operation of a control does not allow management or employees, in the normal course of performing their assigned functions, to prevent, or detect and correct, misstatements on a timely basis. A *material weakness* is a deficiency, or a combination of deficiencies, in internal control, such that there is a reasonable possibility that a material misstatement of NASA's financial statements will not be prevented, or detected and corrected on a timely basis. A *significant deficiency* is a deficiency, or a combination of deficiencies, in internal control that is less severe than a material weakness, yet important enough to merit attention by those charged with governance.

Our consideration of internal control was for the limited purpose described in the first paragraph of this section and was not designed to identify all deficiencies in internal control that might be material weaknesses or significant deficiencies and therefore, material weaknesses or significant deficiencies may exist that have not been identified. Given these limitations, during our audit we did not identify any deficiencies in internal control that we consider to be material weaknesses. However, we did identify certain deficiencies in internal control that we consider to be significant deficiencies. These deficiencies are listed below and described in **Exhibit A**:

- Information Technology Management
- Recording Certain Liabilities Related to the Jet Propulsion Laboratory

Compliance with Laws, Regulations, Contracts, and Grant Agreements

As part of obtaining reasonable assurance about whether NASA's financial statements are free from material misstatement, we performed tests of its compliance with certain provisions of laws, regulations, contracts, and grant agreements, noncompliance with which could have a direct effect on the determination of material financial statement amounts and disclosures. However, providing an opinion on compliance with those provisions was not an objective of our audit, and accordingly, we do not express such an opinion. The results of our tests for the year ended September 30, 2017 disclosed no instances of noncompliance or other matters that are required to be reported in accordance with *Government Auditing Standards* or OMB Bulletin 17-03.

We also performed tests of compliance with certain provisions of the Federal Financial Management Improvement Act of 1996 (FFMIA). However, providing an opinion on compliance with FFMIA was not an objective of our audit, and accordingly, we do not express such an opinion. The results of our tests of these provisions disclosed no instances in which NASA's financial management systems did not comply substantially with (1) Federal financial management

INDEPENDENT AUDITORS' REPORT (Continued)

systems requirements, (2) applicable Federal accounting standards, or (3) the United States Standard General Ledger (USSGL) at the transaction level.

Management's Responsibility for Internal Control and Compliance

Management is responsible for (1) evaluating the effectiveness of internal control over financial reporting based on criteria established under the Federal Managers' Financial Integrity Act of 1982 (FMFIA), (2) providing a statement of assurance on the overall effectiveness on internal control over financial reporting, (3) ensuring NASA's financial management systems comply substantially with FFMIA requirements, and (4) complying with other applicable laws, regulations, contracts, and grant agreements.

Auditors' Responsibilities

We are responsible for: (1) obtaining a sufficient understanding of internal control over financial reporting to plan the audit, (2) testing whether NASA's financial management systems comply substantially with the FFMIA requirements referred to above, and (3) testing compliance with certain provisions of laws, regulations, contracts, and grant agreements.

We did not evaluate all internal controls relevant to operating objectives as broadly established by the FMFIA, such as those controls relevant to preparing statistical reports and ensuring efficient operations. We limited our internal control testing to controls over financial reporting. Because of inherent limitations in internal control, misstatements due to error or fraud, losses, or noncompliance may nevertheless occur and not be detected. We also caution that projecting our audit results to future periods is subject to risk that controls may become inadequate because of changes in conditions or that the degree of compliance with controls may deteriorate. In addition, we caution that our internal control testing may not be sufficient for other purposes.

We did not test compliance with all laws, regulations, contracts, and grant agreements applicable to NASA. We limited our tests to certain provisions of laws, regulations, contracts, and grant agreements noncompliance with which could have a direct effect on the determination of material financial statement amounts and disclosures. However, providing an opinion on compliance with those provisions was not an objective of our audit, and accordingly, we do not express such an opinion. We caution that noncompliance may occur and not be detected by these tests and that such testing may not be sufficient for other purposes. Also, our work on FFMIA would not necessarily disclose all instances of noncompliance with FFMIA requirements.

Management's Response to Findings

Management's response to the findings identified in our report is presented in **Exhibit B**. We did not audit NASA's response and, accordingly, we express no opinion on it.

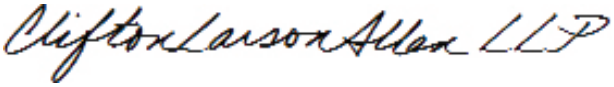
Status of Prior Year's Control Deficiencies and Noncompliance Issue

We have reviewed the status of NASA's corrective actions with respect to the findings included in the prior year's Independent Auditors' Report, dated November 15, 2016. The status of prior year findings is presented in **Exhibit C**.

INDEPENDENT AUDITORS' REPORT (Continued)

Purpose of the Report on Internal Control over Financial Reporting and on Compliance

The purpose of the Report on Internal Control over Financial Reporting and on Compliance is solely to describe the scope of our testing of internal control and compliance and the results of that testing, and not to provide an opinion on the effectiveness of NASA's internal control or on compliance. These reports are an integral part of an audit performed in accordance with *Government Auditing Standards* in considering NASA's internal control and compliance. Accordingly, these reports are not suitable for any other purpose.



CliftonLarsonAllen LLP

Calverton, Maryland
November 15, 2017

INDEPENDENT AUDITORS' REPORT (Continued)
EXHIBIT A
Significant Deficiencies
September 30, 2017

Information Technology Management

Background

The United States Government Accountability Office (GAO) has stated that protecting government computer systems has never been more important because of the complexity and interconnectivity of systems (including those exposed to the Internet and wireless connections), the ease of obtaining and using hacking tools, the steady advances in the sophistication and effectiveness of attack technologies, and the emergence of new and more destructive attacks. Further, the boundary lines between internal and external networks are diminishing as a result of increased interconnectivity. GAO cited challenges, such as maintaining software at current versions with the latest security patches to protect against known vulnerabilities, as contributing factors to weaknesses within Federal agency security programs.

To address these issues throughout the government, the Office of Management and Budget (OMB) revised OMB Circular No. A-130, *Managing Federal Information as a Strategic Resource* (OMB Circular A-130). This circular defines agencies' responsibilities for protecting Federal information resources. NASA relies extensively on Information Technology (IT) system controls to govern the initiation and authorization of financial transactions at user workstations, and the transmission of those transactions across the network to servers that record, process, summarize, and report financial transactions in support of the financial statements. Internal controls over these financial and supporting operations are essential to ensure the confidentiality, integrity, and availability (C-I-A) of critical data while reducing the risk of error, fraud, and other illegal acts.

Information Technology Conditions

IT controls include general controls (at the network, system, and application layers), as well as application business process controls. General controls are the policies and procedures that apply to all or a large segment of an entity's information systems and help ensure their proper operation. The effectiveness of general controls is a significant factor in establishing the effectiveness of business process application controls. Application level general controls consist of general controls operating at the business process application level, including those related to security management, access controls, configuration management, segregation of duties, and contingency planning. Weaknesses in application level general controls can result in unauthorized access, use, disclosure, disruption, modification, or destruction of applications and application data. Without effective general application controls, business process application controls may be rendered ineffective by circumvention or modification.

One of the key general control areas includes configuration management controls. Configuration management controls are intended to provide reasonable assurance that systems, networks, and applications are configured and operating securely. Vulnerability management, an important component of configuration management, specifically addresses mitigating the risks associated with known vulnerabilities.

In the prior years, we noted that NASA did not have an effective vulnerability management process relating to monitoring, detecting, and remediating known vulnerabilities. Specifically, we noted deficiencies in the following areas: A) Patch Management, B) Configuration Weaknesses and Default Passwords, and C) Unsupported Software. In addition, we noted that NASA had additional control deficiencies at the Financial System Application layer related to Segregation of Duties (SoD), User Administration and Least Privilege, and Audit Logging and Monitoring.

INDEPENDENT AUDITORS' REPORT (Continued)
EXHIBIT A
Significant Deficiencies
September 30, 2017

To address the prior year issues, management implemented a strategic plan to remediate the weaknesses. The strategic plan included management's objective and approach to addressing prior year findings in a holistic manner by implementing four critical initiatives: Vulnerability Management, Patch Management, Configuration Management, and Insider Threat Management. While management has made progress in developing a strategic plan to address these issues, it will take time to effectively implement and execute the corrective action plans across the enterprise. As such, we found security weaknesses similar in type and risk level to our findings last year.

While progress has been made, NASA did not substantially address deficiencies in its vulnerability management program identified in the prior year. The vulnerability management program continued to insufficiently address the monitoring, detection, and timely remediation of vulnerabilities associated with the financial application and general support systems. Specifically, a substantial number of critical and high severity vulnerabilities (as well as medium and low vulnerabilities) remained outstanding for an excessive length of time, contrary to NASA policies and procedures. These weaknesses expose NASA to significant risk of exploitation. Below are the categories of control deficiencies related to NASA's vulnerability management program.

1. **Patch Management** – Systems, applications, and networks supporting financial applications were not patched in accordance with NASA guidelines to mitigate information security vulnerabilities. Patching is usually the most effective way to mitigate security flaws in software. Failure to apply patches timely increases the risk that known vulnerabilities will be exploited.

2. **Configuration Weaknesses and Default Passwords** – Operating systems and applications were inadequately configured, including systems with default passwords, which placed key financial systems at unnecessary risk of unauthorized access and manipulation. Default settings are publicly available on the Internet and are well known by attackers. These settings can be exploited to allow them to gain unauthorized access that can compromise the C-I-A of sensitive information. Failure to change weak security configurations, including default password settings, could result in successful attacks on NASA's financial and supporting systems.

3. **Unsupported Software** – Systems and programs, which were no longer fully supported by the associated software vendors, remained so for an extended period of time and continued to expose NASA to vulnerabilities that cannot be sufficiently mitigated.

NASA relied on their defense in depth (DiD) approach, the intent of which was to implement controls at each layer of their IT environment, in order to comprehensively address security risks from vulnerabilities. While we found that NASA had implemented certain defensive technologies and processes to protect the C-I-A of NASA's data, we noted deficiencies in NASA's DiD approach. Specifically, NASA did not substantially address prior year deficiencies related to their financial systems' (General Ledger and Procurement systems) general application controls, outlined below:

1. **Segregation of Duties (SoD)** – NASA's SoD management tool was not appropriately configured to comprehensively prevent or detect SoD conflicts.

INDEPENDENT AUDITORS' REPORT (Continued)
EXHIBIT A
Significant Deficiencies
September 30, 2017

2. **User Administration and Least Privilege** – We noted several users that had excessive financial system privileges. Additionally, we noted powerful default users whose access was not appropriately restricted.

3. **Audit Logging and Monitoring** – NASA did not have effective audit logging and monitoring controls over the financial systems that would adequately identify and address suspicious and potentially harmful activity.

NASA did not follow internal and Federal standards in implementing configuration management and access controls as noted by the following standards:

- NASA Information Technology Security Handbook, *Security Categorization, Risk Assessment, Vulnerability Scanning, Expedited Patching, & Organizationally Defined Values,* (ITS-HBK 2810.04-01A) requires that management "[m]itigate expedited patches within seven business days, non-expedited patches within 30 days, mitigate high and medium vulnerabilities from monthly scans within 30 days of scan date; mitigate high and medium vulnerabilities from quarterly scans within 90 days from scan date; mitigate low vulnerabilities from monthly and quarterly scans within 180 days from scan date."

- OMB Circular A-130, *Managing Information as a Strategic Resource*, Appendix I, establishes minimum requirements for Federal information programs and assigns Federal agency responsibilities for the security of information and information systems. The Circular specifically prohibits agencies from the use of unsupported information systems and system components, and requires agencies to ensure that systems and components that cannot be appropriately protected or secured are given a high priority for upgrade or replacement. In addition, the Circular requires agencies to implement and maintain current updates and patches for all software and firmware components of information systems.

- The National Institute of Standards and Technology (NIST) Special Publication (SP) 800-53, Revision 4, *Security and Privacy Controls for Federal Information Systems and Organizations*, security controls related to patch management and access controls note the following:

  - SI-2, Flaw Remediation, states that an organization must identify information systems affected by announced software flaws, including potential vulnerabilities resulting from those flaws, and report this information to designated organizational personnel with information security responsibilities. Security-relevant software updates include, for example, patches, service packs, hot fixes, and anti-virus signatures.
  - AU-6, Audit Review, Analysis and Reporting, states that an organization must review and analyze information system audit records for indications of inappropriate or unusual activity.
  - AC-5, Separation of Duties, states that an organization must separate organizationally defined duties of individuals, document separations of duties of individuals, and define information system access authorizations to support separation of duties.

INDEPENDENT AUDITORS' REPORT (Continued)
EXHIBIT A
Significant Deficiencies
September 30, 2017

- AC-6, Least Privilege, states that an organization must employ the principle of least privilege, allowing only authorized accesses for users (or processes acting on behalf of users) which are necessary to accomplish assigned tasks in accordance with organizational missions and business functions.

- NIST SP 800-40, Revision 3, *Guide to Enterprise Patch Management Technologies*, states, "[p]atches are usually the most effective way to mitigate software flaw vulnerabilities, and are often the only fully effective solution. Sometimes there are alternatives to patches, such as temporary workarounds involving software or security control reconfiguration, but these workarounds often negatively impact functionality."

Absent an effectively implemented and enforced configuration management program that addresses significant security weaknesses, there is an increased risk that financial information may be inadvertently or deliberately disclosed, manipulated, or misappropriated. Additionally, inappropriate or unnecessary changes may be made to key financial information systems, which could result in compromising the accuracy and integrity of financial information. Further, without effective application access controls, there is an increased risk of unauthorized or inappropriate access to financial and sensitive data.

We will provide NASA management with a separate limited distribution report that further details vulnerabilities in NASA's systems. Due to the sensitivity of the subject matter, we have not discussed those matters in this report.

Recommendations:
We recommend that NASA enhance their efforts to analyze and prioritize remediation to address security and control deficiencies with a focus on these key tasks that include, but are not limited to:

1. Implement improved processes to continuously identify and remediate security deficiencies on the financial application and general support systems.
2. Implement an improved patch and vulnerability management program to address security deficiencies.
3. Implement an effective process to eliminate configuration weaknesses which may allow unauthorized access to sensitive system resources and files.
4. Develop and implement a strategic plan to address outdated technologies that are no longer supported by the vendor.
5. Implement improved deployment processes to eliminate vendor default passwords and weak configurations at the time of installation.
6. Remediate and enhance IT general, application, and technical controls within NASA's IT environment.

INDEPENDENT AUDITORS' REPORT (Continued)
EXHIBIT A
Significant Deficiencies
September 30, 2017

Recording Certain Liabilities Related to the Jet Propulsion Laboratory

Background

The Jet Propulsion Laboratory (JPL) is a federally funded research and development center (FFRDC) managed for NASA by the California Institute of Technology (Caltech), a private, nonprofit 501(c)(3) university. JPL, a component of Caltech, is NASA's only FFRDC and works alongside NASA's nine field centers. However, unlike those centers, which are staffed by government civil servants, JPL's workforce consists of about 5,500 Caltech employees and on-site contractors.

NASA's contractual arrangement with Caltech related to the management of JPL began in 1958. NASA does not have a direct, legal relationship with JPL. Rather, NASA has a recurring, sole source, five year, Federal Acquisition Regulations (FAR) based cost reimbursable contract with Caltech to manage JPL. Under its contract with Caltech, NASA issues task orders for the various research programs and projects conducted by JPL. This contract is subject to the usual federal contract oversight and reporting requirements, including various contract compliance and financial audits. NASA has a resident office at JPL staffed by federal managers from the NASA Management Office (NMO), who administer the NASA/Caltech contract.

NASA's payments under the Caltech contract have historically included health and life insurance premiums, also referred to as Post Retirement Benefits (PRBs), accrued vacation, and workers' compensation for those Caltech employees who qualify for these benefits based on their past and current service in performing work under NASA's contract. Further, a contractual clause states that these costs will be considered allowable even in the event of contract termination or expiration as part of the "termination settlement".

In fiscal year 2015 NASA agreed to Caltech's request to transition the funding of the PRB liability from "pay as you go" to accrual accounting and a contract modification was executed to document this agreement. NASA and Caltech agreed to implement a plan that contributes assets to fund existing PRB liabilities that have accumulated during the period of performance of prior contracts between the parties as well as those incurred during the current contract relative to the operation of JPL. Further, NASA and Caltech agreed that accrued PRB liabilities in excess of PRB plan assets (the "Initial Base" PRB liability) as of September 30, 2014 will be amortized on a straight line basis over 20 years beginning on or about October 1, 2014. The annual funding amount of the PRB liability is equal to the amortization of the "Initial Base" plus the annual applicable "Net Periodic Cost," with the first payment occurring on or about January 1, 2015.

During fiscal years 2015, 2016, and 2017, NASA made payments to Caltech towards the PRB liability. The payment amounts were based on an actuarial estimate of the annual "Net Periodic Cost" and included an amount for the amortization of the "Initial Base" liability. The actuarial estimate is prepared annually by a large national actuarial consulting firm. The Defense Contract Management Agency's Contractor Insurance/ Pension Review Center reviewed the actuarial assumptions used in developing these estimates in a prior year and reported to NASA that they are "reasonably conforming with current guidance on [PRB] assumptions and industry norms, and may therefore be effectively used in future reviews".

INDEPENDENT AUDITORS' REPORT (Continued)
EXHIBIT A
Significant Deficiencies
September 30, 2017

Condition

NASA has not recorded a liability for required future payments related to the PRB, accrued vacation, and workers' compensation (herein after referred to as "employee benefits") for those JPL employees who qualify for these benefits based on their past and current service in performing work under NASA's contract. NASA will have to reimburse Caltech for these JPL employee benefit costs either through future contract payments or, in the event of contract termination, through a lump sum payment in accordance with the contract "termination settlement" clause. Generally accepted accounting principles for Federal reporting entities require accounting events to be recognized in the financial statements when they occur. Therefore, NASA should be recording and reporting a liability for the JPL employee benefit costs when these benefits are earned, even if payment is not immediately due and payable under contract accounting. The benefits earned by JPL employees in the performance of services under NASA's past and current contracts meet the accounting definition of a liability, as they represent "probable and measurable future outflows … of resources arising from past exchange transactions". By not recording the liability related to the future outflow of resources under the Caltech contract, NASA has not followed reporting guidance to ensure its financial statements are presented in accordance with full accrual accounting as established by generally accepted accounting principles. As a result, NASA's liabilities and net position are understated by approximately $371 million, based on amounts reported by Caltech at September 30, 2016.

According to NASA management, NASA considered FAR and other Federal procurement requirements, including Cost Accounting Standards proclaimed by the Cost Accounting Standards Board (CASB), in determining and measuring costs in connection with the Caltech contract pricing and administration. They particularly relied on CASB's ruling stating, "Because contractors need the flexibility to modify, reduce, or even eliminate [PRB] benefits in the future in response to the pressures of medical inflation, an aging population, and global competition, the [CASB] finds that the liability for post-retirement benefits cannot be made sufficiently firm to be recognized for government cost accounting purposes without undue financial risk to both the contractor and the government."

Statement of Federal Financial Accounting Standards (SFFAS) No. 34, *The Hierarchy of Generally Accepted Accounting Principles, Including the Application of Standards Issued by the Financial Accounting Standards Board*, states that the "Federal Accounting Standards Advisory Board (FASAB) is the body designated by the American Institute of Certified Public Accountants (AICPA) as the source of generally accepted accounting principles (GAAP) for federal reporting entities."

SFFAS No. 5, *Accounting for Liabilities of The Federal Government*, states the following:

- Paragraph 19: "A liability for federal accounting purposes is a probable future outflow or other sacrifice of resources as a result of past transactions or events. General purpose federal financial reports should recognize probable and measurable future outflows or other sacrifices of resources arising from… past exchange transactions…"
- Paragraph 20: "The existence of a past event (which includes transactions) is essential for liability recognition. An event is a happening of financial consequence to an entity… An event may also be an external event that involves interaction between an entity and its environment, such as a transaction with another entity…"

INDEPENDENT AUDITORS' REPORT (Continued)
EXHIBIT A
Significant Deficiencies
September 30, 2017

Recommendations:
We recommend that NASA's Office of Procurement:

1. Create policy requiring that contractual agreements potentially having financial reporting implications, be reviewed by personnel experienced in applying generally accepted accounting principles to ensure appropriate accounting and reporting within the financial statements.

We recommend that NASA's Office of the Chief Financial Officer:

1. Record, report, and disclose the employee benefits liability for those JPL employees who qualify for these benefits based on their past and current service in performing work under NASA's contract.
2. Coordinate with NMO for obtaining current year information for the Caltech contractual liability in time for preparing the year-end financial statements.

EXHIBIT B

National Aeronautics and Space Administration

Headquarters
Washington, DC 20546-0001

November 15, 2017

Reply to Attn of: Office of the Chief Financial Officer

TO: Inspector General

FROM: Chief Financial Officer

SUBJECT: Management Response to Report of Independent Auditors

I am pleased to accept your audit report on the Consolidated Financial Statements of the National Aeronautics and Space Administration (NASA) for FY 2016 and FY 2017. The Agency's efforts and achievements toward improved financial management are clearly reflected in the audit opinion. For the seventh year in a row, NASA has received an unmodified "clean" opinion on its financial statements with no reported material weaknesses. Further, NASA continues to be in substantial compliance with the Federal Financial Management Improvement Act.

NASA's independent auditors (CliftonLarsonAllen (CLA)) reported two significant deficiencies, one related to Information Technology (IT) Configuration Management and another related to Recording of Contractual Liabilities Related to the Jet Propulsion Laboratory. NASA's response to these deficiencies is provided below.

Information Technology Configuration Management

The annual financial statement audit has provided NASA with additional insight to areas where enhancement in protecting the confidentiality, integrity, and availability of financial data is warranted. NASA acknowledges that CLA identified opportunities for improvement within Marshall Space Flight Center's (MSFC's) overall vulnerability management program. NASA takes these findings seriously and immediately addressed a substantial portion of the findings cited in FY 2016. We acknowledge that we are not where we want to be; however, we have made significant progress in implementing our multi-year strategy to improve the security of the IT systems managed at MSFC in support of the Agency. We are trending in the right direction based on the findings from the audit, we are seeing a 21% reduction in all vulnerability findings: 82.5% reduction in Critical, 83.5% reduction in Highs and 58.2% reduction in Lows with only a 13.9% increase in Mediums. We did see a repeat in 32% of the findings, most of which were covered by a global risk acceptance. While our vulnerability management program is focused on all vulnerabilities, we placed emphases on the Critical and High vulnerabilities during this cycle.

We will continue to work our strategy to reduce all of our vulnerabilities. We will improve our vulnerability management program by holding system owners accountable, increasing

management visibility, and improving our vulnerability detection efforts with the roll-out of our 120-day vulnerability mitigation campaign and our monthly/quarterly vulnerability detection campaigns where we target configuration related weaknesses. It should be noted that NASA management is proactive in establishing a more stringent and consistent process for documenting, reviewing and approving decisions to accept risk and close corrective action plans, to include proof of remediation.

In addition to these efforts, NASA will continue the deployment of improved system management and patching tools. These enhanced tools, as well as the DHS Continuous Diagnostics and Mitigation (CDM) tools, are expected to improve NASA's ability to detect and mitigate vulnerabilities.

Finally, CLA's review also identified potential opportunities to strengthen NASA's defense in depth (DiD) controls, some of which we have addressed and the remainder we are taking into consideration.

Recording of Contractual Liabilities Related to the Jet Propulsion Laboratory

In fiscal year 2015 NASA and the California Institute of Technology, the manager of the Jet Propulsion Laboratory, agreed to modify an existing contract to change the way certain personnel benefits are funded. This change, which was consistent with Federal Acquisition Regulations, changed funding terms from a "pay as you go" basis to accrual accounting. After thorough review, NASA's Office of the Chief Financial Officer determined, and the Offices of Procurement and General Counsel confirmed, that, contrary to CLA's finding, the change did not establish or result in the creation of a financial liability that should be recorded in NASA's financial statements. In fact, NASA questions CLA's basis for measurement of the proposed adjustment, and further believes recording such would overstate NASA's liability. NASA will continue to work with CLA to address and resolve this issue in the coming fiscal year.

I appreciate the efforts and leadership of NASA's OIG and of the auditors throughout the audit of NASA's financial statements and related internal controls over financial reporting. Please convey my sincere appreciation and thanks to your team for the professionalism and cooperation exhibited during this audit.

for Andrew Hunter
Chief Financial Officer (Acting)

Concur:

Renee P. Wynn
Chief Information Officer

INDEPENDENT AUDITORS' REPORT (Continued)
EXHIBIT C
Status of Prior Year's Control Deficiency and Noncompliance Issue
September 30, 2017

Our assessment of the current status of the prior year control deficiencies and noncompliance issue is presented below:

Fiscal Year 2016 Finding	Fiscal Year 2017 Status
Significant Deficiency 1 – Information Technology Configuration Management NASA did not have an effective vulnerability management process relating to monitoring, detecting, and remediating known vulnerabilities. Specifically, we noted deficiencies in the following areas: A) Patch Management, B) Configuration Management and Default Passwords, and C) Software Support. NASA had additional failures at the Financial System Application layer related to Segregation of Duties, User Administration and Least Privilege, and Audit Logging and Monitoring failures.	NASA did not substantially address deficiencies in its vulnerability management program, which continued to inadequately address monitoring, detecting, and timely remediation of vulnerabilities associated with their financial application and general support systems. Additionally, management did not substantially address control failures at the Financial System Application layer. Therefore, the prior year Significant Deficiency 1 remains open and was renamed "Information Technology Management" in fiscal year 2017.
Noncompliance with Certain Provisions of Title 2 of the Code of Federal Regulations, *Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards (Uniform Guidance)* NASA lacked processes and procedures to determine (1) which of its grant recipients are required, based on spending thresholds, to have audits conducted in accordance with the Single Audit Act, (2) if the recipients that require such audits have completed the audits, and (3) if the resulting audit report was submitted to the Federal Audit Clearinghouse (FAC) in a timely manner. Further, NASA did not consistently issue management decisions on audit findings of grant recipients within six months of acceptance of the grantee's single audit report by the FAC. In addition, the form and content of the management decision letters did not contain the required elements stipulated in the Uniform Guidance.	NASA substantially completed implementation of corrective actions on the prior year noncompliance findings by the end of fiscal year 2017. As such, we consider the prior year finding on noncompliance with laws and regulations closed.

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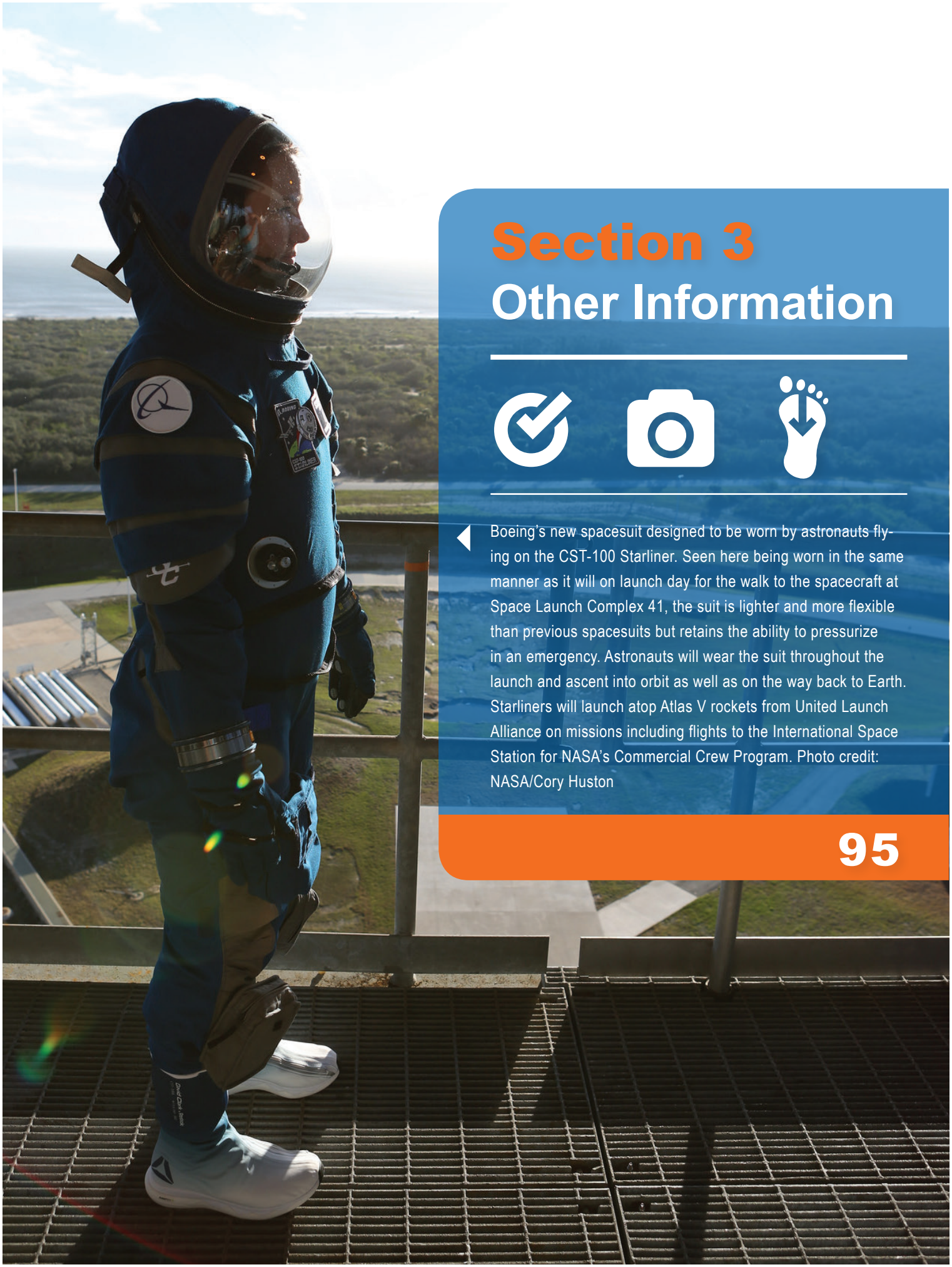


Section 3
Other Information

Boeing's new spacesuit designed to be worn by astronauts flying on the CST-100 Starliner. Seen here being worn in the same manner as it will on launch day for the walk to the spacecraft at Space Launch Complex 41, the suit is lighter and more flexible than previous spacesuits but retains the ability to pressurize in an emergency. Astronauts will wear the suit throughout the launch and ascent into orbit as well as on the way back to Earth. Starliners will launch atop Atlas V rockets from United Launch Alliance on missions including flights to the International Space Station for NASA's Commercial Crew Program. Photo credit: NASA/Cory Huston

NASA OFFICE OF INSPECTOR GENERAL

SUITE 8U37, 300 E ST SW
WASHINGTON, D.C. 20546-0001

November 6, 2017

TO: Robert M. Lightfoot Jr.
Acting Administrator

SUBJECT: NASA's 2017 Top Management and Performance Challenges

Dear Acting Administrator Lightfoot,

As required by the Reports Consolidation Act of 2000, this annual report provides our views of the top management and performance challenges facing NASA for inclusion in the 2017 Agency Financial Report. We previously provided a draft copy of this document to NASA officials and considered all comments received when finalizing our report.

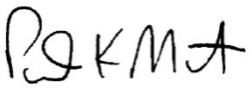
Similar to past years, in deciding whether to identify an issue as a top challenge we considered its significance in relation to NASA's mission; its susceptibility to fraud, waste, and abuse; whether the underlying causes are systemic in nature; and the Agency's progress in addressing the challenge. Not surprisingly, given the importance and scope of the issues, this year's list includes many of the same challenges discussed in previous reports.

Looking to 2018, we organized the top management and performance challenges facing NASA under the following topics:

- Deep Space Exploration
- NASA's Science Portfolio
- Information Technology Governance and Security
- Aging Infrastructure and Facilities
- Contracting and Grants

During the coming year, the Office of Inspector General plans to conduct audits and investigations that focus on NASA's continuing efforts to meet these and other challenges.

Sincerely,



Paul K. Martin
Inspector General

Enclosure – 1

NASA'S TOP MANAGEMENT AND PERFORMANCE CHALLENGES, NOVEMBER 2017

This annual report provides the Office of Inspector General's (OIG) independent assessment of the top management and performance challenges facing NASA, which we organize under the following topics:

- Deep Space Exploration
- NASA's Science Portfolio
- Information Technology Governance and Security
- Aging Infrastructure and Facilities
- Contracting and Grants

In deciding whether to identify an issue as a top challenge, we considered its significance in relation to NASA's mission; whether its underlying causes are systemic in nature; and its susceptibility to fraud, waste, and abuse. Identification of an issue as a "top challenge" does not necessarily denote significant deficiencies or lack of attention on the part of NASA. Rather, all of these issues are long-standing and inherently difficult challenges central to the Agency's mission and, as such, will remain challenges for years. Consequently, these issues require consistent, focused attention from NASA management and engagement on the part of Congress and the public.

That said, this year we removed "Ensuring the Continued Efficacy of the Space Communications Networks" as a top management challenge because of the progress made in addressing the issues we identified in a series of audit reports over the past few years.[1] Otherwise, the challenges described in this report correspond to those we identified in our November 2016 report and, like previous years, are not listed in priority order.

Deep Space Exploration

NASA's long-term objective for its human exploration program is a crewed surface mission to Mars in the late 2030s or early 2040s. To meet this goal, the Agency must develop more sophisticated rockets, capsules, and related hardware, manage the aging International Space Station (ISS or Station) to maximize its use as a test-bed for research and development of new technologies, and mitigate human health risks of extended space travel – all within the constraints of a static budget profile. In the near-

[1] NASA OIG, "NASA's Management of Electromagnetic Spectrum" (IG-17-012, March 9, 2017); "NASA's Management of the Near Earth Network" (IG-16-014, March 17, 2016); "NASA's Management of the Deep Space Network" (IG-15-013, March 26, 2015); and "Space Communications and Navigation: NASA's Management of the Space Network" (IG-14-018, April 29, 2014).

term, successful development of the Space Launch System (SLS), the Orion Multi-Purpose Crew Vehicle (Orion), and launch infrastructure under development by the Agency's Ground Systems Development and Operations (GSDO) Program are critical to achieving NASA's human exploration goals beyond low Earth orbit. However, the first unmanned flight of the integrated SLS, Orion, and GSDO systems on Exploration Mission-1 (EM-1) – initially planned for 2016 and currently scheduled for no earlier than October 2019 – and the first crewed flight, Exploration Mission-2 (EM-2) – planned for no earlier than August 2021 – face significant challenges to meet their launch dates.

In the long term, NASA's plans beyond EM-2 for achieving a crewed Mars surface mission in the late 2030s or early 2040s remain high level, serving as more of a strategic framework than a detailed operational plan. For example, the Agency's current Journey to Mars framework lacks objectives; does not identify key system requirements other than SLS, Orion, GSDO, and a Deep Space Gateway; and does not suggest target mission dates for crewed orbits of Mars or planet surface landings.[2] If the Agency is to reach its goal of sending humans to Mars in the late 2030s or early 2040s, significant development work on key systems – such as a deep space habitat, in-space transportation, and Mars landing and ascent vehicles – must be accomplished in the 2020s. In addition, NASA will need to begin developing more detailed cost estimates for its Mars exploration program after EM-2 to ensure the commitment from Congress and other stakeholders exists to fund an exploration effort of this magnitude over the next several decades. Finally, NASA's decision whether to continue spending $3–$4 billion annually to maintain the ISS after 2024 – roughly a third of its exploration budget – will affect its funding profile for human exploration efforts in the 2020s, and therefore has significant implications for the Agency's Mars plans.

Space Launch System

The SLS is a heavy lift launch vehicle that uses liquid propellant and a pair of five-segment solid boosters to transport cargo and crew into space for missions beyond Earth's orbit into deep space. NASA is using the Space Shuttle's RS-25 engines to power the SLS core stage and is designing the vehicle with an evolvable architecture that can be tailored to accommodate longer and more ambitious missions. Initial versions will be capable of lifting 70 metric tons to low Earth orbit and will use a modified Delta IV upper stage to propel Orion on a trajectory around the Moon during EM-1. Later versions of the SLS will include a more powerful upper stage and advanced rocket boosters with a capability to lift 130 metric tons to low Earth orbit and 41 metric tons to Mars.

We reported in April 2017 that the SLS Program faced several technical challenges leading up to the EM-1 launch that negatively affected its schedule margin.[3] As a result of these challenges, NASA subsequently announced a schedule delay for the EM-1 mission from November 2018 to no earlier than October 2019. Even though the SLS Program factored in a schedule margin of 11 months to allow time to address any unexpected technical issues or other factors, testing has been delayed from October 2017 until December 2018 because of welding issues with the SLS core stage tanks and damage from a February 2017 tornado at Michoud Assembly Facility. Notwithstanding the 1-year launch delay, testing and delivery of the core stage remains on the critical path with little schedule margin available to manage problems that may arise during the integration and test phase before an integrated SLS/Orion launch. The late completion of the core stage is a critical schedule issue in meeting the EM-1 launch date.

[2] Deep Space Gateway, which will consist of a small space habitat, docking station, and propulsion system, is intended for operation near the Moon and will serve as a testing platform and staging point for deep space missions.

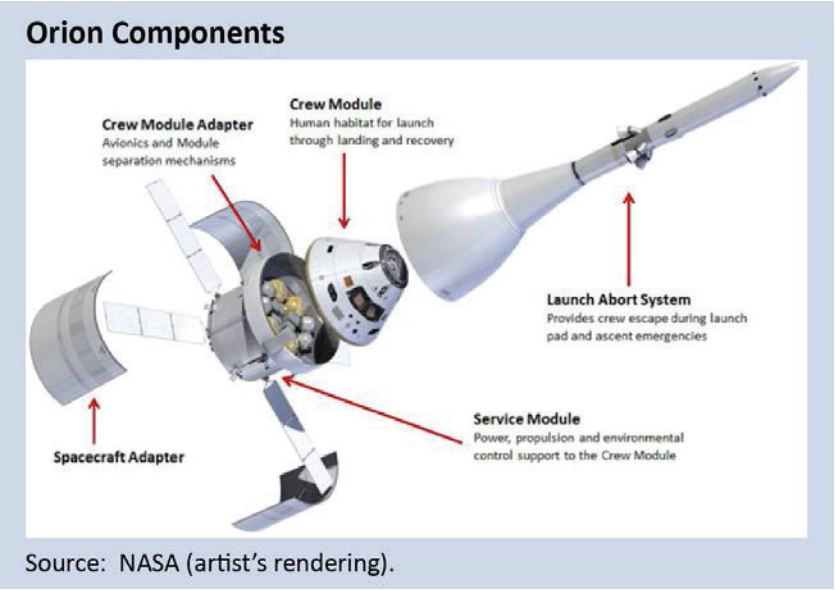
[3] NASA OIG, "NASA's Plans for Human Exploration Beyond Low Earth Orbit" (IG-17-017, April 13, 2017).

The rising cost of the SLS Program also presents challenges for NASA given the program may exceed its $9.7 billion budget commitment. The Agency plans to spend roughly $2 billion a year on SLS development but has minimal monetary reserves to address any technical challenges that may arise for EM-1 or EM-2. According to guidance developed at Marshall Space Flight Center (Marshall), the standard monetary reserve for a program such as the SLS should be between 10 and 30 percent during development.[4] The SLS Program did not carry any program reserves in fiscal year (FY) 2015 and only $25 million in FY 2016 – approximately 1 percent of its development budget. Moving forward, the SLS Program plans to carry only minimal reserves through 2030, which in our view is unlikely to be sufficient to enable NASA to address issues that may arise during development and testing.

Prior to the EM-2 flight, NASA will make a major upgrade in the SLS configuration by integrating the Exploration Upper Stage (EUS) as the spacecraft's new upper stage. This will increase SLS capability from 70 to 105 metric tons of cargo to low Earth orbit. However, in addition to integration and testing changes needed to accommodate the new upper stage, the height and weight of the SLS will increase, so changes to the ground processing infrastructure and mobile launcher will be necessary. In addition, a new tank will need to be fabricated and installed at the launch pad to provide the additional fuel required by the EUS.

Orion Multi-Purpose Crew Vehicle

The Orion capsule – which will be mounted atop the SLS and serve as the crew vehicle for up to four astronauts – has four major components: a crew module; a service module; a spacecraft adapter that connects the vehicle to the rocket; and a launch abort system. NASA began developing Orion in 2006 as part of the Agency's former deep space exploration effort known as the Constellation Program and had spent about $5.7 billion on the effort when Constellation was cancelled in 2010. Since then, NASA has spent more than $1 billion annually, or about 6 percent of its overall budget, on the Orion Program. In 2016, we estimated the Agency will have devoted approximately $17 billion in funding for all Orion activities, including Constellation Program funding, by the time the spacecraft makes its first crewed flight on EM-2.[5]



Source: NASA (artist's rendering).

[4] Marshall Procedural Requirements (MPR) 7120.1.

[5] NASA OIG, "NASA's Management of the Orion Multi-Purpose Crew Vehicle Program" (IG-16-029, September 6, 2016).

The biggest challenge facing Orion for EM-1 is delivery of the European Service Module, which is integral to the overall service module. In September 2016, we reported that the service module had undergone design changes and as a result would be delivered to NASA at least 5 but possibly up to 10 months later than originally planned.[6] The module has been further delayed and is now scheduled to be delivered in February 2018. Because the new Orion service module differs from the module flown during the first Orion test flight in December 2014, assembly, integration, and processing of the new module may delay transfer of Orion to the GSDO Program for integration with the SLS. Consequently, delivery, test, and integration of the service module is another critical schedule issue to meet the current EM-1 launch date.

Looking ahead to EM-2, one of the key challenges NASA faces is ensuring the Orion capsule's Environmental Control and Life Support System functions properly. NASA is testing portions of this critical life support system on the ISS and on Earth, and will fly substantial parts of the system (such as thermal control pumps, heat exchangers, radiators, gas containment and delivery systems, and cabin pressurization controls) on EM-1. However, the first flight test of the complete Environmental Control and Life Support System will be during EM-2 with crew aboard. The Aerospace Safety Advisory Panel, an advisory committee that reports to NASA and Congress on safety issues, expressed concern in its 2015 and 2016 annual reports about the lack of flight testing before EM-2, suggesting the mission remain in low Earth orbit until NASA gains more confidence the life support systems are performing properly.[7] The Advisory Panel acknowledged in its 2016 annual report that NASA had selected a mission profile in which the crew spends its first 24 hours in an elliptical high Earth orbit to check the Environmental Control and Life Support System and other systems for possible malfunction.

Like SLS, the Orion Program has less than 1 percent in monetary reserves leading up to EM-1, much less than the recommended 10 to 30 percent.[8] Although NASA expects to increase Orion's reserves for EM-2 to a more appropriate level beginning in 2019 and 2020, the impact of the delay in EM-1's launch date to no earlier than October 2019 on Orion's overall funding profile remains unclear.

Ground Systems Development and Operations Program

NASA's GSDO Program is modifying infrastructure at Kennedy Space Center (Kennedy) formerly used by the Space Shuttle Program to launch the combined SLS/Orion, including refurbishing the crawler transporter that will transport the SLS to the launch pad and modifying the mobile launcher and tower (originally built for the Constellation Program's Ares I rocket), the Vehicle Assembly Building (VAB), and Launch Pad 39B.

In 2015 and 2017, we reported that modifications to the VAB and mobile launcher needed to support SLS have left GSDO with only 1 month of schedule margin to address any further issues that arise.[9] Similarly, the Government Accountability Office (GAO) reported in July 2016 that although the Program is making progress in modifying facilities and equipment to support SLS and Orion, it is encountering

[6] IG-16-029.

[7] Aerospace Safety Advisory Panel, "Annual Report for 2015," January 13, 2016, and "Annual Report for 2016," January 11, 2017.

[8] MPR 7120.1.

[9] IG-17-017; NASA OIG, "NASA's Launch Support and Infrastructure Modernization: Assessment of the Ground Systems Needed to Launch SLS and Orion" (IG-15-012, March 18, 2015).

technical challenges that require additional time and money, which in turn has reduced cost and schedule reserves, threatening the EM-1 launch readiness date.[10] Although the delay in the launch date may have mitigated some of these concerns, development of software needed to launch SLS and Orion remains a concern.

In a March 2016 audit, we reported that the GDSO Program's software, known as the Spaceport Command and Control System (SCCS), had significantly exceeded its initial cost and schedule estimates.[11] SCCS is a software system that will control pumps, motors, valves, power supplies, and other ground equipment; record and retrieve data from systems before and during launch; and monitor the health and status of spacecraft as they prepare for and during launch. In 2016, we reported that, compared to FY 2012 projections, development costs had increased approximately 77 percent to $207.4 million and the release of a fully operational version had slipped by 14 months from July 2016 to September 2017 for an EM-1 launch in November 2018. Given that the launch date has slipped to no earlier than October 2019, GSDO is in the process of extending the SCCS completion date to align with the new launch date.

Furthermore, GSDO will not be able to complete all necessary software validation and verification efforts until SLS and Orion complete development, testing, and delivery of their software. Delivery of Orion software is the third most critical task, schedule-wise, to meeting the current EM-1 launch date of no earlier than October 2019.

Finally, after EM-1 is launched GSDO will need to make additional modifications to Kennedy's launch infrastructure to prepare for EM-2. Among other issues, the Program has identified a budget shortfall associated with EUS upgrades that will need to be addressed.[12]

International Space Station

A significant amount of research aboard the ISS is related to understanding and mitigating the health and performance risks associated with human space travel such as protecting against bone loss and eyesight degeneration and testing new technologies to overcome challenges associated with preventing, diagnosing, and treating medical conditions during long-duration exploration missions. In November 2015, NASA formally extended the life of the Station through 2024, ensuring this unique facility, which has operated in low Earth orbit for almost 20 years, remains available to support research into the development of new exploration technologies and ways to mitigate the dangers posed by space travel.[13] Despite the extension, in October 2015, we reported NASA will not have enough time to mitigate several known human space flight risks for future deep space missions.[14] Accordingly, the Agency needs to prioritize its research to address the most important risks in the time available while also ensuring a spacecraft originally designed and tested for a 15-year life span will continue to operate safely and as economically as possible.

[10] GAO, "NASA Human Space Exploration: Opportunity Nears to Reassess Launch Vehicle and Ground Systems Cost and Schedule" (GAO-16-612, July 27, 2016).

[11] NASA OIG, "Audit of the Spaceport Command and Control System" (IG-16-015, March 28, 2016).

[12] IG-17-017.

[13] In 2009, NASA asked The Boeing Company, the primary ISS contractor, to examine the feasibility of extending Station operations until 2028. Boeing has completed a significant portion of the hardware analysis and its review is expected to be complete by June 2018.

[14] NASA OIG, "NASA'S Efforts to Manage Health and Human Performance Risks for Space Exploration," (IG-16-003, October 29, 2015).

While the amount of research being conducted on the ISS has increased over the past 8 years, several factors continue to limit full utilization. In particular, until a seventh crew member is brought onboard, NASA will not be in a position to maximize the amount of crew time dedicated to research on the Station.[15] Moreover, the launch failures of two commercial resupply missions – an Orbital ATK (Orbital) mission in October 2014 and a Space Exploration Technologies Corporation (SpaceX) mission in June 2015 – led to compressed launch schedules in FYs 2016 and 2017.

Source: NASA.

The United States has invested more than $87 billion in the ISS over the last 24 years, and the Station continues to account for a significant portion of NASA's annual budget.[16] In FY 2016, NASA's cost to operate the Station – including on-orbit vehicle operations, research, crew transportation, and cargo resupply missions – was almost $3 billion, with the Agency projecting these costs will increase to approximately $3.5 billion in the 2020s. Balancing the need for continued ISS research to mitigate human exploration risks with the need to construct the key exploration hardware systems required for reaching Mars will challenge the Agency's budgeting process well into the next decade.

Commercial Transportation to the International Space Station

From 1998 through 2011, NASA primarily relied on the Space Shuttle to construct the ISS and ferry astronauts and materials to the Station. With the Shuttle's retirement in 2011, NASA began relying on European and Japanese spacecraft to ferry cargo and the Russian Soyuz to transport crew while partnering with U.S. corporations to develop privately owned and operated cargo and crew transportation systems. Unlike the Shuttle, NASA does not own these systems but rather purchases flights from the companies to carry NASA supplies and crew to the ISS. Both cargo and crew contractors have faced delays and setbacks – two failed cargo missions lost critical ISS cargo and impacted resupply schedules – and crew vehicle development delays have pushed back the first demonstration flights from 2016 to 2018.

[15] Although the ISS is capable of supporting a seven-person crew, currently only six individuals can be on Station at one time. The Russian Soyuz capsule, currently the only vehicle transporting astronauts to the Station, has a three-person capacity and only two Soyuz capsules can be attached to the Station simultaneously for evacuation in the event of an emergency.

[16] This figure includes $30.7 billion for 37 supporting Space Shuttle flights.

Cargo Resupply

Between 2006 and 2008, NASA entered into a series of funded Space Act Agreements with Orbital, SpaceX, and other private companies to stimulate development of space flight systems capable of transporting cargo to the ISS.[17] In 2008, while development efforts were still underway, NASA awarded fixed-price contracts valued at $1.9 billion and $1.6 billion to Orbital and SpaceX, respectively, for a series of resupply missions to the ISS known as Commercial Resupply Services (CRS-1) contracts. NASA selected two companies to ensure redundancy if one was unable to perform. The contracted services include delivery of supplies and equipment (upmass) to the Station and, depending on the mission, return of equipment and experiments to Earth or disposal of waste (downmass).[18]

Both Orbital and SpaceX experienced launch failures during their CRS-1 missions. In October 2014, Orbital's third delivery mission failed during lift-off, causing the vehicle to crash near the launch pad and destroying the company's Antares rocket and Cygnus spacecraft as well as $51 million of cargo aboard. The mishap also caused $15 million in damage to the Virginia Commercial Space Flight Authority's launch pad and supporting facilities at NASA's Wallops Flight Facility on Virginia's Eastern Shore. Following an investigation and acceptance by NASA of the company's Return to Flight Plan, Orbital resumed resupply missions in December 2015 and, as of September 2017, has completed four successful missions since returning to flight.

Similarly, in June 2015 SpaceX's seventh resupply mission (SPX-7) exploded shortly after takeoff from Cape Canaveral Air Force Station in Florida, resulting in the total loss of $118 million in cargo. Like Orbital, SpaceX suspended resupply missions until completion of an investigation and acceptance by NASA of a Return to Flight Plan.[19] SpaceX resumed resupply missions in April 2016 and completed two successful cargo flights for NASA when, on September 1, 2016, a Falcon 9 rocket exploded as it was being prepared for a static fire test, destroying the rocket and its commercial satellite payload and damaging the launch pad, which the company leases from the Air Force.[20] Although this was not a NASA mission, because of its contracts with SpaceX to deliver cargo and eventually crew to the ISS, NASA needed to understand the cause of the mishap and ensure the company took appropriate steps to prevent similar incidents in the future. SpaceX resumed resupply missions in February 2017 and, as of September 2017, has completed five successful cargo missions since returning to flight.

In September 2015, we examined the effects of the Orbital failure on ISS resupply, finding Orbital's Return to Flight Plan contained technical and operational risks.[21] Specifically, we found the company's plan to drop one of its five remaining previously scheduled resupply flights and carry the promised cargo in four missions may have disadvantaged NASA by decreasing the Agency's flexibility in choosing the type and size of cargo Orbital transports to the ISS.

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[17] NASA bartered with the Japan Aerospace Exploration Agency for cargo transportation on Japan's H-II Transfer Vehicle and can place a small amount of upmass on the Russian space agency's Progress cargo vehicle. In the past, NASA sent cargo to the ISS on the European Space Agency's Automated Transfer Vehicle, which made its final delivery in July 2014.

[18] The SpaceX capsule returns intact and therefore can carry experiments and other cargo back to Earth. In contrast, Orbital's capsule burns up upon reentry to Earth's atmosphere and therefore removes only waste from the Station.

[19] In addition to the Orbital and SpaceX failures, two Russian Progress cargo missions failed to reach the ISS in April 2015 and December 2016.

[20] A static fire test involves a full propellant loading sequence, launch countdown and engine ignition operations, and testing of the launch pad's high-volume water deluge system.

[21] NASA OIG, "NASA's Response to Orbital's October 2014 Launch Failure: Impacts on Commercial Resupply of the International Space Station" (IG-15-023, September 17, 2015).

In June 2016, we issued a similar examination of the SpaceX cargo failure.[22] We found the loss of SPX-7 and the shift of SpaceX's eighth resupply mission into 2016 resulted in approximately 3.48 metric tons of pressurized cargo scheduled for delivery in FY 2015 not arriving on the Station. NASA absorbed this loss by placing additional upmass on two other SpaceX missions, a Japanese cargo flight, and six Russian flights, thereby reducing the total upmass shortfall from 3.48 to 2.63 metric tons.

The most significant item lost during the SPX-7 mishap was a Docking Adapter necessary to support upcoming commercial crew missions. Although NASA had planned to have two adapters installed on the Station before the first "crewed" commercial crew demonstration mission scheduled for June 2018, it is now likely there will be only one installed in time for this mission. Having only one adapter means that a commercial crew vehicle will not be able to dock with the ISS if technical issues arise with the single available docking port. ISS Program officials told us they plan to have the second adapter installed before regular commercial crew rotations begin in late 2018.

Our report also examined the Agency's risk management approach and found that it differs between commercially-procured resupply services and traditional NASA-owned missions. For CRS missions, the ISS Program does not provide a risk rating for each launch, and this process may not provide NASA management with sufficient information concerning actual launch risks. Finally, we noted NASA had no official, coordinated, and consistent mishap investigation policy for commercial resupply launches, which could affect its ability to determine the root cause of a launch failure and ensure corrective actions are implemented. Based on this finding, NASA reviewed its mishap investigation policies and is in the process of updating the process for commercial launches with NASA payloads.

In January 2016, NASA awarded follow-on cargo resupply contracts known as CRS-2 to Orbital, SpaceX, and the Sierra Nevada Corporation (Sierra Nevada). NASA is expected to order a minimum of six missions from each provider at fixed prices with specified cargo amounts and performance dates based on the Station's needs. Challenges going forward include both fiscal and technical risks and NASA's need to manage similar but separate contracts with each company. In addition, NASA needs to complete certifications of all spacecraft prior to approving them for approach and mating with the ISS. Specifically, Orbital is planning on using upgraded versions of the Cygnus capsule and Antares rocket; SpaceX plans to use a modified Dragon capsule and may reuse Falcon 9 rockets, subject to NASA's approval; and Sierra Nevada is developing its delivery vehicle – the Dream Chaser spacecraft – and has yet to prove its flight worthiness.

Crew Transportation

Since the Space Shuttle Program ended in July 2011, the United States has lacked a domestic capability to transport crew to the ISS, instead relying on the Russian Federal Space Agency (Roscosmos) to ferry astronauts at prices up to $82 million per astronaut. The goal of the Commercial Crew Program is to enable domestically provided safe, reliable, and cost-effective crew transportation to and from the ISS and low Earth orbit. Although NASA has spent approximately $4 billion on the Commercial Crew Program, progress toward that goal has been slower than expected.

[22] NASA OIG, "NASA's Response to SpaceX's June 2015 Launch Failure: Impacts on Commercial Resupply of the International Space Station" (IG-16-025, June 28, 2016).

Boeing's Launch Site at Cape Canaveral Air Force Station

Source: NASA.

NASA's efforts to facilitate the development of a commercial crew transportation capability began in earnest in February 2010. However, it was not until September 2014 that the final phase of the effort began and NASA awarded SpaceX and The Boeing Company (Boeing) firm-fixed-price contracts to complete development of their crew transportation systems and, assuming they met the Agency's safety and performance requirements, receive certification to begin flying astronauts to the ISS.

In September 2016, we reported that the Commercial Crew Program continues to face multiple challenges that will likely delay the first routine flight carrying NASA astronauts to the ISS until late 2018 – more than 3 years after NASA's original 2015 goal.[23] While past funding shortfalls contributed to the delay, technical challenges with the contractors' spacecraft designs are now driving schedule slippages. For Boeing, these include issues related to the effects of vibrations from intense sound waves generated during launch and challenges regarding vehicle mass. For SpaceX, delays resulted from a change in capsule design to enable a water-based rather than ground-based landing and related concerns that the capsule would take on excessive water.

Moreover, both companies must satisfy NASA's safety review process to ensure they meet Agency requirements for "human rating" their vehicles. As part of the certification process, Boeing and SpaceX conduct safety reviews and report to NASA on potential hazards and how they plan to mitigate these risks. We found significant delays in NASA's evaluation and approval of these hazard reports and related requests for variances from NASA requirements that increase the risk that costly redesign work may be required late in development, further delaying vehicle certification.

SpaceX Launch Site at Kennedy Space Center

Source: SpaceX.

Given delays in the Commercial Crew Program, NASA extended its contract with the Russian Space Agency for astronaut transportation through 2018 at a cost of $490 million for six seats, or $82 million each, and entered into a new agreement to purchase flights from Boeing to the ISS on the Soyuz vehicle.[24] If the Commercial Crew Program experiences additional delays, NASA may need to buy additional seats from Russia to ensure a continued U.S. presence on the ISS.

[23] NASA OIG, "NASA's Commercial Crew Program: Update of Development and Certification Efforts" (IG-16-028, September 1, 2016).

[24] Boeing received the Soyuz flight opportunities as part of a legal settlement with the Russian company Energia, which manufactures the Soyuz spacecraft and has the legal rights to sell seats and associated services.

NASA's Science Portfolio

With a budget that has averaged about $5.3 billion a year over the past 5 years, NASA's Science Mission Directorate focuses on answering questions related to the origins and destiny of the universe; the Sun and its effects on Earth and the rest of the solar system; the Earth's climate; the history of the solar system; and the potential for life elsewhere. In doing so, the Directorate manages about 125 flight projects in various phases of development and operations and funds research drawn from the data provided by these projects.

The selection and balance of NASA's science missions is heavily influenced by stakeholders external to the Agency, including the President, Congress, the science community, and, to a lesser extent, other Federal and international agencies. The President and Congress provide direction through the budgeting and appropriation processes, which has a strong influence on the composition and overall balance of the Agency's science portfolio. The science community – as represented by the National Research Council (NRC) – establishes mission priorities based on a broad consensus within various science research disciplines.[25] These priorities are set forth in the NRC's decadal surveys on the subject matter areas encompassed by the Science Mission Directorate's four divisions: Astrophysics, Earth Science, Heliophysics, and Planetary Science. Each survey lists the NRC's recommendations by priority (e.g., the 2007 Earth Science Decadal Survey grouped missions by Tier 1 through Tier 3, with Tier 1 being the highest priority).[26] Managing differing priorities from numerous stakeholders and funding changes on a year-to-year basis (which we described as "funding instability" in a September 2012 report) can lead to inefficiencies, resulting in cost increases and schedule delays that can have a cascading effect on NASA's entire science portfolio.[27]

On a macro scale, the changing priorities of a new President and Congress, and results of the annual appropriation process, tend to create challenges managing a science portfolio with projects that take many years to develop and launch. For example, in FY 2017 NASA anticipated that the FY 2018 budget for Earth Science and Planetary Science would be $1.99 billion and $1.44 billion, respectively. However, the Presidential Budget Request for FY 2018 included $1.75 billion for Earth Science and $1.93 billion for Planetary Science. Specific changes to the portfolio include the proposed cancellation of five Earth Science missions, including one that was a high priority in the 2007 Earth Science Decadal Survey, one that was to launch to the ISS next year, and one that would have funded NASA instruments on an operational National Oceanic and Atmospheric Administration (NOAA) satellite – each of which we described in a November 2016 report on NASA's Earth Science portfolio.[28] To further complicate management of the portfolio, in July 2017 both Houses of Congress provided differing direction with regard to the balance of Earth Science and Planetary Science missions, with the Senate explicitly directing money to four of the projects marked for cancellation by the President. We described the

[25] The NRC is the research arm of the National Academy of Sciences, the National Academy of Engineering, and the National Academy of Medicine, and issues reports to help improve public policy, understanding, and education in matters of science, technology, and health.

[26] NRC, "Earth Science and Applications from Space: National Imperatives for the Next Decade and Beyond," 2007.

[27] NASA OIG, "NASA's Challenges to Meeting Cost, Schedule, and Performance Goals" (IG-12-021, September 27, 2012).

[28] NASA OIG, "NASA's Earth Science Mission Portfolio" (IG-17-003, November 2, 2016). The five missions are Pre-Aerosol, Clouds, and ocean Ecosystem; Orbiting Carbon Observatory 3; Radiation Budget Instrument; Climate Absolute Radiance and Refractivity Observatory Pathfinder; and two instruments on the Deep Space Climate Observatory.

negative effects of this "on again, off again" funding and policy direction in a July 2014 report on NASA's Stratospheric Observatory for Infrared Astronomy.[29]

Mars Exploration Rover Opportunity

Source: NASA (artist's rendering).

Further challenging efficient management of the science portfolio are sometimes conflicting and fluid stakeholder priorities. The Mars Exploration Program has been a centerpiece of the Planetary Science Division for decades. This year, Mars Odyssey and Mars Reconnaissance Orbiter surpassed 16 and 11 years, respectively, far exceeding their planned operational lifespans while sending back photographs, science data, and acting as relays for surface rovers.[30] The Mars Exploration Rover, Opportunity, continues to send back data after nearly 14 years operating on the Martian surface. The Mars Science Laboratory rover, Curiosity, recently celebrated its fifth anniversary on the Red Planet in August 2017 after a challenging development period.[31] In January 2017, we reported on the challenges facing the Program's next rover, Mars 2020, which NASA designed to collect soil samples for storage on the planet's surface.[32] The Mars 2020 mission is the highest priority flagship mission of the most recent Planetary Decadal Survey and was described as the first of three missions to return Martian soil samples to Earth.[33] However, NASA has no follow-on Mars mission planned after the 2020 launch, rover or orbiter, as exploration of the outer planets has emerged as a higher priority in recent years.

For example, the 2011 Planetary Decadal Survey described an orbiter mission to Europa, an icy moon of Jupiter, as the second highest priority flagship mission. Although the NRC specifically warned against a mission with costs that would cause unacceptable programmatic imbalance and elimination of other important missions, since FY 2014 Congress has appropriated $500 million more to a Europa mission than NASA requested, and consistently directed specific mission elements – a lander to the surface of Europa – that both NASA and the NRC have said would be prohibitively expensive. As currently designed, the mission would cost approximately $3.1 billion to develop and launch by 2022. If Congress insists on inclusion of a lander, the additional mission costs would certainly impact the overall Science Mission Directorate portfolio.

[29] NASA OIG, "SOFIA: NASA's Stratospheric Observatory for Infrared Astronomy" (IG-14-022, July 9, 2014).

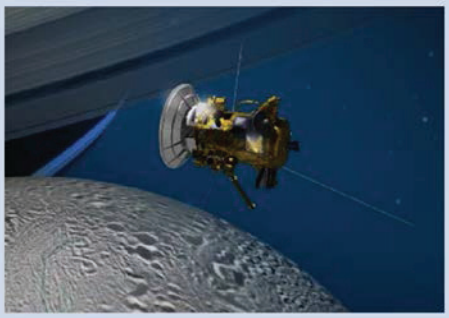
[30] Mars Odyssey launched in April 2001 and arrived at Mars in October 2001. The Mars Reconnaissance Orbiter launched in August 2005 and arrived at Mars in March 2006.

[31] Opportunity was launched in July 2003 and landed on Mars in January 2004. Curiosity launched in November 2011 and landed in August 2012. Our report, "NASA's Management of the Mars Science Laboratory Project" (IG-11-019, June 8, 2011), reported on the challenges project managers faced that led to 2-year launch delay and cost increase of $969 million.

[32] NASA OIG, "NASA's Mars 2020 Project" (IG-17-009, January 30, 2017).

[33] NRC, "Vision and Voyages for Planetary Science in the Decade 2013-2022," 2011.

Cassini Space Probe



Source: NASA (artist's rendering).

In spite of these ongoing challenges, NASA has had many operational and developmental successes in the past few years. For example, in July 2015, New Horizons made a close pass of Pluto, revealing unexpected details; in February 2017, the 14-year-old Spitzer Space Telescope discovered seven Earth-size planets around a single star – setting the record for greatest number of habitable-zone planets found around a single star outside our solar system; in September 2017, Cassini completed 13 years of investigating Saturn, making numerous discoveries, including water emanating from the icy moon, Enceladus; and the Solar and Heliospheric Observatory will turn 22 in December 2017, having provided early alert space weather observations and enabled discovery of more than 3,000 comets – an unanticipated capability when it was launched.[34] In addition, NASA launched the Origins, Spectral Interpretation, Resource Identification, Security-Regolith Explorer (OSIRIS-REx) in September 2016 approximately 20 percent under budget and launched the Cyclone Global Navigation Satellite System (CYGNSS) in December 2016, 5 months early and approximately 15 percent under budget.[35]

Several of NASA's recent developmental successes are partially attributable to the implementation of tools that help improve the fidelity of the Agency's cost and schedule estimates, such as a requirement that projects exceeding $250 million conduct a Joint Cost and Schedule Confidence Level (JCL) assessment. However, as we discussed in a September 2015 report, the JCL process has inherent limitations in that, like any estimating practice, it does not fully address all of the root causes of NASA's project management challenges such as funding instability, underestimation of technical complexity, and to a lesser extent overly optimistic expectations.[36] In fact, the projects discussed below are some of NASA's largest science projects currently in development and are continuing to face the same project management challenges discussed in our September 2012 report as well as the challenges we highlighted in a May 2016 report regarding NASA's work with international partners.[37] Each of the projects implemented JCL; all but one – Parker Solar Probe – have experienced schedule delays and cost increases and are due to be launched in the coming year. Overcoming these challenges and launching these projects on schedule at their baseline costs is vital to NASA effectively managing its science portfolio.

[34] New Horizons was launched in January 2006. Spitzer Space Telescope was launched in August 2003 and trails the Earth in an orbit around the Sun. Cassini was launched in October 1997 and arrived at Saturn in July 2004. The Solar and Heliospheric Observatory was launched in December 1995 and orbits around the First Lagrangian Point, about 1 million miles from the Earth toward the Sun.

[35] OSIRIS-REx is designed to study and obtain a sample of surface material from the asteroid Bennu and return it to Earth in 2023. CYGNSS is designed to facilitate better weather forecasting by measuring ocean surface winds throughout the life cycle of tropical storms and hurricanes.

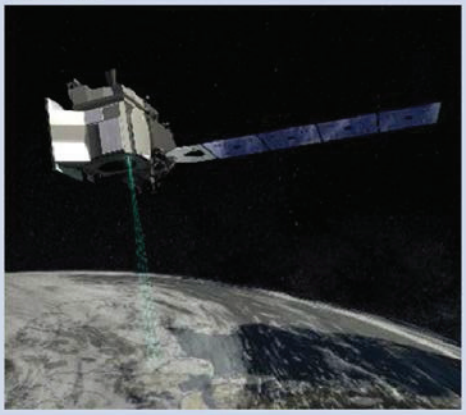
[36] NASA OIG, "Audit of NASA's Joint Cost and Schedule Confidence Level Process" (IG-15-024, September 29, 2015).

[37] NASA OIG, "NASA's International Partnerships: Capabilities, Benefits, and Challenges" (IG-16-020, May 5, 2016); IG-12-021.

Ice, Cloud, and land Elevation Satellite-2

Ice, Cloud, and land Elevation Satellite-2 (ICESat-2) is a satellite mission designed to collect data on ice sheets and track changes in glaciers and sea ice, which will allow scientists to see where ice is flowing, melting, or growing and to investigate the global impacts – such as sea level rise – of these changes. Although the NRC recommended the mission in its 2007 Earth Science Decadal Survey with a suggested launch in 2013, NASA baselined ICESat-2 in December 2012 with a life-cycle cost of $860 million and a launch date of May 2017.[38] However, managers underestimated the technical complexity of building the satellite's sole instrument – the Advanced Topographic Laser Altimeter System (ATLAS) – and therefore significantly understated the mission's cost and schedule. In May 2014, NASA revised the baseline to reflect a $1.06 billion life-cycle cost and a planned launch date in June 2018. Funds to cover this 24 percent cost increase were drawn from other projects in the Earth Science Division portfolio.

ICESat-2



Source: NASA (artist's rendering).

Although last year the Project appeared to be making good progress toward an early or on-schedule launch of this revised date, development was negatively impacted in July 2016 when one of the two flight lasers manufactured for the ATLAS instrument failed during thermal vacuum testing. Consequently, the Project will not launch earlier than September 2018, 3 months later than the revised baseline date, and costs may increase to support the additional work.

Interior Exploration using Seismic Investigations Geodesy and Heat Transport

Interior Exploration using Seismic Investigations Geodesy and Heat Transport (InSight) is NASA's next Mars lander mission, designed to investigate the crust, deep interior, and tectonic activity of Mars to better understand how rocky planets like Earth and Mars formed. Using a German-built penetrating "mole," the lander will pound a probe 16 feet into the Martian crust to take thermal measurements while a French-built seismometer will attempt to sense and measure "Marsquakes." However, a leak discovered in the seismometer in November 2015 caused NASA to delay its planned March 2016 launch for 26 months and increased Project life-cycle costs $154 million to $829 million.

InSight Mars Lander

Source: NASA.

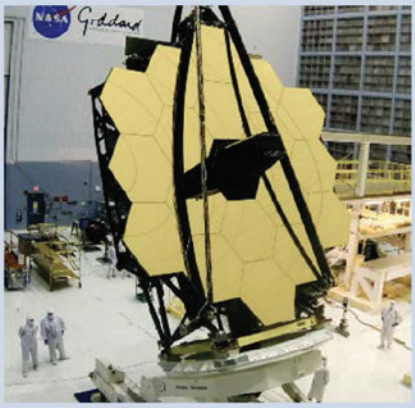
In July 2017, InSight was still experiencing delays with its seismometer, was troubleshooting unexpected technical issues with the penetrating mole, and was developing mitigation strategies to address degradation of parachute

[38] This baseline cost was approximately $75 million higher than initial estimates because NASA had to procure a separate launch vehicle when its plan to share the cost of a launch vehicle with a U.S. Air Force payload did not materialize.

strength found in testing – all of which eroded schedule and cost reserves. As of September 2017, the seismometer instrument and mole had been delivered and installed on the spacecraft, managers concluded that the parachute strength was within the performance margin, and the Project was on schedule for launch in May 2018.

James Webb Space Telescope

James Webb Space Telescope



Source: NASA.

The successor to the Hubble Space Telescope, the James Webb Space Telescope (JWST) is designed to help understand the origin of the first stars and galaxies in the universe, the evolution of stars, the formation of stellar systems, and the nature of celestial objects in our solar system. The 2001 Astrophysics Decadal Survey identified JWST as its top priority for that decade.[39] Early cost and schedule estimates – ranging from $1 billion to $3.5 billion, with an expected launch date between 2007 and 2011 – proved overly optimistic, and following a change in the launch vehicle and other revisions in 2005, NASA estimated life-cycle costs at $4.5 billion with a launch date in 2013. Soon after, a review team found the 2013 launch date unachievable. Consequently, in 2009 NASA rebaselined JWST with a life-cycle cost estimate of $4.9 billion and a June 2014 launch date. However, it soon became clear that neither the new cost estimate nor the 2014 launch date were attainable. Subsequently, NASA restructured the JWST Project and in September 2011 established a revised baseline life-cycle cost estimate of $8.84 billion and an October 2018 launch date.

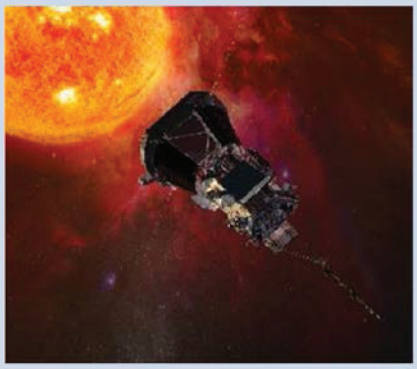
JWST has made significant progress in integration and testing, including installation of all five sunshield membranes and environmental testing of the optical telescope and science instrument module. Although the Project remains within its revised baseline cost and schedule, some integration and test activities have taken longer than expected, which is likely to consume available cost and schedule reserves. While not completely unexpected at this point in a project's life cycle, the schedule margin has fallen below what was planned, increasing costs have resulted in a smaller-than-planned funding reserve, and issues were identified with integration and testing of the spacecraft bus and sunshield. In late September 2017, the Agency delayed the JWST launch to no earlier than March 30, 2019, and the project will need to tap into JWST budget reserves to remain within the Agency's cost cap.

[39] NRC, "Astronomy and Astrophysics in the New Millennium," 2001. At the time, JWST was referred to as the Next Generation Space Telescope.

Parker Solar Probe

The $1.6 billion Parker Solar Probe mission is designed to orbit the Sun closer than any other spacecraft while investigating the Sun's corona or outer atmosphere. The mission will sample plasma and the coronal magnetic field in the region that heats the solar atmosphere and accelerates the solar wind to provide insights into coronal heating and the origin and evolution of the solar wind – questions posed in the 2003 and 2013 Heliophysics Decadal Surveys.[40] The mission will also provide a better understanding of the radiation environment in which future space explorers will work and live.

Parker Solar Probe



Source: NASA (artist's rendering).

The Parker Solar Probe has a 20-day launch window that opens on July 31, 2018. Development delays and testing failures with instruments and spacecraft subsystems required the use of schedule reserve and funding from Headquarters-held reserves. As late as August 2017, two instruments critical to the mission meeting its primary science objectives were experiencing development delays and testing failures. As the Project begins spacecraft-level environmental testing, solving any remaining technical issues in time to meet the launch window is imperative if NASA is to avoid a minimum 10-month launch delay.

Information Technology Governance and Security

Information Technology (IT) plays an integral role in every facet of Agency operations, and hundreds of thousands of individuals – from NASA personnel to members of academia to the public – rely on NASA IT systems every day. In 2017, NASA spent approximately $1.4 billion (7.6 percent) of it $18.5 billion budget on IT investments. The Agency's portfolio of IT assets includes approximately 500 information systems used to control spacecraft, collect and process scientific data, and enable NASA personnel to collaborate with colleagues around the world.

For more than 10 years, the OIG has identified securing NASA's IT systems and data as a top management challenge. Over the last 7 years, we have issued 24 audit reports containing over 119 recommendations designed to improve NASA's IT governance and IT security efforts. Although the Agency has made progress in this area, we remain concerned about the state of the Agency's IT governance, its acquisition of IT systems, cybersecurity vulnerabilities, IT security incident detection and handling capabilities, continuous monitoring tools, cloud-computing services, and web application security.

[40] NRC, "The Sun to the Earth – and Beyond: A Decadal Research Strategy in Solar and Space Physics," 2003, and "Solar and Space Physics: A Science for a Technological Society," 2013.

Information Technology Governance

Effective IT governance must balance compliance, cost, risk, security, and mission success to meet the Agency's strategic goals and the needs of external stakeholders. However, for more than 2 decades NASA has struggled to implement an effective IT governance approach that appropriately aligns authority and responsibility commensurate with the Agency's overall mission.

In a June 2013 audit, we examined whether NASA's Office of the Chief Information Officer (OCIO) had the organizational, budgetary, and regulatory framework needed to effectively meet the Agency's varied missions.[41] We found the decentralized nature of NASA's operations and its longstanding culture of autonomy hindered its ability to implement effective IT governance. Specifically, the Chief Information Officer (CIO) had limited visibility and control over a majority of the Agency's IT investments, operated in an organizational structure that marginalized the authority of the position, and could not enforce security measures across NASA's computer networks. Moreover, the IT governance structure in place at the time was overly complex, did not function effectively, and operated under a decentralized model that relegated decision making about critical IT issues to numerous individuals across the Agency, leaving such decisions outside the purview of the CIO. As a result, NASA's IT governance model weakened accountability and did not ensure that IT assets across the Agency were cost effective or secure.

Given the criticality of these issues, we reexamined the Agency's reform efforts and in an October 2017 follow-on audit report found a continued lack of progress in improving the Agency's IT governance, casting doubt on the OCIO's ability to effectively oversee the $1.4 billion the Agency spends annually on IT.[42] Specifically, the CIO continues to have limited visibility into IT investments across NASA and the process the Agency developed to correct those shortcomings is flawed. Moreover, the OCIO continues its decade-long struggle to establish an effective enterprise architecture. While the OCIO has made changes to its three senior advisory boards over the past few years, these boards have yet to make strategic decisions that substantively impact how IT at NASA is managed. Consequently, slow implementation of the OCIO's revised IT governance structure has left many Agency IT officials operating under the previous inefficient and ineffective framework, and as of July 2017 the OCIO had not finalized the roles and responsibilities for IT management at NASA. Further, lingering confusion regarding security roles coupled with poor IT inventory practices negatively impacts NASA's security posture. Finally, the OCIO continues to have limited influence over IT management within the Mission Directorates and at Centers due to the autonomous nature of NASA's operations and its lack of credibility on IT issues in the eyes of many of its customers. Moving forward, NASA needs to redouble its efforts to create and sustain a system of IT governance and operation that provides secure and efficient IT systems for Agency employees, contractors, and the public.

[41] NASA OIG, "NASA's Information Technology Governance" (IG-13-015, June 5, 2013).

[42] NASA OIG, "NASA's Efforts to Improve the Agency's Information Technology Governance" (IG-18-002, October 19, 2017).

Securing Information Technology Systems and Data

NASA manages approximately 1,200 publicly accessible web applications, or about half of all publicly accessible, non-military Federal Government websites.[43] The Agency's vast connectivity with educational institutions, research facilities, and other outside organizations offers cybercriminals a larger target than most other Government agencies and presents unique IT security challenges.

NASA must ensure that its IT systems and associated components are safeguarded, assessed, and monitored to protect against inevitable attacks. Over the past 2 years, NASA reported more than 3,000 computer security incidents related to malicious software on or unauthorized access to Agency computers. These incidents included individuals testing their skills to break into NASA systems, well-organized criminal enterprises hacking for profit, and intrusions that may have been sponsored by foreign intelligence services seeking to further their countries' objectives. To protect against these incidents, NASA recently completed a series of initiatives, including:

- expanding network penetration testing and incident response assessments;
- deploying intrusion detection systems across mission, corporate, and research networks;
- increasing web application security scanning;
- implementing intrusion prevention systems;
- expanding anti-phishing exercises Agency-wide; and
- implementing anti-exploitation software to reduce potential incidents.

While these actions improve NASA's security posture, the Agency has yet to develop an Agency-wide risk management process specific to information security. Furthermore, in April 2016 we reported that although NASA has made progress in meeting requirements in support of an Agency-wide information security program, it has not fully implemented key management controls essential to managing that program.[44] Specifically, NASA lacked an Agency-wide risk management framework for information security and an information security architecture. This situation is further complicated by high personnel turnover in the Agency's OCIO – specifically, the CIO and Senior Agency Information Security Officer roles – resulting in a lack of continuity and effective program planning.

NASA's efforts to incorporate a greater use of cloud computing also challenges the Agency's IT security posture. While cloud computing offers the potential for significant cost savings through faster deployment of computing resources, a decreased need to buy hardware or build data centers, and enhanced collaboration capabilities, the move to a cloud-computing environment poses operational and IT security risks such as limited controls over the management of critical or sensitive data within the cloud environment. In 2013, we reported that the Agency's IT governance and risk management practices were impeding NASA from fully realizing the benefits of cloud computing and potentially

[43] In 2014, we examined NASA's efforts to assess vulnerabilities on its publicly accessible web applications and mitigate the most severe vulnerabilities before hackers exploit them. NASA OIG, "Security of NASA's Publicly Accessible Web Applications" (IG-14-023, July 10, 2014). Although the OCIO and Center IT security officials have reduced NASA's web presence by eliminating some unused and duplicative web applications, the Agency's remaining publicly accessible web applications continue to present a significant target for hackers.

[44] NASA OIG, "Review of NASA's Information Security Program" (IG-16-016, April 14, 2016).

placed at risk its information stored in the cloud.[45] In February 2017, we reexamined NASA's efforts and found that while NASA has made improvements since the 2013 report, continuing weaknesses in its governance and risk management processes have prevented the Agency from fully realizing the benefits of cloud computing and continue to leave Agency information stored in cloud environments at unnecessary risk.[46] Specifically, we found cloud services in use by NASA that lacked IT security authorizations to operate and system security plans, and cloud services using contracts that lacked provisions intended to address key business and IT security risks associated with cloud environments. As NASA continues to move more data to the cloud, the Agency's OCIO is challenged to strengthen its risk management and governance practices to safeguard this information.

Advancements in technology have enabled NASA to move away from isolated, manually controlled operational technology (OT) systems to an environment in which physical processes are controlled with sophisticated and interconnected IT equipment. As more devices become "smart" through wireless connectivity, OT systems that once required hands-on manipulation, such as adjusting a valve or flipping a switch can now be controlled remotely. Many of these OT systems are part of the Agency's critical infrastructure used to test rocket propulsion systems, control and communicate with spacecraft, and operate ground support facilities, or are associated with electrical power, heating and cooling systems, and other supporting infrastructure. While the convergence of IT and OT can lead to cost savings and other efficiencies, it also means OT systems are potentially vulnerable to the same types of security challenges more common to IT systems, including malicious hacking.

In February 2017, we issued a report critical of the Agency's ability to protect systems that contain OT components.[47] Specifically, NASA had no complete inventory of systems that incorporated OT, and this shortcoming resulted in those systems lacking comprehensive IT security controls. In addition, we found that NASA's policies did not distinguish OT from IT, and the Agency did not offer training focused on protecting OT systems. As a result, NASA was not well-positioned to meet the security demands of an evolving OT environment and was assuming unnecessary risk for critical Agency systems and facilities with OT components. Further, because we found Centers implementing inconsistent security practices, we questioned the overall efficacy of NASA's process for identifying its critical infrastructure. Finally, inadequate guidance and oversight, coupled with insufficient funding and record keeping, limit the visibility and insight into NASA's critical infrastructure protection processes and ultimately impair the Agency's ability to protect its vital assets.

In the past several years, we also identified IT security deficiencies in NASA's Space Communication and Navigation Program that operates the networks that provide communications, navigation, and transmission of scientific data to space flight missions. In March 2016, we found the Near Earth Network was at increased risk of compromise due to operators deviating from required elements of Federal and Agency cyber and physical security risk management policies.[48] Similarly, in a March 2015 report on the Deep Space Network, we found that NASA's Security Operations Center (SOC) was not adequately integrated into the Jet Propulsion Laboratory's (JPL) computer network operations resulting in a lack of oversight for some JPL systems because the two organizations had not agreed on plans for

[45] NASA OIG, "NASA's Progress in Adopting Cloud-Computing Technologies" (IG-13-021, July 29, 2013).

[46] NASA OIG, "Security of NASA's Cloud Computing Services" (IG-17-010, February 7, 2017).

[47] NASA OIG, "Industrial Control System Security Within NASA's Critical and Supporting Infrastructure" (IG-17-011, February 8, 2017).

[48] IG-16-014.

comprehensive monitoring.[49] As a result, NASA lacked the ability to monitor a large portion of JPL network traffic for suspicious activity, provide timely assistance in the event of an incident, and ensure its information systems and data are fully protected. In response to the reports' recommendations, the Agency said it has improved SOC oversight at JPL. To check on its progress, in March 2017 we initiated an audit to assess the SOC's capability, workload, and resource management as well as continuity of operations.

In addition to our audit work, the OIG continues to expend substantial resources investigating IT security issues, including breaches of NASA IT networks. The OIG recently arrested a former NASA contract employee indicted for illegally accessing and attempting to damage NASA systems. During the course of another cyber investigation, the OIG found NASA was not sufficiently protecting sensitive export-controlled software and, acting on OIG recommendations, subsequently improved its internal controls.

Aging Infrastructure and Facilities

NASA controls approximately 5,000 buildings and structures with an estimated replacement value of at least $34 billion, making the Agency one of the largest property holders in the Federal Government. However, more than 80 percent of the Agency's facilities are 40 or more years old and are beyond their design life. While NASA strives to keep these facilities operational – and when not operational, in sufficient condition so they do not pose a safety hazard – the Agency has not been able to fully fund required maintenance for its facilities for many years, with NASA estimating its deferred maintenance costs at $2.4 billion in 2016. The Agency faces ongoing operational challenges in this area as it juggles a long history of decentralized governance, intense political interest in its Centers and their real property assets, and the likelihood of flat or reduced budgets.

Test Stand 4693

Source: NASA.

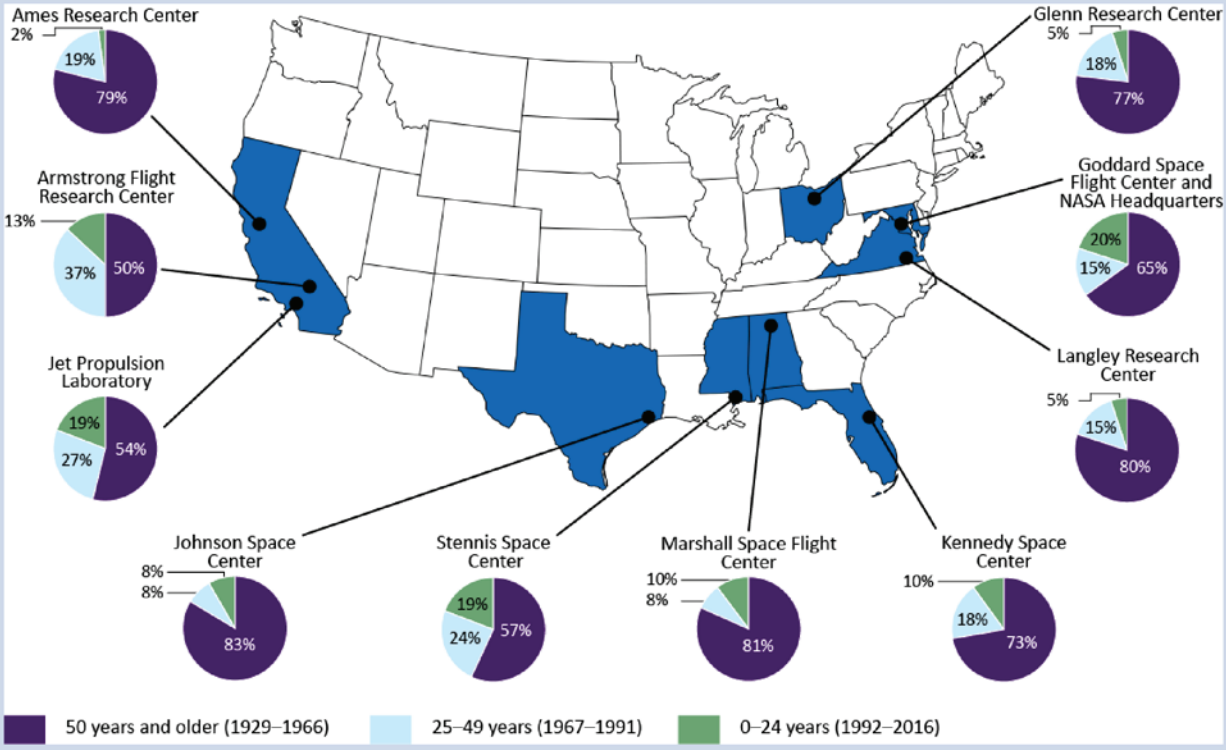
Over the last 7 years, the OIG has dedicated substantial resources – issuing 16 audit reports – examining NASA's infrastructure challenges. In doing so, we assessed a variety of issues including NASA's efforts to "right-size" its workforce, facilities, and other supporting assets; the construction of new assets such as test stands at Marshall Space Flight Center; NASA's plans for underused test facilities at Plum Brook Station in Ohio; management of its Pressure Vessels and Pressurized Systems and Explosive Safety Programs; the Agency's environmental remediation efforts; and NASA's efforts to reduce unneeded infrastructure and facilities. Common themes throughout all of these reviews are slow implementation of corrective actions, inconsistent implementation of Agency policies, and a need for stronger life-cycle cost considerations in facility construction decisions.

NASA established the Technical Capabilities Assessment Team (TCAT) in June 2012 to assess the Agency's technical capabilities (including infrastructure and personnel resources) and make recommendations for investing in, consolidating, or eliminating capabilities based on mission

[49] IG-15-013. The SOC provides an Agency-wide single point-of-contact for information security incidents and continuously monitors computer network traffic entering and leaving NASA Centers.

requirements.[50] In our April 2017 review of the undertaking, we found that after more than 4 years the Agency has yet to make many concrete decisions about its technical capabilities – for example, to consolidate or dispose of assets.[51] Rather, most decisions have been iterative steps on the path to making actual determinations about technical capabilities, leaving us concerned that the Agency's efforts have been slow to produce meaningful results. Moreover, NASA's assessments of its capabilities did not consistently include information needed to make informed decisions, including mission needs or facility usage data, analyses to determine gaps or overlaps, recommendations to achieve cost savings, or firm timeframes for completing actions. The Agency must be willing to make difficult decisions to invest, divest, or consolidate unneeded infrastructure; effectively communicate those decisions to stakeholders; and withstand the inevitable pressures from Federal, state, and local officials to retain capabilities and structures "just in case."

NASA's Aging Facilities



Source: NASA OIG analysis of Agency data (some percentages sum to greater or less than 100 because of rounding).

In another example, in May 2017, we reported on NASA's construction of two test stands at Marshall Space Flight Center and found that inadequate planning for the effort ultimately increased costs.[52] NASA built two test stands to test the liquid hydrogen and liquid oxygen tanks from the core stage of the SLS rocket. To meet schedule commitments, test stand design and construction began before tank

[50] To institutionalize capability management into its annual planning and budgeting processes, NASA replaced TCAT with the Capability Leadership Model (CLM) in 2015. CLM is designed to advance NASA's technical capabilities to meet long-term missions, optimize deployment of capabilities across its major facilities, and transition capabilities no longer needed.

[51] NASA OIG, "NASA's Efforts to 'Rightsize' its Workforce, Facilities, and Other Supporting Assets" (IG-17-015, March 21, 2017).

[52] NASA OIG, "Construction of Test Stands 4693 and 4697 at Marshall Space Flight Center" (IG-17-021, May 17, 2017).

design was finalized. In addition, NASA paid the contractor a premium of $7.6 million for the additional labor needed to work around-the-clock to meet the ambitious schedule. Subsequently, when the project's requirements matured, NASA needed an additional $20.3 million to make modifications to the original test stand designs. In addition, because NASA failed to establish adequate funding reserves to cover these increased costs, project officials had to secure $35.5 million in additional funding over the planned budget. Finally, NASA did not adequately consider alternative locations before selecting Marshall as the site for the new test stands and therefore cannot be sure it made the most cost effective decision.

Contracting and Grants

Approximately 76 percent of NASA's $18.5 billion FY 2016 budget was spent on contracts to procure goods and services, and the Agency awarded an additional $974 million in grants and cooperative agreements. Accordingly, NASA managers face the ongoing challenge of ensuring the Agency receives fair value for its money and that recipients spend NASA funds appropriately to accomplish agreed-upon goals. The OIG seeks to assist NASA in these efforts by examining Agency-wide procurement and grant-making processes; auditing individual contracts, grants, and cooperative agreements; and investigating potential misuse of Agency contract and grant funds. Additionally, we monitor the impact of contracts and grants awarded to assist NASA in accomplishing its aeronautics, exploration, and science missions as well as to provide support-type functions in areas like information technology. While many project management and IT reviews are highlighted elsewhere in this report, we discuss below several underlying issues that correlate directly to the Agency's contracting and grant challenges.

During the past year, the OIG continued to uncover fraud and misconduct related to NASA contracts. For example, as the result of an investigation conducted by the NASA OIG and several other agencies, a Nevada aerospace company agreed to pay $14.9 million to settle allegations it violated the Federal False Claims Act by knowingly misclassifying costs, causing Government agencies to pay inflated overhead rates. Further, in January 2017 a Los Angeles contractor was sentenced to 2 years of imprisonment after being found guilty for conspiring to provide $42,590 in illegal gratuities to approximately 70 Government purchase cardholders, which yielded an estimated $3 million in return business for the contractor's company.

Given NASA's continued reliance on contractors to provide essential services, the Agency will remain susceptible to contract fraud schemes, including collusion among bidders, employers, and contractors; corrupt payments in the form of bribes and kickbacks; bid manipulation; failure to meet contractual specifications; substitution of products or materials of lesser quality than specified in the contract; use of counterfeit, defective, or used parts; submission of false, inflated, or duplicate invoices; false claims regarding a contractor's abilities or level of experience; and conflicts of interest. To assist in identifying such issues, in 2015 the OIG established an Advanced Data Analytics Program that uses statistical and mathematical techniques to gather, analyze, and interpret Agency and open-source data to assist investigative and audit staff in identifying, among other issues, contract, grant, and procurement fraud.

Over the years, we have consistently reported on the Agency's challenges in effectively executing its contract and grant functions and we continue to track open recommendations related to prior award fee, contract management, and service contract audit findings. For example, two programmatic and policy-based recommendations remain open from our May 2016 report on NASA's $1.9 billion Engineering Services Contract at Kennedy that found the size and scope of the Center's agreement with

Vencore, the prime contractor, made managing the contract particularly challenging.[53] Specifically, costs and tasks were not clearly defined, some managers overseeing the contract lacked appropriate expertise, and several tasks performed by Vencore on a cost-reimbursable basis appeared more suitable to a fixed-price arrangement.[54] Moreover, NASA limited its ability to evaluate Vencore's performance by including generic milestones and deliverables in several task orders, and the Agency employed evaluation standards that did not align with the Federal Acquisition Regulation or the contract's award-fee plan. As a result, NASA's evaluations of the contractor's performance did not consistently support the award-fee scores assigned and we questioned more than $450,000 in award-fee payments. These challenges relating to managing award-fee contracts mirrored similar concerns we raised in previous reports, and we continue to work with the Agency to ensure our recommendations are addressed to improve contract management.[55]

More recently, in an April 2017 report we questioned NASA's management of the contracts used to develop new spacesuits.[56] Specifically, in 2011 Johnson Space Center officials recommended terminating a contract for a spacesuit development project associated with the cancelled Constellation Program. However, rather than end the contract, NASA paid the contractor $80.8 million between 2011 and 2016 for spacesuit technology development despite parallel development activities being conducted elsewhere in the Agency. Consequently, NASA has spent nearly $200 million to develop spacesuit technologies, though the Agency remains years away from having a flight-ready spacesuit suitable for use on future exploration missions.

NASA also awards millions of dollars in grants and cooperative agreements annually to facilitate research and fund scholarships, fellowships, and stipends to students and teachers, as well as research by educational institutions or other nonprofit organizations. The Agency faces the ongoing challenge of ensuring grant and cooperative agreement funds are administered appropriately and that recipients are accomplishing agreed-upon goals. We continue to conduct audits and investigations to assist NASA in meeting this challenge. For example, in our June 2015 report on NASA's cooperative agreements awarded to the Wise County Clerk of Circuit Court (Wise County), we found that although Wise County satisfied the overall performance goals and objectives of its cooperative agreements with NASA, substantial deficiencies existed in the County's management of award funds that resulted in recovery of unallowable costs and cost avoidance totaling $208,808.[57] In another audit report on NASA's grant awards to the Philadelphia College Opportunity Resources for Education (CORE), we found that CORE charged $60,511 in unallocable or unallowable expenditures and failed to maintain appropriate time and attendance documentation to support personnel charges totaling $156,409, among other control

[53] NASA OIG, "Audit of NASA's Engineering Services Contract at Kennedy Space Center" (IG-16-017, May 5, 2016).

[54] In a cost-reimbursement contract, NASA reimburses contractors for allowable costs they incur producing or delivering the contracted goods or services. Cost-type contracts pose a financial risk to the procuring agency because they do not promise delivery of a good or service at a set price. An award fee is money a contractor may earn in whole or in part by meeting or exceeding predetermined performance criteria.

[55] NASA OIG, "Audit of NASA's Management of International Space Station Operations and Maintenance Contracts" (IG-15-021, July 15, 2015); "Extending the Operational Life of the International Space Station Until 2024" (IG-14-031, September 18, 2014); and "NASA's Use of Award-fee Contracts" (IG-14-003, November 19, 2013).

[56] NASA OIG, "NASA's Management and Development of Spacesuits" (IG-17-018, April 26, 2017).

[57] NASA OIG, "Audit of NASA's Cooperative Agreements Awarded to Wise County Circuit Court" (IG-15-022, July 16, 2015). The cooperative agreements were awarded in support of the Agency's DEVELOP National Program, a capacity building program that seeks to address environmental management and public policy issues through interdisciplinary research projects that apply NASA Earth observations to community concerns around the globe.

deficiencies identified.[58] In another audit, we found that NASA's poor internal controls resulted in the Texas Space Grant Consortium, led by the University of Texas at Austin, inappropriately awarded scholarships to students who were not U.S. citizens and failed to adequately track required cost matching.[59] We continue to monitor the Agency's status in addressing open recommendations related to our grant and cooperative agreement audits.

Similarly, our Office of Investigations is actively helping the Agency prevent and make recoveries from grant fraud and abuse. Over the past 5 years, the OIG has conducted 25 grant fraud investigations resulting in 8 indictments, 5 prosecutions, $638,783 in direct recoveries to NASA, $2.9 million in civil settlements, 2 suspensions, and 7 debarments. In one case, an investigation of fraud committed by Educational Advancement Alliance, Inc., (EAA) and its president ended in the convictions of its president, former Pennsylvania Congressman Chaka Fattah, and several associates.[60] The organization received a series of Federal grants, including a $1.8 million grant from NASA to promote science, technology, engineering, and mathematics education. The investigation revealed that EAA improperly used $100,000 of the NASA grant to pay a campaign debt on former Congressman Fattah's behalf. In June 2016, a Federal jury convicted the Congressman and his associates of taking part in a racketeering conspiracy by misappropriating Federal, charitable, and campaign funds. In December 2016, the Congressman was sentenced to 10-years' imprisonment while the company president was sentenced to 2-years' imprisonment.

[58] NASA OIG, "Audit of NASA Grants Awarded to the Philadelphia College Opportunity Resources for Education" (IG-12-018, July 26, 2012). CORE is a not-for-profit organization that provides college scholarships to high school seniors.

[59] NASA OIG, "Audit of NASA Space Grant Awarded to the University of Texas at Austin" (IG-16-013, February 18, 2016). In 2010, NASA awarded a $3.36 million grant to the University of Texas at Austin for educational training to increase interest in science, technology, engineering, and mathematics.

[60] NASA OIG assisted the Federal Bureau of Investigation and Internal Revenue Service in the investigation.

National Aeronautics and Space Administration

Office of the Administrator
Washington, DC 20546-0001

October 31, 2017

TO: Inspector General

FROM: Acting Administrator

SUBJECT: Agency Response to Office of Inspector General Report, "NASA's 2017 Top Management and Performance Challenges"

The National Aeronautics and Space Administration (NASA) appreciates the opportunity to review and comment on the Office of Inspector General's (OIG) report entitled, "NASA's 2017 Top Management and Performance Challenges."

The audits and investigations conducted by your office provide NASA's leadership and management with valuable contributions to the collective effort to provide oversight and gain insight into NASA's broad portfolio of programs, projects, and mission support activities with which it is entrusted. The efforts expended by your office during this past year have furthered the cause of providing the taxpayer with maximum value for each dollar invested in NASA's wide-ranging, ambitious, and challenging portfolio. As an Agency, we continue to aggressively pursue the mitigation and remediation of findings related to the audit recommendations issued by your office, including those which form the underpinnings of your observations as cited in your 2017 Top Management and Performance Challenges Letter.

While we fundamentally agree that the five areas outlined in your 2017 letter constitute significant challenges for the Agency, we would like to highlight the following mitigation and remediation efforts that have either been taken, or are underway, which we believe further demonstrate NASA's commitment in addressing its most significant management and performance challenges:

1. Deep Space Exploration

Space Launch System, Orion, and Ground Systems Development Program:

The predominance of Orion, Space Launch System (SLS), and Ground Systems Development and Operations (GSDO) development and production content is on track for Exploration Mission (EM-1), and work is underway to prepare for the first flight of crew on EM-2 and subsequent exploration missions. While progress on these programs has been substantial, NASA and its partners have faced challenges relative to the critical path for the EM-1 test flight and as a result is rescheduling program planning of EM-1 to

reflect completion of work required to prepare for flight. NASA has made significant progress in addressing first-time development issues, such as resolving the Vertical Assembly Center (VAC) weld strength issues and all VAC assembly welding for EM-1 has been completed. Michoud Assembly Facility operations have resumed following the tornado that damaged the facility. All EM-1 booster separation motors are cast and finalized, and the engine controller qualification testing has been completed. The EM-1 Crew Module (CM) and Crew Module Adapter (CMA) production at the Operations and Checkout Center is making good progress; both the CM and the CMA have completed initial power on. European Service Module coordination on assembly, integration, and testing is improving, and NASA has increased involvement in resolving vendor technical and schedule performance issues. The Interim Cryogenic Propulsion Stage has been delivered to GSDO. At the Kennedy Space Center, Vehicle Assembly Building (VAB) platform installation is complete. Pad 39B development is progressing well, and five sets of umbilicals/attach points have been installed on the Mobile Launcher as of September. Finally, NASA is making progress on issues associated with spacecraft command and control software. SLS, Orion, and GSDO are on track to serve as the foundation of U.S. human spaceflight exploration and, along with emerging capabilities in cislunar space, will ensure continued U.S. space leadership for decades to come.

International Space Station (ISS):

This past year has seen the ISS International Partnership and the ISS National Lab mature the safe operations and utilization of this unique on-orbit research platform. Research and utilization for the wide variety of fields including human health and performance, long-duration life support demonstrations, life and physical sciences, Earth and space science, astrophysics, and multiple technology development fields continue to expand in the number of experiments and the number of investigators. From Increment 41/42 (first half of FY 2015) to the recently completed ISS Increment pair 51/52 (second half of FY 2017), the number of investigations have increased by ~40 percent and the amount of crew time has also increased by ~34 percent. This has been made possible by the ongoing efforts of the ISS Program, the National Lab operator CASIS, and the commercial cargo suppliers to utilize and operate the ISS to its utmost capability. The ISS Program is now operating based on the many years of experience learned in pre-flight integration activities, on-orbit crew planning and execution, logistics planning and management, and other aspects of ISS management and operations; all of which is providing dividends in returning benefits to humanity, enabling the development of a commercial market, and enabling deep space long-duration exploration.

Research, technology development, and commercial development efforts onboard the ISS by NASA, other government agencies, and by the private sector through the National Lab continues to see benefits applied to us here on Earth as documented in the ISS Benefits to Humanity Document that is posted on NASA's ISS Web page. NASA has prioritized the human research testing on ISS in order to develop techniques to keep crews healthy on extended microgravity missions.

Through the NASA budget process, the ISS Program has projected the resources necessary to continue with its mission based on actual contract and on-orbit performance data for many aspects of the ISS Program, including transportation, maintenance, and operations. The ISS integration process for utilization continues to become more efficient based on private industry inputs and interactions with the National Lab providers.

Overall the ISS Program is starting to realize its full potential in accomplishing NASA's and the Nation's goals in exploration, commercial development, and extending human presence beyond LEO.

Commercial Cargo/Commercial Transportation to the ISS:

Over the past year, Orbital ATK and SpaceX have continued to become more responsive to NASA's needs to resupply the ISS. Both commercial service providers have flown their expected cargo missions to the ISS over the past year. Both companies have improved their processes and timeliness of service as a result of anomalies that occurred in 2014 and 2015. NASA continues to work with both suppliers to access the risk to ISS operations and cargo launches within NASA's procedures documented in NPD 8610.7, "Launch Services Risk Mitigation Policy for NASA-Owned and/or NASA-Sponsored Payloads/Missions," and NPD 8610.23, "Launch Vehicle Technical Oversight Policy."

Commercial Crew:

Both commercial crew providers, Boeing and SpaceX, are making steady progress in returning domestic crew launches to the U.S. Both providers are working through development technical challenges that are not uncommon in the human spaceflight and launch industries Nationwide. NASA maintains close coordination with both entities to understand their progress as well as to assess their readiness for flight from a safety perspective. NASA has also been working with Roscosmos and other domestic industry partners to ensure that the U.S. has uninterrupted access to the ISS for U.S. and partner astronauts.

2. Science Mission Directorate Portfolio

The Science Mission Directorate (SMD) develops and implements an extensive portfolio of scientific programs and projects that are inherently complex and present unique challenges. In developing its diverse science portfolio, NASA receives guidance, sometimes conflicting, from a variety of stakeholders including the President, Congress, the National Research Council, and others. SMD strives to develop a balanced portfolio to achieve three overall, interdisciplinary objectives: 1) Safeguarding and improving life on Earth, 2) Searching for life elsewhere, and 3) Expanding our knowledge through research from here at home into the deep universe. We appreciate the OIG's recognition

of the inherent challenges involved with managing a portfolio with contradiction guidance from our stakeholders.

The Mars Exploration Program continues to be a key component of our Planetary Science Division. NASA will continue to look for additional opportunities, after Mars 2020, to capitalize on the experience base gained through recent Mars missions.

Upcoming missions, such as ICESat-2 and InSight, continue to progress toward launch. While ICESat-2 encountered challenges during thermal vacuum testing, resulting in a three month slip to the launch date, funding reserves are sufficient to cover the additional work. InSight's seismometer and penetrating mole were recently delivered and installed in the spacecraft and no longer pose any schedule risk. Recent testing has indicated that potential degradation of the parachutes are within the performance margin and will be used as is. Currently, the project has sufficient schedule and cost reserves for the launch in May of 2018.

We continue to make significant progress in the development, integration, and testing of the James Webb Space Telescope (JWST) observatory. This year, the highly complex cryovacuum test of the JWST optical telescope and instrument system (OTIS) was completed on October 22, 2016. Additionally, the integration of the sunshield components with the spacecraft bus is complete (forming the spacecraft element), leaving one major integration step - the integration of OTIS to the spacecraft element. As noted by OIG, due to future schedule considerations in the integration and test of the remainder of the JWST system, in particular testing of the spacecraft element, NASA worked with the European Space Agency (ESA) to shift the launch window of JWST to no earlier than March 30, 2019. NASA continues to work closely with the industry team leading the sunshield and spacecraft work to ensure successful development of JWST.

The Parker Solar Probe will travel closer to the Sun than any spacecraft and will dive into the corona to provide the closest-ever observations, revolutionizing our understanding of the Sun. All instruments, with the exception of one, have been delivered to the spacecraft, which recently was approved to begin environmental testing. The final instrument, the Solar Probe Cup, has been delivered to the Applied Physics Lab for testing and acceptance. The Project currently holds adequate schedule and cost reserves to achieve an August 2018 launch.

These and other new missions, combined with those in operations, allow NASA to use the vantage point of space to achieve--with the science community and our partners--a deep scientific understanding of our home planet, the Sun, and its effects on the solar system, other planets and solar system bodies, our galactic neighborhood, and the universe beyond.

3. Information Technology, Security, and Governance

The information technology (IT) necessary to accomplish NASA's missions is complex and tightly integrated within a variety of mission products and capabilities. This complexity guides the approach and pace at which the Office of the Chief Information Officer (OCIO) progresses toward the goal of managing NASA IT as a strategic resource. The Chief Information Officer (CIO) must utilize a combination of partnerships, collaborations, and governance to implement IT management that enables mission success and allows effective and secure management of mission and corporate IT operations. We appreciate the OIG's recognition of the Agency's efforts to meet the challenges facing NASA's IT governance and the security of IT systems and data.

In FY 2017, the OCIO continued to advance the effectiveness of IT governance that aligned the NASA CIO's authority and responsibility with the Agency's overall mission governance. Improvements included refining the accuracy and expansion of the CIO's visibility into NASA's IT portfolio, utilizing the Information Technology Council (ITC) as both a decision body and collaboration source with the stakeholder members, and implementing Center Functional Reviews.

In FY 2018, the Agency's planned efforts to improve IT governance include, but are not limited to:

1) Refining the Annual Capital Investment Review (ACIR) process to improve the completeness of the IT portfolio, culminating in the FY 2020 Planning, Programming, Budgeting, and Execution (PPBE) IT portfolio ITC presentation, and subsequent submission to the Office of Management and Budget.
2) Realigning IT management roles and responsibilities to establish the clear authorities of the Agency CIO for management and oversight of the NASA IT portfolio as required by Federal Information Technology Acquisition Reform Act (FITARA) and other policies and regulations.
3) Revising the program-level board charters that support senior-level IT governance.

The OCIO continues its efforts to improve the Agency's cybersecurity posture and address NASA's unique IT security challenges. FY 2017 improvements included expanding network penetration testing, deploying active intrusion detection systems, increasing anti-phishing education efforts, and implementing anti-exploitation software. The deployment of the Department of Homeland Security's Continuous Diagnostics and Mitigation (CDM) Phase 1 program to the corporate network offers another example of a major FY 2017 accomplishment, improving the Agency's cybersecurity posture, hardware and software asset management, vulnerability management, and configuration management.

In FY 2018, the OCIO will implement critical security initiatives to address Agency cybersecurity gaps as they pertain to the Agency's information security program. These initiatives include, but are not limited to:

1) Executing an Agency-wide Cybersecurity strategy, approved in FY 2017, aligned with the Agency IT Strategic Plan, to address NASA's cybersecurity priorities.
2) Deploying CDM Phase 1 tools on the mission networks.
3) Establishing a Cybersecurity Integration Team (CIT), to operationalize NASA's response to the Presidential Executive Order on Strengthening the Cybersecurity of Federal Networks and Critical Infrastructure, including but not limited to, the evaluation and improvement of NASA's cybersecurity risk management policies, processes, and reporting, under the auspices of the ITC.

4. Aging Infrastructure

NASA recognizes the imbalance between the infrastructure that it maintains and the funding available to properly sustain the infrastructure. To respond to and manage that imbalance, NASA has implemented a strategy to reduce its infrastructure over time, eliminate facilities that it no longer needs, consolidate capabilities when it makes sense, and make focused investments in critical capabilities.

NASA's demolition and disposal program has reduced NASA's total square footage by 449,200 square feet in the last three years. During the last three years, NASA has eliminated $66.7 million in deferred maintenance through demolition. In the last seven years, NASA has disposed of four sites (Palmdale Orbiter Processing Site, Camp Parks, White Sands Space Harbor, and Glenn Research Center North Campus). NASA continues to work to dispose of the Santa Susana Field Lab and Crows Landing sites. Toward that effort, NASA has demolished more than 30 structures at Santa Susana and 27 structures at Crows Landing.

NASA has shifted from managing demolition through annual plans to managing against a five-year reduction plan. As NASA has implemented managing to five-year reduction plans, NASA has become more aggressive in its downsizing. In 2015, NASA's five-year disposal plan indicated that NASA would reduce infrastructure by 1.5 percent over a five-year period. NASA's 2017 disposal plan indicates that NASA expects to reduce its infrastructure by 4 percent over the next 5 years. This year, NASA established 25 percent infrastructure reduction as the Agency's planning goal over 20 years. This planning goal will be incorporated into future master plans. The reduction goal will increase the emphasis on infrastructure reduction and drive the infrastructure sustainment requirements to a size that is in line with estimated funds availability.

Although 80 percent of NASA's infrastructure is 40 or more years old, NASA's investments in replacing old buildings with new efficient buildings, renewing or refurbishing serviceable buildings, and demolishing old, un-needed buildings has helped to stem the tide. The trend of obsolescence (percentage of facilities more than 40 years old) was increasing through 2010, but over the past few years has not increased. In the 2017 facilities assessment, NASA's overall facilities condition improved from 3.7 to 3.8, on a 5-point scale. The assessment team concluded that investments in the areas of

"Repair by Replacement" and demolition are providing the intended results of improving facility condition and reducing deferred maintenance.

To reduce the risk from unexpected infrastructure failures, NASA is focusing on unscheduled maintenance and implementing strategies to reduce unscheduled maintenance. NASA continues to invest in remote sensing and assessment technologies to improve reliability of facilities systems while improving the efficiency of maintaining facilities systems. NASA is investing in remote monitoring by including the technology in new construction and by installing the technology during retro-commissioning of existing buildings, when practical. The emphasis on improving planned and programmed maintenance has resulted in reductions in NASA's unscheduled maintenance ratio (Unscheduled Maintenance Expenditures/Total Maintenance Expenditures). In 2017, seven of ten Centers reduced their unscheduled maintenance from 2016 levels, reducing the risk of unexpected failures at critical times. Overall, the Agency has reduced unscheduled maintenance from 31.5 percent in 2015 to 30.3 percent in 2017.

To improve management of pressure systems, NASA has revised its standard for pressure systems, evaluated management of relief devices, set minimum requirements for pressure systems managers, conducted corrosion assessments of pressurized systems, and implemented purchase controls. NASA is implementing a database management system at one Center and has adjusted resources for managing pressurized systems at another Center. NASA also continues to monitor the areas of concern raised by the OIG in a 2013 explosives safety program audit to ensure the continued effective management of the program.

NASA's Technical Capabilities Assessment Team (TCAT) studies resulted in NASA establishing a new more centralized model for managing its technical capabilities. The NASA Technical Capability Leadership model provides cross-Agency reviews of capabilities, allowing NASA to identify redundancies or capabilities that are obsolete. Since the implementation of the new management model and the establishment of capability management offices such as the Space Environments Testing Management Office (SETMO), NASA has made the following progress consolidating space environmental testing capabilities: ten assets demolished, four assets excessed, and an additional six assets added to the demolition program. In 2017, NASA completed a significant technical capability consolidation effort with the demolition of the Atmospheric Re-entry Materials and Structures Evaluation Facility (ARMSEF) at Johnson Space Center (JSC). The demolition of the JSC ARMSEF was the final phase of a five-year effort to consolidate all atmospheric re-entry materials testing at Ames Research Center. Consolidation of atmospheric re-entry materials testing eliminated $1.5 million in deferred maintenance at JSC and consolidated this critical technical expertise at one site.

NASA has diligently responded to each of the fifteen OIG reports related to infrastructure challenges published over the last seven years. NASA has completed actions on all, but two OIG recommendations from reports published prior to 2017. NASA is currently

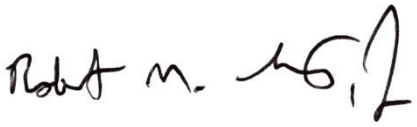
developing new policy for managing technical capabilities to close the remaining two recommendations.

5. Contracting and Grants Process

NASA appreciates the investigative and audit work cited by the OIG and acknowledges the importance of this effort, particularly where fraud is uncovered and process improvements can be made.

NASA continues to strengthen and improve contracting and grants processes throughout the Agency. NASA continues to strengthen its award fee process through training and the issuance of an updated NASA Award Fee Guide. We believe NASA's approach to award fee is sound and compliant with the Federal Acquisition Regulation and related statute. We continue to strengthen the management of grants through our issuance of revisions to the NASA Grant and Cooperative Agreement Manual as well as updates to our financial assistance forms, which ensured compliance with the requirements of 2 CFR 200, Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards.

If you have any questions regarding NASA's response to the 2017 Top Management and Performance Challenges, please contact Paul Roberts, Audit Liaison Program Manager, on (202) 358-2260.



Robert M. Lightfoot, Jr.

cc:
Associate Administrator for Human Exploration and Operations Mission Directorate/ Mr. Gerstenmaier
Associate Administrator for Science Mission Directorate/Dr. Zurbuchen
Chief Information Officer/Ms. Wynn
Assistant Administrator for Procurement/Mr. McNally
Assistant Administrator for Strategic Infrastructure/Mr. Williams

FY 2017 INSPECTOR GENERAL ACT AMENDMENTS REPORT

Background

The Inspector General Act Amendments of 1988 (P.L. 100-504) require that the heads of Federal agencies submit semi-annual reports to Congress on the actions taken in response to Office of Inspector General (OIG) audit reports. Under the 1988 Amendments, agency heads are required to report on: a) Management Action on OIG Reports with Monetary Benefits (see Table 1) and; b) Management Action Not Taken on OIG Audit Reports in Excess of One-Year (see Table 2). The Reports Consolidation Act of 2000 (P.L. 106-531) provides agencies with the flexibility to annualize and consolidate semi-annual reports, such as this one, into the annual Agency Financial Report (AFR).

In addition to the requirements in the 1988 Amendments, the Office of Management and Budget (OMB) outlines specific "action requirements" to Federal agencies in its Circular No. A-50, *Audit Followup*. The requirements in the Circular include ensuring that final management decisions on OIG audit recommendations are reached within six months after the issuance of an audit report and that corresponding corrective actions begin as soon as practicable.

In order to enhance the readability and utility of NASA's FY 2017 reporting under the Inspector General Act Amendments of 1988, the following definitions are provided:

Corrective Action consists of management's planned or proposed remediation efforts intended to mitigate an audit finding.

Disallowed Costs are questioned costs that management has sustained or agreed should not be charged to the Government.

Final Management Action is the point in time when corrective action, taken by management in conjunction with a final management decision, is completed.

Final Management Decision is reached when management evaluates the OIG's findings and recommendations and determines whether or not to implement a proposed recommendation.

Funds to be Put to Better Use (FPTBU) are potential cost savings, identified by the OIG, that could be realized through the implementation of an audit recommendation.

Questioned Costs are those costs identified by the OIG as being potentially unallowable because of either: a) a purported violation of law, regulation, contract, grant, cooperative agreement, or other device governing the incurrence of cost; b) a finding that, at the time of the audit, such cost is not supported by adequate documentation; or c) a finding that the cost incurred for the intended purpose is unnecessary or unreasonable.

Resolution is the point at which NASA and the OIG agree on action(s) to be taken in response to an audit recommendation or, in the event of disagreement, the point at which the Audit Follow-up Official determines the matter to be resolved.

NASA's Audit Follow-up Program

NASA leverages the results of OIG audits to improve the overall efficiency and effectiveness of the Agency's programs, projects, and functional activities. NASA is also committed to ensuring timely and responsive final management decisions, along with timely and complete final management action on all audit recommendations issued by the NASA OIG. To this end, NASA has implemented a comprehensive program of audit follow-up intended to ensure that audit recommendations issued by the OIG are resolved and implemented in a timely, responsive, and effective manner. NASA's audit follow-up program is a key element in improving the overall efficiency and effectiveness of NASA's programs, projects and operations.

NASA's Mission Support Directorate (MSD) serves as the Agency's Office of Primary Responsibility for policy formulation, oversight, and functional leadership of NASA's audit follow-up program. MSD implements audit follow-up program activities through an Agency-wide network of Audit Liaison Representatives (ALRs) who, in turn, are responsible for executing audit follow-up program activities at the Mission Directorate, Field Center, and Mission Support Office levels. In conjunction with NASA's network of ALRs, MSD

provides the infrastructure to support NASA's audit follow-up program. The program utilizes NASA's Audit and Assurance Information Reporting System (AAIRS) to track and monitor OIG audit reports and corresponding recommendations, as well as to support internal and external reporting.

In accordance with requirements outlined in OMB Circular No. A-50, MSD monitors audit recommendations issued by the OIG to ensure that a final management decision is reached within six months of the issuance of a final audit report. A final management decision is reached when either: a) management agrees to implement corrective actions in response to an OIG audit recommendation; or b) management determines that implementing a particular audit recommendation is imprudent, impractical, not cost beneficial, etc. In those instances where a final management decision cannot be reached, resolution is achieved in conjunction with NASA's Audit Follow-up Official (AFO), consistent with provisions of OMB Circular No. A-50.

When a final management decision has been made to implement an audit recommendation, corrective action is pursued as rapidly as practicable. In some instances, the corrective actions associated with a final management decision may span multiple fiscal years due to factors such as the complexity or cost of the planned corrective action or unexpected delays in the formulation, review, and approval of NASA policies, procedural requirements, or regulations. In these instances, MSD works with the OIG and respective Mission Directorate, Field Center, or Mission Support Office to ensure communication and coordination regarding necessary revisions to timelines and milestones associated with the implementation of these recommendations.

FY 2017 Audit Follow-up Results

The Inspector General Act Amendments of 1988 require that heads of Federal agencies report on management action taken, or remaining to be taken, in response to OIG audit reports containing monetary benefits. For the purposes of this report, monetary benefits consist of: a) Questioned Costs; or b) Funds to be Put to Better Use (FPTBU), as defined above. NASA's FY 2017 results of management action on OIG reports with monetary benefits are found in Table 1.

The 1988 Amendments also require that Federal agencies report on those OIG recommendations for which a final management decision had been made in a prior fiscal year, but final management action is still ongoing. NASA's FY 2017 results of management action not taken on OIG reports in excess of one-year are found in Table 2.

In addition to the statutory reporting requirements delineated in the 1988 Amendments, OMB Circular No. A-50 requires that final management decisions on OIG audit recommendations be made within six months of the issuance of a final audit report.

NASA's FY 2017 reporting in conjunction with the requirements of the Inspector General Act Amendments of 1988 and OMB Circular No. A-50, follows:

1. Management Action on OIG Reports with Monetary Benefits

Cumulative prior year carry-over of outstanding management action on monetary benefits consisted of $4,416,226 in OIG identified questioned costs. These questioned costs were initially identified in three OIG audit reports[1] issued in fiscal years 2012, 2015, and 2016. Additionally, in FY 2017 the OIG issued three audit reports[2] to NASA containing monetary benefits consisting of $97,932,317 in questioned costs. As a result, total monetary benefits pending management action in FY 2017 totaled $102,348,543 in OIG identified questioned costs.

During FY 2017 final management action by NASA was taken on the three OIG audit reports issued in fiscal years 2012, 2015, and 2016 (see footnote 1) in the amount of $4,416,226. However, management action on the monetary benefits identified in the three OIG audit reports issued during FY 2017 (see footnote 2) consisting of $97,932,317 in questioned costs remains outstanding as of September 30, 2017.

[1] "Audit of NASA Grants Awarded to the Philadelphia College Opportunity Resources for Education" (IG-12-018; July 26, 2012); "Audit of NASA's Cooperative Agreements Awarded to Wise County Circuit Court" (IG-15-022; July 16, 2015); and "Audit of NASA's Engineering Services Contract at Kennedy Space Center" (IG-16-017; May 5, 2016).

[2] "NASA's Management and Development of Spacesuits" (IG-17-018; April 26, 2017); "Construction of Test Stands 4693 and 4697 at Marshall Space Flight Center" (IG-17-021; May 17, 2017); and "NASA's Research Efforts and Management of Unmanned Aircraft Systems" (IG-17-025; September 18, 2017).

Table 1 below, summarizes NASA's actions taken with respect to monetary benefits identified in OIG audit reports issued during FY 2017, as well as carry-over monetary benefits identified in OIG audit reports issued in prior fiscal years, that required management action during FY 2017.

Management Action on OIG Audit Reports with Monetary Benefits For the Year Ended September 30, 2017						
	Category	Questioned Costs		Funds to be Put To Better Use		Total Monetary Benefits (Dollars)
		Number of Reports	Dollars	Number of Reports	Dollars	
Line 1	Beginning Balance: Audit reports with monetary benefits issued in prior years requiring final management action (prior year carry-over into FY 2017)	3	$4,416,226	0	$0	$4,416,226
Line 2	Plus: Audit reports with monetary benefits issued during FY 2017 requiring final management action	3	$97,932,317	0	$0	$97,932,317
Line 3	Total audit reports with monetary benefits requiring final management action durin FY 2016 [line 1 + 2]	6	$102,348,543	0	$0	$102,348,543
Line 4	Less: Audit reports with monetary benefits on which final management action was taken during FY 2017	3	$4,416,226	0	$0	$4,416,226
Line 5	Ending Balance: Audit reports with monetary benefits awaiting final management action at the end of FY 2017 [line 3 - line 4] (carry-over into FY 2018)	3	$97,932,317	0	$0	$97,932,317

2. Management Action Not Taken on OIG Reports in Excess of One-Year

As of September 30, 2017, a total of 50 recommendations in 20 OIG audit reports remain open, pending completion of final management action, in excess of one year since the issuance of the corresponding final audit reports.

Although these 50 recommendations remain open in excess of one year after issuance of the corresponding audit reports, NASA management continues to aggressively pursue final management action intended to fully implement the OIG's recommendations. These 50 open recommendations span the following three broad categories in terms of the nature of outstanding corrective actions:

1) Policy Development/Revision (40 percent);

2) Oversight/Monitoring/Program Review (46 percent); and

3) Program/ Project Operations (14 percent).

By way of comparison and perspective, as of September 30, 2016, a total of 63 recommendations in 20 OIG audit reports were open, pending completion of final management action, in excess of one year since the issuance of the corresponding final audit reports. During the five-year period ended September 30, 2017, the number of OIG audit recommendations open in excess of one year after report issuance has ranged between 50 and 63.

Table 2 below summarizes those OIG audit reports and associated recommendations issued prior to FY 2017 for which final management action on open recommendations has not yet been completed in excess of one year since the issuance of the corresponding final audit reports.

Management Action Not Taken on OIG Reports in Excess of One-Year (As of September 30, 2017)				
Report No. (Report Date)	Report Title	Final Action on Recommendations		
		Pending	Completed	Total
IG12017 (8/8/2012)	*Review of NASA's Computer Security Incident Detection and Handling Capability*	2	1	3
IG13008 (02/12/2013)	*NASA's Efforts to Reduce Unneeded Infrastructure and Facilities*	2	3	5
IG14015 (02/27/2014)	*NASA's Management of Its Smartphones, Tablets, and Other Mobile Devices*	1	1	2
IG14026 (07/22/2014)	*Audit of the Space Network's Physical and Information Technology Security Risks*	2	2	4
IG14031 (09/18/2014)	*Extending the Operational Life of the International Space Station Until 2024*	1	2	3
IG15013 (03/26/2015)	*NASA's Management of the Deep Space Network*	3	9	12
IG15015 (05/15/2015)	*NASA's Compliance with the Improper Payments Information Act for Fiscal Year 2014*	6	4	10
IG15019 (06/30/2015)	*Review of NASA'S Pressure Vessels and Pressurized Systems Program*	1	9	10
IG15023 (09/17/2015)	*NASA's Response to Orbital's October 2014 Launch Failure: Impacts on Commercial Resupply of the International Space Station*	1	6	7
IG16001 (10/19/2015)	*NASA's Education Program*	2	3	5
IG16008 (12/15/2015)	*NASA's Efforts to Manage Its Space Technology Portfolio*	2	3	5
IG16013 (02/18/2016)	*Audit of NASA Space Grant Awarded to the University of Texas at Austin*	2	2	4
IG16014 (03/17/2016)	*NASA's Management of the Near Earth Network*	7	7	14
IG16015 (03/28/2016)	*Audit of the Spaceport Command and Control System*	1	0	1
IG16016 (04/14/2016)	*Review of NASA's Information Security Program*	1	0	1
IG16017 (05/05/2016)	Audit of NASA's Engineering Services Contract at Kennedy Space Center	2	2	4
IG16021 (05/12/2016)	NASA's Compliance with the Improper Payments Information Act for Fiscal Year 2015	4	1	5
IG16025 (06/28/2016)	NASA's Response to SpaceX's June 2015 Launch Failure: Impacts on Commercial Resupply of the International Space Station	4	2	6
IG16029 (09/06/2016)	NASA's Management of the Orion Multi-Purpose Crew Vehicle Program	3	1	4
IG16030 (08/24/2016)	Follow-up Evaluation of NASA's Implementation of Executive Order 13526, Classified National Security Information	3	1	4
20	**Totals**	**50**	**59**	**109**

3. Final Management Decisions Made Within Six Months of Report Date

During FY 2017, the OIG issued 16 audit reports containing 162 recommendations addressed to NASA which required a final management decision within six months of the respective final report dates, as required by OMB Circular No. A-50. Final management decisions on 160 of the 162 (99 percent) recommendations were made within six months of issuance of the corresponding final audit reports. Final management decisions on the remaining two recommendations contained in two OIG audit reports[3] issued during the second half of FY 2017 remain unresolved (final management decisions are pending) as of September 30, 2017. Resolution efforts intended to achieve a final management decision between NASA and the OIG on these two unresolved audit recommendations are ongoing and are expected to be completed in the first quarter of FY 2018.

In addition to the 160 OIG recommendations that were issued to NASA and resolved during FY 2017, final management decisions were made on four OIG recommendations in three OIG audit reports[4] that were issued during the second half of FY 2016. Resolution on these four prior year audit recommendations were made within six months of the respective final report dates, consistent with requirement in OMB Circular No. A-50.

For the five-year period ended September 30, 2017, the OIG issued 794 audit recommendations in 87 reports requiring a final management decision within six months of the respective final report dates. Final management decisions were made within six months of the respective final reports dates on 779, or 98 percent, of the 794 OIG audit recommendations issued between FY 2013 and FY 2017.

4. Audit Recommendation Closure Efficiency

During FY 2017, a total of 137 OIG audit recommendations (including 132 recommendations issued in prior years) were closed by the OIG based on responsive management action taken by NASA. Of the 137 recommendations closed by the OIG during FY 2017:

- 84 recommendations (61 percent) were closed within one year after issuance of the associated audit report;
- 31 recommendations (23 percent) were closed between one and two years after issuance of the associated audit report; and
- 22 recommendations (16 percent) were closed in excess of two years after issuance of the associated audit report.

For comparative purposes, during FY 2016 a total of 172 OIG audit recommendations (including 158 recommendations issued in prior years), were closed by the OIG based on responsive management action, with:

- 33 recommendations (19 percent) closed within one year after issuance of the respective audit reports;
- 127 recommendations (74 percent) closed between one and two years after issuance of the respective audit reports; and
- 12 recommendations (7 percent) closed in excess of two years after issuance of the respective audit reports.

For the five-year period ended September 30, 2017, an average of 40 percent of OIG audit recommendations were closed within one year of issuance of the respective audit reports, 48 percent were closed within two years after issuance of the respective audit reports, and 12 percent were closed in excess of two years after issuance of the respective audit reports.

[3] "Construction of Test Stands 4693 and 4697 at Marshall Space Flight Center" (IG-17-021; May 17, 2017); and "NASA's Compliance with the Improper Payments Information Act for Fiscal Year 2016" (IG-17-020; May 15, 2017).

[4] "NASA's Compliance with the Improper Payments Information Act for Fiscal Year 2015" (IG-16-021; May 12, 2016); "NASA's Response to SpaceX's June 2015 Launch Failure: Impacts on Commercial Resupply of the International Space Station" (IG-16-025; June 28, 2016); and "NASA's Commercial Crew Program: Update on Development and Certification Efforts" (IG-16-028; September 1, 2016).

IMPROPER PAYMENTS INFORMATION ACT (IPIA) ASSESSMENT

Payment Integrity

The Improper Payments Information Act of 2002 (IPIA) (Public Law (P.L.) 107-300)[a] requires Federal agencies to review their programs and activities for improper payments, identify programs and activities subject to significant improper payments, generate an annual estimate of improper payments for susceptible programs and activities, and report the results of improper payment activities to the President and Congress. IPIA aims to detect and prevent improper payments made by Federal Government agencies in order to verify that taxpayer dollars are spent properly and efficiently. Since its inception, executive agency responsibilities for improper payments have expanded and evolved in order to further reduce fraud, waste, abuse and misuse of government funds. Throughout this evolution, NASA has stayed committed to preventing and reducing fraud, waste and abuse through its Improper Payments Program.

In order to amend the IPIA and prevent further loss of taxpayer dollars, Congress also enacted the Improper Payments Elimination and Recovery Act of 2010 (IPERA) (P.L. 111-204)[b]. IPERA, as compared to IPIA, expanded the scope and level of detail required for improper payment reporting amongst executive agencies. It also introduced the OMB risk factors contributing to program susceptibility to significant improper payments and repealed the Recovery Auditing Act (Section 831, Defense Authorization Act, for FY 2002; P.L.107-107)[c] by adding requirements for executive agencies to report on the actions taken to recover improper payments.

On January 10, 2013, the Improper Payments Elimination and Recovery Improvement Act of 2012 (IPERIA) (P.L. 112-248)[d] was signed into law, further amending IPIA and IPERA. As designed, IPERIA was intended to strengthen and intensify efforts to identify, prevent, and recover payment error, waste, fraud and abuse with Federal spending[1]. The law aimed to improve upon agency efforts to identify and estimate improper payments, further develop improper payment recovery efforts, and support "Do Not Pay" efforts. To provide implementation guidance in executing the legislative principles of IPIA, IPERA and IPERIA, OMB issued Memorandum M-13-20, *Protecting Privacy while Reducing Improper Payments with the Do Not Pay Initiative*[e] in 2013 and Memorandum M-15-02, *Requirements for the Effective Estimation and Remediation of Improper Payments*[f] in 2014. Memorandum M-15-02 modified both OMB Memorandum M-11-16 (Circular A-123 Appendix C Parts I and II) and OMB Memorandum M-10-13 (Circular No. A-123, *Appendix C Part III*) and changed the framework of improper payment compliance. In addition to modifying the requirements of OMB Circular No. A-123, *Appendix C, Part I and II*, it also consolidated and implemented the requirements of the following:

- IPIA (P.L. No. 107-300)
- IPERA (P.L. No. 111-204)
- IPERIA (P.L. No. 112-248)
- Executive Order 13520, *Reducing Improper Payments*, issued November 20, 2009.

In 2013, additional improper payment legislation was ratified via the Disaster Relief Appropriations Act (Disaster Relief Act)[g]. The Act, as signed, provided $50.5 billion in aid for Hurricane Sandy disaster victims and their communities and detailed additional requirements for agencies receiving Hurricane Sandy appropriations. Furthermore, implementation guidance for the principles presented in the Disaster Relief Act was issued within OMB Memorandum M-13-07, *Accountability for Funds Provided by the Disaster Relief Appropriations Act*[h]. As noted in OMB Memorandum M-13-07, section 904(b) of the Disaster Relief Act, one of these requirements provides that all programs and activities receiving funds under the Act shall be deemed to be "susceptible to significant improper payments" for the purposes of the Improper Payment assessment.

Under the parameters set forth in IPIA, IPERA, and IPERIA, agencies are required to perform a risk assessment of its programs and activities, identify programs and activities that are susceptible to significant improper payments, estimate annual improper

[1] Improper Payments Elimination and Recovery Improvement Act of 2012 (IPERIA) (P.L. 112-248)

IMPROPER PAYMENTS INFORMATION ACT (IPIA) ASSESSMENT (continued)

payments for susceptible programs and activities, and report the result to Congress. Throughout the last decade, NASA has worked to meet all requirements for compliance with IPIA.

Improper Payment Reporting

As specified by OMB Circular No. A-123, Appendix C [i] (Appendix C), NASA performed the FY 2017 improper payment risk assessment on FY 2016 payments. NASA evaluated 30 of its 90 identified programs using the OMB qualitative risk factors detailed in Appendix C as well as additional quantitative factors. NASA determined that none of the 30 Agency programs were susceptible to significant improper payments; therefore, no further estimation or reporting related to these programs is required.

In contrast to prior years, there were no Disaster Relief Act payments made under the Hurricane Sandy project in FY 2016, as part of the Institutional Construction of Facilities (CoF) program. Additionally, under legislative guidance issued by OMB[2], the Hurricane Sandy project met the requirements for relief from improper payment reporting for FY 2017. As a result, OMB granted NASA a waiver from the reporting requirements stipulated by the Disaster Relief Act; OMB Memorandum M-13-07, *Accountability for Funds Provided by the Disaster Relief Appropriations Act;* and IPIA, as amended. Accordingly, for FY 2017 no additional disclosures regarding the Disaster Relief Act and Hurricane Sandy project funds are included in the AFR.

Given the results of the FY 2017 Improper Payment Risk Assessment and related activities, no additional reporting is required via the NASA FY 2017 AFR. NASA management will continue to work diligently to hold agency personnel and other stakeholders accountable for the prevention of improper payments and to verify the agency performs necessary testing, identifies applicable root causes, and develops appropriate corrective actions and controls when applicable. Additional details related to NASA Improper Payments, including all information previously reported in the AFR that is not included in the FY 2017 AFR, can be found at https://paymentaccuracy.gov/.

Recapture of Improper Payments Reporting

On July 22, 2010, the President signed into law the Improper Payment Elimination and Recovery Act (IPERA; Pub. L. No. 111-204). IPERA requires all Federal agencies to conduct payment recapture audits as part of its overall program to ensure effective internal controls over payments. NASA continues to perform recapture audits over fixed price contracts only as part of its overall program to ensure effective internal control over payments.

This approach is in accordance with the amended Appendix C guidance, which allows agencies to make the determination to exclude classes of contract payments from recapture audit activities if the agency determines that recapture audits are inappropriate or not a cost-effective method for identifying and recovering improper payments. Performing a separate recapture audit on cost-type contracts would not be cost-effective as determined in prior years. NASA does not consider it cost-effective to conduct payment recapture audits for cost type contracts or grants and cooperative agreements as payments are made through our centralized procure to pay process, which provides reasonable assurance of proper payment.

NASA attributes much of the positive results of its improper payment program to the centralized procurement and payment activities executed at the NASA Shared Services Center (NSSC). Centralized processing provides a sound internal control environment that mitigates the risk of improper payments across the Agency. As such, grants and cooperative agreements are not included as part of its recapture audit efforts.

In FY 2014, NASA awarded the contingency based Recapture Audit contract to an industry leading consul-

[2] According to the Improper Payments Elimination and Recovery Act of 2010 (IPERA), and OMB's IPERA implementing guidance (OMB Circular No. A-123, Appendix C), if a program has been reporting improper payment estimates, but has documented a minimum of two consecutive years of improper payments that are below the thresholds set by IPERA, the agency may request relief from the annual reporting requirements for this program.

IMPROPER PAYMENTS INFORMATION ACT (IPIA) ASSESSMENT (continued)

tant. For FY 2017, the Recapture Audit scope entailed the review of FY 2016 disbursements to identify and recover overpayments, duplicate payments, erroneous payments, lost credit memos, and internal transaction errors of NASA's fixed price contracts that expend $1 million or more annually. There were no overpayments identified nor recaptured through the payment recapture audit, and there are no outstanding identified overpayments from previous year's audits.

In addition to the Recapture Audit activities described above, the Agency conducted activities outside of the FY 2017 Agency Recapture Audit. Examples of such activities include Agency post-payment review/audits, single audits and self-reported overpayments. As a result of the activities conducted outside of the Recapture Audit, NASA recovered $5.25 million, which is 93 percent of the total overpayments identified for recapture.

NASA has taken steps through Improper Payment Reviews and The Recapture Audits to continue efforts already embedded in the control environment for reducing and recovering improper payments. The recapture audit process is monitored by the Office of the Chief Financial Officer to ensure compliance with NASA's Recapture Audit Guidance. In addition, all collection and disbursement functions are centralized, which ensures consistent application of the control activities and reduction of improper payments. There are no statutory or regulatory barriers limiting NASA's ability to reduce improper payments.

Barriers

Given the results of the FY 2017 Improper Payment Risk Assessment and no programs being identified as susceptible to significant improper payments, NASA is not required to develop a corrective action plan or identify applicable barriers for FY 2017. NASA will continue to monitor and assess its payment processes and processing environment in order to minimize Agency vulnerability to improper payments. Should improper payments be identified, a root cause analysis will be performed, formulation of corrective actions will be considered, and barriers will be identified.

Accountability

Although none of NASA's programs have improper payments exceeding the statutory thresholds outlined in Appendix C, NASA's management works diligently to hold Agency personnel and other stakeholders accountable for the prevention of improper payments and to verify the Agency has proper infrastructure, internal controls, and systems. Given no improper payments were identified, further reporting on accountability is not required.

Agency Information Systems and Other Infrastructure

As the backbone of defense and prevention of improper payments, NASA is dedicated to the establishment, maintenance, and ongoing assessment of robust information systems, Agency infrastructure and related internal controls, especially over Agency payments. NASA will continue to monitor its information systems and infrastructure and apply the five (5) standards and attributes of internal control (Control Environment, Risk Assessment, Control Activities, Information and Communications, and Monitoring) to its programs and activities to reinforce the ability of the Agency internal control program to prevent, detect, and recover improper payments. As NASA did not identify any programs with improper payments exceeding the statutory thresholds of Appendix C during the FY 2017 risk assessment, additional reporting on information systems and other infrastructure is not required.

Sampling and Estimation

Under the parameters set forth in IPIA, IPERA, and IPERIA, agencies are required to perform a risk assessment of its programs and activities, identify programs and activities that are susceptible to significant improper payments, and produce improper payment estimates for programs determined to be susceptible to significant improper payments. In FY 2017, the Agency did not identify any programs as susceptible to significant improper payments; therefore, no further sampling or improper payment estimation was performed or reported.

IMPROPER PAYMENTS INFORMATION ACT (IPIA) ASSESSMENT (continued)

Fraud Reduction Reporting

NASA has taken several measures to address the Fraud Reduction Act. These include, assessment of fraud risk as part of NASA's Enterprise Risk Management framework and evaluation of the status of controls over fraud risk through the annual assessment of financial and operational controls. NASA remains committed to combating fraud and has a strong risk management and internal control culture and organizational structure conducive to effective fraud risk management.

Leveraging GAO's "A Framework for Managing Fraud Risks in Federal Programs" as a guide, NASA has implemented several activities to prevent and/or detect possible instances of fraud across the Agency and will continue to enhance processes to identify and mitigate fraud risks. Fraud prevention and detection activities include Acquisition Integrity and Improper Payments Programs, regular fraud risk assessments, an enhanced Statement of Assurance process to include assessment and evaluation of fraud risk management control activities, external and internal audits and investigations, and a Data Breach Response Process. NASA has deployed several fraud-awareness initiatives across the Agency, including mandatory fraud prevention training for all employees, anti-fraud campaigns to increase awareness of reporting mechanisms and coordination and collaboration with the Office of Inspector General to further assess the Agency's risk posture. NASA has an extensive Counterfeit Parts Awareness and Inspection program that includes regular investigation and examination of parts, components and materials to mitigate the risk of misrepresentation by a supplier or vendor. As such, NASA employs many of the leading practices outlined in GAO's Framework to ensure effective fraud risk management across NASA.

IPIA References

[a] Improper Payments Information Act of 2002 (IPIA) (Public Law (P.L.) 107-300)
https://www.congress.gov/107/plaws/publ300/PLAW-107publ300.pdf

[b] Improper Payments Elimination and Recovery Act of 2010 (IPERA) (P.L. 111-204)
https://www.gpo.gov/fdsys/pkg/BILLS-111s1508enr/pdf/BILLS-111s1508enr.pdf

[c] Recovery Auditing Act (Section 831, Defense Authorization Act, for FY 2002; P.L.107-107)
https://www.gpo.gov/fdsys/pkg/PLAW-107publ107/pdf/PLAW-107publ107.pdf

[d] The Improper Payments Elimination and Recovery Improvement Act of 2012 (IPERIA) (P.L. 112-248)
https://www.gpo.gov/fdsys/pkg/PLAW-112publ248/pdf/PLAW-112publ248.pdf

[e] Memorandum M-13-20, *Protecting Privacy while Reducing Improper Payments with the Do Not Pay Initiative*
https://donotpay.treas.gov/OMB_M-13-20.pdf

[f] Memorandum M-15-02, *Requirements for the Effective Estimation and Remediation of Improper Payments*
https://paymentaccuracy.gov/pdf/m-15-02.pdf

[g] Disaster Relief Appropriations Act (Disaster Relief Act)
https://www.congress.gov/113/plaws/publ2/PLAW-113publ2.pdf

[h] OMB Memorandum M-13-07, *Accountability for Funds Provided by the Disaster Relief Appropriations Act*
https://paymentaccuracy.gov/pdf/m-13-07.pdf

[i] Office of Management and Budget (OMB) Circular No. A-123, *Appendix C*
https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/memoranda/2015/m-15-02.pdf

NASA FY 2017 PUBLIC LAW 114-113
UNDISBURSED BALANCES IN EXPIRED GRANT ACCOUNTS

NASA monitors and tracks grants undisbursed balances in expired accounts through a monthly review of internal control activities designed to identify undisbursed balances in expired accounts. The Continuous Monitoring Program (CMP) ensures ongoing review and validation of financial data and the effectiveness of internal controls over the entire financial management process, including grants. When grants undisbursed balances in expired accounts are identified, appropriate action is taken to ensure optimum use of grant resources.

NASA generates financial management reports to aid in the tracking and monitoring of undisbursed amounts. An aging report of open obligations is generated on a monthly basis to determine the last day activity occurred. For open obligations in which no activity has occurred in a six month period and/or there is no supporting documentation, further review is performed to determine the validity of obligation balances and the existence of valid source documentation. Additionally, further analysis is performed to determine if funds can be de-obligated. If obligations are valid, the aging reports are updated to reflect that obligations have been confirmed with procurement as valid.

NASA will continue to track undisbursed balances in expired grant accounts through its monthly review of internal control activities designed to identify funds for de-obligation. This involves the continuous monitoring of undisbursed balances, identifying balances that should be de-obligated, and performing timely close-out of grants and other activities. Additionally, NASA's financial management and procurement offices will continue to collaborate in monitoring and tracking undisbursed balances.

Currently, NASA does not have undisbursed balances in expired accounts that may be returned to the Treasury of the United States. The following chart reflects the total number and dollar amount of undisbursed grants in expired appropriations. All amounts have been obligated to a specific project.

Fiscal Year	Total Number of Expired Grants with Undisbursed Balances	Total Amount of Undisbursed Balances for Expired Grants (In Millions of Dollars)
2014	945	$4.6
2015	979	$5.3
2016	954	$6.8

GRANTS OVERSIGHT & NEW EFFICIENCY (GONE) ACT REQUIREMENTS

NASA monitors and tracks grants' undisbursed balances in expired accounts through a monthly review of internal control activities designed to identify undisbursed balances in expired accounts. The Continuous Monitoring Program (CMP) ensures ongoing review and validation of financial data and the effectiveness of internal controls over the entire financial management process, including grants. When grants' undisbursed balances in expired accounts are identified, appropriate action is taken to ensure optimum use of grants resources.

NASA awards numerous grants and cooperative agreements to institutions with provisional indirect rate agreements. Final indirect rate determination often happens years after a grant award expires, and some grantees prefer to delay final billing and Federal financial reporting until their rates have been finalized. NASA policy requires grantees to submit final reporting within 90 days after the awards expire, but the grantees argue that they cannot submit final financial reporting until final rates have been established. This causes significant delays in the closeout of those awards. Of the 21 awards expired more than 2 years, 14 (67%) of them were provisional indirect rate awards. The oldest 10 awards are all provisional rate grants.

We have significantly reduced the number of grants expired more than two years by utilizing unilateral closeout procedures where appropriate, and by encouraging provisional rate grantees to estimate final billing (at the provisional rate) prior to final indirect rate determination. We will continue to utilize these procedures to facilitate the timely closeout of grants.

NASA's financial management and procurement offices will continue to collaborate in monitoring and tracking undisbursed balances.

Per OMB Circular No. A-136, *Federal Reporting Requirements*, the following table reflects the total number and dollar amount of undisbursed grants and cooperative agreements, for which closeout has not yet occurred and the period of performance has elapsed by more than two years.

CATEGORY	2-3 Years	>3-5 Years	>5 Years
Number of Grants/Cooperative Agreements with Zero Dollar Balances	3	6	3
Number of Grants/Cooperative Agreements with Undisbursed Balances	4	4	1
Total Amount of Undisbursed Balances	$25,168	$35,185	$711

REDUCE THE FOOTPRINT

The National Aeronautics and Space Administration (NASA) is committed to the goal of reducing the total square footage of its domestic office and warehouse inventory compared to its FY 2015 baseline. This reduction in square footage contributes to reducing the costs associated with real property in accordance with Section 3 of the Office of Management and Budget (OMB) Memorandum 12-12, *Promoting Efficient Spending to Support Agency Operations,* and OMB Management Procedures Memorandum 2013-02, the "Reduce the Footprint" policy implementation guidance. NASA continues to meet its national responsibilities, fully leveraging retained assets to increase their functionality in support of mission success while disposing of unneeded assets, increasing the use of under-utilized assets, minimizing operating costs, and improving efficiency.

From 2018 to 2022, NASA plans to dispose over 5 percent of its owned other-than-office-and-warehouse buildings (over 1.7 million square feet), while acquiring about 1 percent (400,000 square feet), resulting in about a 4 percent net consolidation (1.3 million square feet). Rooted in policy and strategy, NASA applies several processes for consolidating its footprint:

- NASA Centers are required to show how they will renew and consolidate their footprint in their master plans, projecting changes in both valuation and footprint over twenty years;

- Capital investment candidates must conform to an approved master plan and an underlying business case (routinely removing more facility than is constructed). Divestments that can result from candidate investments are a key element of the business cases for these investments; and

- Recognizing that divesting of legacy assets may be a low priority for NASA Centers compared with supporting current mission, NASA Headquarters funds the divestment of such assets centrally each year.

In FY 2016, Operating and Maintenance costs totaling $962,715 were reported for 165 abandoned assets. Almost all of these assets are scheduled for disposal.

NASA will continue identifying, implementing, and executing facility efficiency and effectiveness through management, development, and operational strategies that reduce life-cycle cost and risk while ensuring safety and mission success.

Reduce the Footprint Baseline Comparison	FY 2015 Baseline	FY 2016	Change (FY 2015 Baseline - FY 2016)
Square Footage *(SF in Millions)*	15.519	15.618	0.099

O&M Costs - Owned and Direct Lease Buildings	FY 2015 Reported Cost	FY 2016	Change (FY 2015 - FY 2016)
Operation and Maintenance Cost *($ in Millions)*	$78	$89	$ 11

CIVIL MONETARY PENALTY ADJUSTMENT FOR INFLATION

For the Fiscal Year Ended September 30, 2017

The Federal Civil Penalties Inflation Adjustment Act of 1990, as amended, requires agencies to make regular and consistent inflationary adjustments of civil monetary penalties to maintain their deterrent effect. To improve compliance with the Act, and in response to multiple audits and recommendations, agencies should report annually in the Other Information section the most recent inflationary adjustments to civil monetary penalties to ensure penalty adjustments are both timely and accurate.

NASA reviewed each of the penalty amounts under its statutes and penalty amounts for inflation when required under law. The following table reflects the authorities imposing the penalties, the civil penalties, the adjustment years, the current penalty amount and location for penalty updates.

Authority (Statute)	Penalty (Name or Description)	Year Enacted	Latest Year Adjustment	Penalty Level ($ Amount)	Location
Program Fraud Civil Remedies Act of 1986	Penalty for False Claims	1986	2017	$10,957	Federal Register Vol.82 No.202 (20 Oct. 2017) 48760 - 48763 Docket No. NASA-2017-004 www.federalregister.gov
Department of the Interior and Related Agencies Appropriations Act of 1989, Public Law 101-121, sec. 319	Penalty for use of appropriated funds to lobby or influence certain contracts.	1989	2017	$19,246	Federal Register Vol.82 No.202 (20 Oct. 2017) 48760 - 48763 Docket No. NASA-2017-004 www.federalregister.gov
Department of the Interior and Related Agencies Appropriations Act of 1989, Public Law 101-121, sec. 319	Penalty for use of appropriated funds to lobby or influence certain contracts.	1989	2017	$192,459	Federal Register Vol.82 No.202 (20 Oct. 2017) 48760 - 48763 Docket No. NASA-2017-004 www.federalregister.gov
Department of the Interior and Related Agencies Appropriations Act of 1989, Public Law 101-121, sec. 319	Penalty for failure to report certain lobbying transactions	1989	2017	$19,246	Federal Register Vol.82 No.202 (20 Oct. 2017) 48760 - 48763 Docket No. NASA-2017-004 www.federalregister.gov
Department of the Interior and Related Agencies Appropriations Act of 1989, Public Law 101-121, sec. 319	Penalty for failure to report certain lobbying transactions	1989	2017	$192,459	Federal Register Vol.82 No.202 (20 Oct. 2017) 48760 - 48763 Docket No. NASA-2017-004 www.federalregister.gov

SUMMARY OF FINANCIAL STATEMENT AND MANAGEMENT ASSURANCES

The following tables summarize the Agency's FY 2017 Financial Statement Audit and Management Assurances. Table 1 summarizes the status of prior year material weaknesses identified by the Financial Statement Auditor. Table 2 summarizes the status of prior year material weaknesses identified by NASA Management.

Table 1: Summary of Financial Statement Audit

Audit Opinion	Unmodified
Restatement	No

Material Weaknesses	Beginning Balance	New	Resolved	Consolidated	Ending Balance
None	0	0	0	0	0
Total Material Weaknesses	0	0	0	0	0

Table 2: Summary of Management Assurances

Effectiveness of Internal Control over Financial Reporting (FMFIA 2)	
Statement of Assurance	Unmodified

Material Weaknesses	Beginning Balance	New	Resolved	Consolidated	Reassessed	Ending Balance
None	0	0	0	0	0	0
Total Material Weaknesses	0	0	0	0	0	0

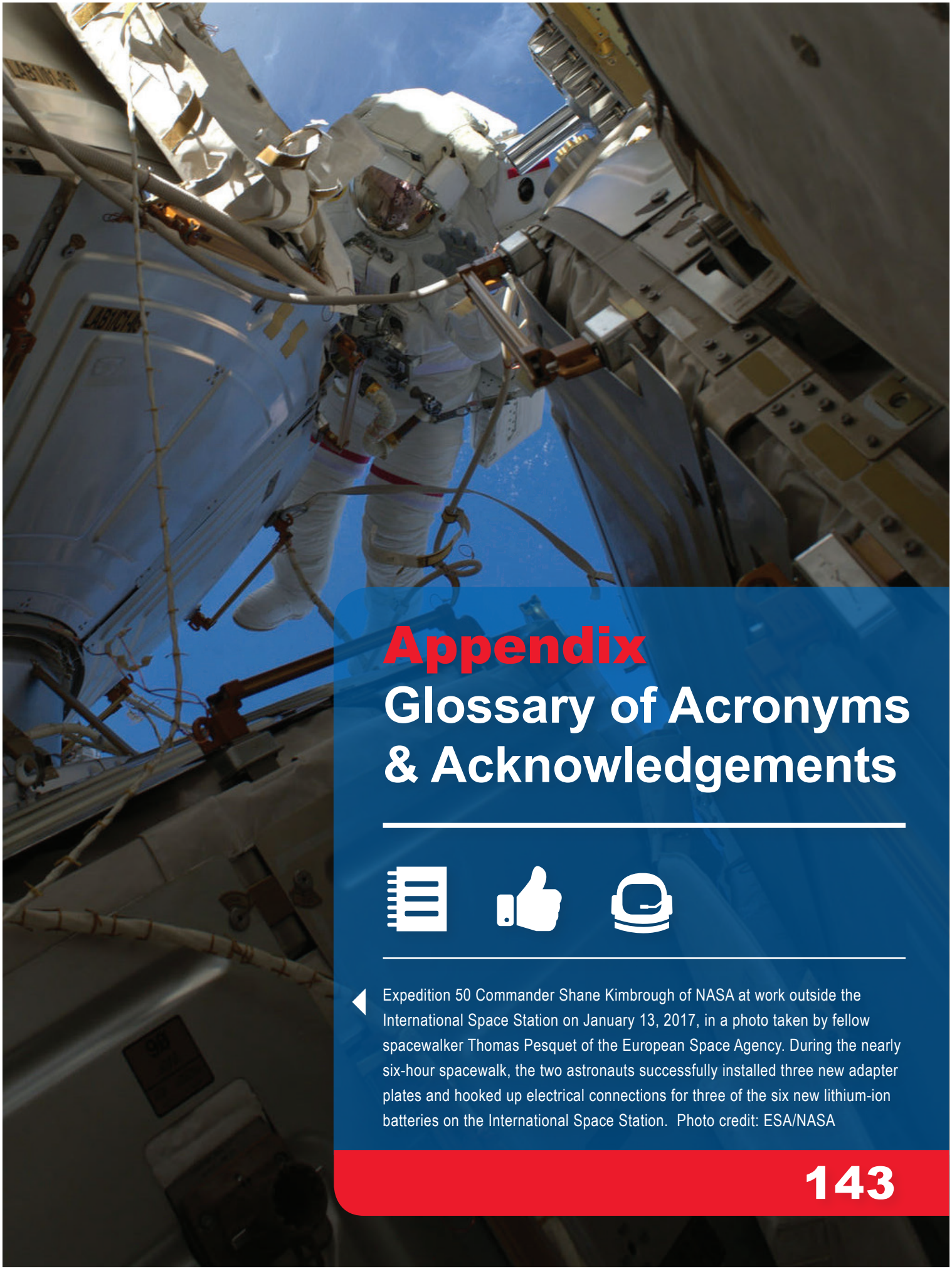
Effectiveness of Internal Control over Operations (FMFIA 2)	
Statement of Assurance	Unmodified

Material Weaknesses	Beginning Balance	New	Resolved	Consolidated	Reassessed	Ending Balance
None	0	0	0	0	0	0
Total Material Weaknesses	0	0	0	0	0	0

Conformance with Financial Management System Requirements (FMFIA 4)	
Statement of Assurance	Systems conform

Non-Conformances	Beginning Balance	New	Resolved	Consolidated	Reassessed	Ending Balance
None	0	0	0	0	0	0
Total Non-Conformances	0	0	0	0	0	0

Compliance with Financial Management System Requirements (FMFIA)		
	Agency	Auditor
1. System Requirements	No lack of substantial compliance noted	No lack of substantial compliance noted
2. Accounting Standards	No lack of substantial compliance noted	No lack of substantial compliance noted
3. USSGL at Transaction Level	No lack of substantial compliance noted	No lack of substantial compliance noted



Appendix
Glossary of Acronyms & Acknowledgements

Expedition 50 Commander Shane Kimbrough of NASA at work outside the International Space Station on January 13, 2017, in a photo taken by fellow spacewalker Thomas Pesquet of the European Space Agency. During the nearly six-hour spacewalk, the two astronauts successfully installed three new adapter plates and hooked up electrical connections for three of the six new lithium-ion batteries on the International Space Station. Photo credit: ESA/NASA

GLOSSARY OF ACRONYMS

AAIRS	Audit and Assurance Information Reporting System
AES	Advanced Exploration Systems
AFO	Audit Follow-Up Official
AFR	Agency Financial Report
AFRC	Armstrong Flight Research Center
AIA	Aerospace Industry Association
AICPA	American Institute of Certified Public Accountants
ALR	Audit Liaison Representatives
AMO	Agency Management and Operations
APG	Agency Priority Goal
API	Annual Performance Indicator
APR	Annual Performance Report
ARC	Ames Research Center
ARMD	Aeronautics Research Mission Directorate
ARRM	Asteroid Redirect Robotic Mission
ASC	Accounting Standards Codification
ATV	Automated Transfer Vehicle
BPDD	Business Process Design and Documentation
Caltech	California Institute of Technology
CAP	Cross Agency Priority
CCP	Commercial Crew Program
CCR	Contractor Cost Reporting
CF	Core Financial
CFO	Chief Financial Officer
CIO	Chief Information Officer
CLA	CliftonLarsonAllen LLP
CM	Crew Module
CMO	Center Management and Operations
CMP	Continuous Monitoring Program
CoF	Construction of Facilities
COTS	Commercial Off-The-Shelf
CSRS	Civil Service Retirement System

CST	Commercial Supersonic Technology
DATA	Digital Accountability and Transparency Act
DCIA	Debt Collection Improvement Act
DM	Deferred Maintenance
DM&R	Deferred Maintenance and Repairs
DRE	Distributed Roughness Element
DSCOVR	Deep Space Climate Observatory
EGS	Exploration Ground Systems
EM	Exploration Mission
EPSCoR	Experimental Program to Stimulate Competitive Research
ERM	Enterprise Risk Management
ERP	Enterprise Resource Planning
ESA	European Space Agency
FAR	Federal Acquisition Regulation
FASAB	Federal Accounting Standards Advisory Board
FASB	Financial Accounting Standards Board
FBWT	Fund Balance with Treasury
FCI	Facility Condition Index
FECA	Federal Employees' Compensation Act
FEGLI	Federal Employees Group Life Insurance
FEHB	Federal Employees Health Benefits
FERS	Federal Employment Retirement System
FFATA	Federal Funding Accountability and Transparency Act
FFMIA	Federal Financial Management Improvement Act
FFRDC	Federally Funded Research and Development Center
FISCAM	Federal Information System Controls Audit Manual
FMFIA	Federal Managers' Financial Integrity Act
FOIA	Freedom of Information Act
FPTBU	Funds to be Put to Better Use
FY	Fiscal Year
GAAP	Generally Accepted Accounting Principles
GAO	Government Accountability Office
GCTC	Gagarin Cosmonaut Training Center
GOES-R	Geostationary Operational Environmental Satellite

GOLD	Global-scale Observations of the Limb and Disk
G-PP&E	General Property, Plant and Equipment
GPRAMA	Government Performance and Results Act Modernization Act of 2010
GRACE-FO	Gravity Recovery and Climate Experiment Follow-on
GRC	Glenn Research Center
GSFC	Goddard Space Flight Center
GTAS	Government-wide Treasury Account Symbol Adjusted Trial Balance System
HEOMD	Human Exploration and Operating Mission Directorate
HQS	NASA Headquarters
HTV	H-II Transfer Vehicle
HVAC	Heating, Ventilating and Air-Conditioning
I3P	IT Infrastructure Integration Program
IBNR	Incurred But Not Reported
ICE Sat2	Ice, Cloud and Land Elevation Satellite-2
ICON	Ionospheric Connection Explorer
IPERA	Improper Payments Elimination and Recovery Act of 2010
IPERIA	Improper Payments Elimination and Recovery Improvement Act of 2012
IPIA	Improper Payments Information Act of 2002
ISRU	In-Situ Resource Utilization
ISS	International Space Station
IT	Information Technology
JPL	Jet Propulsion Laboratory
JPSS	Joint Polar Satellite System
JSC	Johnson Space Center
KMSAL	Key Management Single Audit Liaison
KSC	Kennedy Space Center
LaRC	Langley Research Center
LBFD	Low Boom Fight Demonstrator
LEO	Low Earth Orbit
LSP	Launch Services Program
MAVEN	Mars Atmosphere and Volatile Mission
M&R	Maintenance and Repairs
MdM	Metadata Manager
MOMA	Mars Organic Molecule Analyzer

MOXIE	The Mars Oxygen ISRU Experiment
MSD	Mission Support Directorate
MSFC	Marshall Space Flight Center
MSWG	Management Systems Working Group
NASA	National Aeronautics and Space Administration
NICER	Neutron star Interior Composition Explorer
NISAR	NASA-ISRO Synthetic Aperture Radar
NOAA	National Oceanic and Atmospheric Administration
NSSC	NASA Shared Services Center
OCE	Office of the Chief Engineer
OCFO	Office of Chief Financial Officer
OCHMO	Office of the Chief Health and Medical Officer
OHCM	Office of Human Capital Management
O&M	Operating and Maintenance
OIG	Office of Inspector General
OMB	Office of Management and Budget
OSIRIS-REx	Origins Spectral Interpretation Resource Identified Security - Regolith Explorer Mission
OSMA	Office of Safety and Mission Assurance
PG	Performance Goal
P.L.	Public Law
PMMe	Performance Measures Manager Extension
PPS	Procurement for Public Sector
QM-2	Qualification Motor
R&D	Research and Development
R&T	Research and Technology
RBI	Radiation Budget Instrument
RPT	Rocket Propulsion Testing
RSI	Required Supplementary Information
RSSI	Required Supplementary Stewardship Information
SAAO	Single Audit Accountable Official
SAM-EPLS	System for Award Management Excluded Parties List System
SAP	Systems Applications & Products
SAT	Senior Assessment Team
SBIR	Small Business Innovation Research

SBR	Statement of Budgetary Resources
SCaN	Space Communications and Navigation
SCAP	Strategic Capabilities Assets Program
SEP	Solar Electric Propulsion
SEWP	Solutions for Enterprise-Wide Procurement
SFFAS	Statement of Federal Financial Accounting Standards
SLS	Space Launch System
SMD	Science Mission Directorate
SNC	Statement of Net Cost
SOAR	Strategic Objective Annual Review
SOC	Solar Orbiter Collaboration
SOS	Schedule of Spending
SPP	Solar Probe Plus
SSA-DMF	Social Security Administration Death Master File
SSC	Stennis Space Center
STEM	Science, Technology, Engineering and Mathematics
STMD	Space Technology Mission Directorate
SWOT	Surface Water Ocean Topography
STTR	Small Business Technology Transfer
TESS	Transiting Exoplanet Survey Satellite
TIN	Tax Identification Number
U.S.	United States
WCF	Working Capital Fund
Webb	James Webb Space Telescope
WFIRST	Wide Field InfraRed Survey Telescope

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Office of the Chief Financial Officer

Andrew Hunter Lisa Ziehmann

Financial Management Division

Terrance Alfred
Irvin Bigay
Sharon Bryant
Michelle Butler
Gabrielle Chapman
Tamara Chapman
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Jerome Commander
John Emery
Glendon Hale
Tina Liu
Ellis Ogun
Ignatius Okonkwo
Joi Salisbury
Tierra Sawe
Sunita Sharma
Camelia Spence
Jeanne Tran

Financial & Budget Systems Management Division

Beth Mantiply
David Mielke

Budget Division

Janice Davis
Brian Dewhurst
Shawn Mansfield

Quality Assurance Division

Cherisse Aquil
Kelly Barnes
Cheryl Carrington
Purnell Johnson
Frank Petersen
Jamell Sharpe
Nestor Tezna
Charlene Williams

Office of Inspector General

Regina Dull
Mark Jenson

Policy Division

Kevin Buford
Laura Koren
Chandran Pillai

Office of Strategic Infrastructure

Ronald Dilustro
Patricia Jones
Kristy Thompson

Mission Support Directorate

Anthony Mitchell
Paul Roberts

Strategic Investments Division

Cristina Guidi
Reid Koester
Augustin Manke
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National Aeronautics and Space Administration

NASA Headquarters
300 E Street, SW
Washington, DC 20546
www.nasa.gov/centers/hq

www.nasa.gov