



National Aeronautics and  
Space Administration

# FY2019 AGENCY FINANCIAL REPORT



# 5 YEARS



[WWW.NASA.GOV](http://WWW.NASA.GOV)

**“THAT’S  
ONE SMALL  
STEP FOR  
MAN, ONE  
GIANT  
LEAP FOR  
MANKIND.”**

**- NEIL ARMSTRONG**

One of the first steps taken on the Moon, this is an image of Buzz Aldrin’s footprint from the Apollo 11 mission. Neil Armstrong and Buzz Aldrin walked on the Moon on July 20, 1969. The Apollo 11 mission launched on July 16 on a Saturn V launch vehicle developed by NASA’s Marshall Space Flight Center in Huntsville, Alabama.

**Photo Credit: NASA**



**COVER IMAGE**

This artist’s concept celebrates NASA’s history with the 50th anniversary of Apollo 11, while also looking forward to the future with the Moon to Mars missions.

**Image Credit: NASA**

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## Section 3

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# WE CHOOSE TO GO TO THE MOON

- PRESIDENT JOHN F. KENNEDY -

APOLLO 11 | FIRST LUNAR LANDING | 50<sup>th</sup> ANNIVERSARY | 1969 - 2019



On September 12, 1962, President John F. Kennedy announced that the United States would land men on the Moon. Video Credit: NASA



The crew of NASA's Apollo 11 mission, from left, Neil Armstrong, Michael Collins, and Edwin "Buzz" Aldrin, pose with a model of the Moon in 1969. Photo Credit: NASA



On July 16, 1969, the huge, 363-foot tall Saturn V rocket launches on the Apollo 11 mission from Pad A, Launch Complex 39, Kennedy Space Center, at 9:32 a.m. Eastern Daylight Time (EDT). Photo Credit: NASA



On July 20, 1969, U.S. Apollo 11 astronauts Neil Armstrong and Edwin "Buzz" Aldrin became the first humans to set foot on the Moon. Photo Credit: NASA



# MESSAGE FROM THE ADMINISTRATOR



November 15, 2019



2019

## STRATEGIC GOALS

### I. DISCOVER

Expand human knowledge through new scientific discoveries

### II. EXPLORE

Extend human presence deeper into space and to the Moon for sustainable long-term exploration and utilization

### III. DEVELOP

Address national challenges and catalyze economic growth

### IV. ENABLE

Optimize capabilities and operations

I am pleased to present the Fiscal Year (FY) 2019 Agency Financial Report (AFR) for the National Aeronautics and Space Administration (NASA). This document represents an annual view of our financial and programmatic performance relative to the Agency's Vision and Mission. A complete overview of our Mission Performance is provided including the final year-end programmatic performance assessment. In addition, a full accounting of our financial statements in accordance with the Generally Accepted Accounting Principles (GAAP) provide visibility into our business operations. As responsible stewards of the American taxpayers, NASA is committed to delivering credible, quality data and information regarding the Agency's fiscal operations. We follow standard financial reporting practices, ensuring appropriate controls, and efficient and effective management of appropriated and reimbursable Agency funds.

Every day, NASA is pushing boundaries in aeronautics, space exploration, science, and technology. Since the Agency's establishment in 1958, we have aimed to accomplish our Vision and Mission with the utmost care. With leadership from the White House, we have aligned our activities to four major themes - **DISCOVER, EXPLORE, DEVELOP, and ENABLE**, that in turn correspond to the Strategic Goals identified in our 2018 Strategic Plan. This year, as we celebrate the 50th anniversary of the first American landing on the Moon, we are once again preparing to embark on a great voyage of exploration. NASA is going forward to the Moon and Mars, with our U.S. industry and international partners. We are returning humanity to our nearest neighbor in order to build a sustainable, open architecture that will prepare us to establish a long-term human presence in deep space, before embarking on human missions to Mars. The Artemis program will land the first woman and next man on the Moon by 2024 using innovative technologies to explore more of the lunar surface than ever before. This new journey will surely enable discovery, economic growth, and American global leadership for generations to come.

NASA acknowledges that landing humans on the Moon by 2024 is a top management and performance challenge. To meet our goal, NASA continues to proactively accelerate development of the sustainable architecture needed to support a successful lunar landing. The development of the Gateway, the lunar outpost that will support human and scientific exploration of the Moon, is a major component to our long-term success. In FY 2019, NASA focused development on the initial critical elements that will support Artemis in the future, including awarding long-lead contracts for the Power and Propulsion Element, the Habitation and Logistics Outpost, as well as logistics delivery services.

The Space Launch System (SLS), the most powerful rocket in the world, is another critical component for our future deep space exploration plans. SLS will send humans to the Moon, enabling our Orion spacecraft to carry our astronauts to the Gateway, where they will board a human landing system for missions to the surface of the Moon. In FY 2019, the first integrated test of these deep space exploration systems was completed at the Kennedy Space Center (KSC) in Cape Canaveral, Florida. This fiscal year, NASA also initiated activity for the commercial development of lunar human landing systems, as well as the development of lunar surface suit systems.

As you can imagine, this is truly an exciting time for NASA, and I am humbled to be a part of all that is to come. It is with honor and gratitude that I recognize the efforts of the women and men who ensure NASA's success as it continues to drive America's leadership in space and aeronautics.

Ad Astra,

James F. Bridenstine  
Administrator



NASA's Artemis lunar exploration program will land the first woman and next man on the Moon by 2024, and establish sustainable exploration by 2028. Using innovative technologies to explore more of the lunar surface than ever before we will collaborate with our commercial and international partners to:

to explore more of the lunar surface than ever before we will collaborate with our commercial and international partners to:

- ▲ Demonstrate new technologies, capabilities, and business approaches needed for future exploration to Mars
- ▲ Establish American leadership and a presence on the Moon
- ▲ Expand our United States global economic impact with commercial and international partnerships
- ▲ Inspire a new generation and encourage careers in STEM

NASA's powerful new rocket, the Space Launch System (SLS), will send astronauts, in newly customized Artemis Generation Spacesuits, aboard the Orion spacecraft a quarter million miles from Earth to lunar orbit. Astronauts will dock Orion at the lunar outpost, Gateway where they will live and work around the Moon. The crew will take expeditions from the Gateway to the surface of the Moon in a new human landing system before returning to the orbital outpost. Crew will ultimately return to Earth aboard Orion.

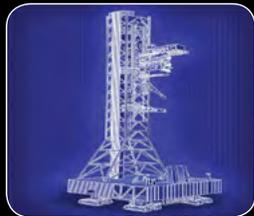
The Agency will fly two missions around the Moon to test its deep space exploration systems. NASA is working toward launching Artemis 1, an unmanned flight to test the SLS and Orion spacecraft together in 2020. Artemis 2, the first SLS and Orion flight with crew, is targeted for launch in 2022. NASA is scheduled to land astronauts on the Moon by 2024 on the Artemis 3 mission and once a year thereafter.

While Mars remains our horizon goal, NASA has set its sights on exploring the entire surface of the Moon with human and robotic explorers first. We will send astronauts to new locations, starting with the lunar South Pole. At the Moon, we will:

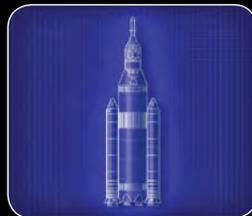
Find and use water and other critical resources needed for long-term exploration

- ▲ Investigate the Moon's mysteries and learn more about our home planet and the universe
- ▲ Learn how to live and operate on the surface of another celestial body
- ▲ Prove the technologies we need before sending astronauts on missions to Mars

<https://www.nasa.gov/specials/artemis/>



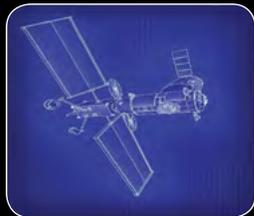
Exploration Ground Systems



Space Launch System



Orion



Gateway



Lunar Landers



Artemis Generation Spacesuits



**LUNAR SOUTH POLE TARGET SITE**



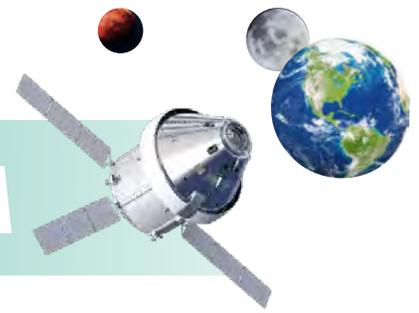
# SECTION 1

## MANAGEMENT'S DISCUSSION AND ANALYSIS

NASA astronaut candidate Kayla Barron is seen after donning her space-suit, Friday, July 12, 2019 at NASA's Johnson Space Center in Houston, Texas. **Photo Credit: NASA/Bill Ingalls**



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# WELCOME TO NASA

NASA produces an Annual Performance Report (APR) and Agency Financial Report (AFR). The APR is provided as part of NASA's annual Volume of Integrated Performance (VIPer). The VIPer is a consolidated document reporting prior year performance with an updated performance plan for the current fiscal year, and a proposed performance plan for the requested budget fiscal year. The VIPer is published in conjunction with the President's Budget Request, due in February 2020.

This AFR provides an overview of NASA's major programmatic and financial results for Fiscal Year (FY) 2019. It integrates NASA's financial and program performance to demonstrate stewardship and accountability,

highlighting FY 2019 achievements and challenges.

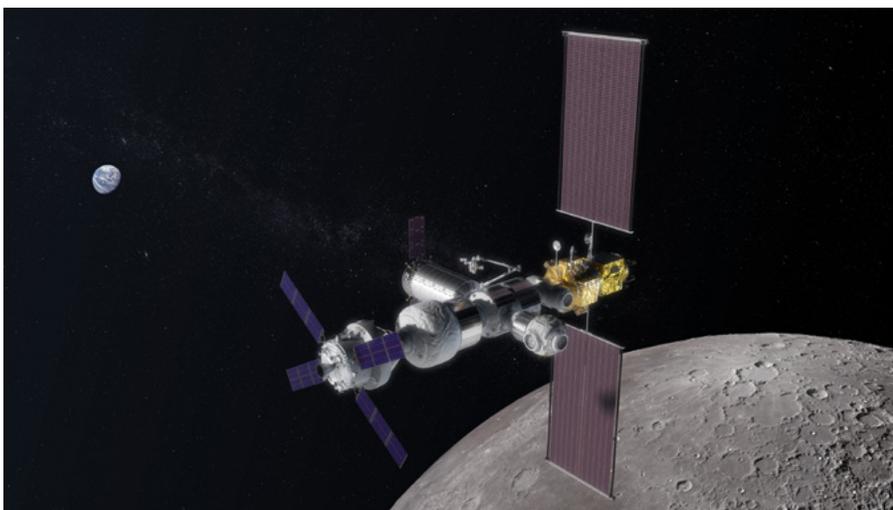
NASA demonstrates stewardship of its resources and accountability for results through compliance with the Chief Financial Officers Act of 1990 (CFO Act) and the [Government Performance and Results Act Modernization Act of 2010](#)<sup>a</sup> (GPRAMA). Financial aspects of the Agency's business operations 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 goals as identified in the [2018 Strategic Plan](#)<sup>b</sup>. Highlights of

key program activities contributing to each strategic goal are provided in the Mission Performance section (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), found in the Financial section (starting on page 45). The SNC presents comparative net cost of operations during FY 2019 and FY 2018 by strategic goal and for the Agency as a whole. In addition, the Financial Highlights, in the Financial Performance section (starting on page 27), explains any significant changes in NASA's financial condition from FY 2018 to FY 2019.

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.

The AFR presents the Agency's audited FY 2019 and FY 2018 financial statements and disclosures, the related independent auditors' audit opinion, and other information. The FY 2019 AFR can be found on NASA's website at <https://www.nasa.gov/news/budget>.



## PLAY VIDEO **NASA 2019: KEEPING THE PROMISE**

In 2019, NASA is once again preparing for human missions to the Moon. We're keeping the promise by developing new systems and spacecraft, making innovations in flight and technology, living and doing science on the International Space Station, and delivering images and discoveries from our home planet, our solar system and beyond.

<sup>a</sup> Government Performance and Results Act Modernization Act of 2010 (GPRAMA) <https://obamawhitehouse.archives.gov/omb/performance/gprm-act>

<sup>b</sup> 2018 Strategic Plan [https://www.nasa.gov/sites/default/files/atoms/files/nasa\\_2018\\_strategic\\_plan.pdf](https://www.nasa.gov/sites/default/files/atoms/files/nasa_2018_strategic_plan.pdf)

# ACHIEVING OUR VISION AND MISSION

## VISION

To discover and expand knowledge for the benefit of humanity.

## MISSION

Lead an innovative and sustainable program of exploration with commercial and international partners to enable human expansion across the solar system and bring new knowledge and opportunities back to Earth.

Support growth of the Nation's economy in space and aeronautics, increase understanding of the universe and our place in it, work with industry to improve America's aerospace technologies, and advance American leadership.

NASA inspires the world with our exploration of new frontiers, our discovery of new knowledge, and our development of new technology. Our work benefits Americans and all humanity. Since NASA's inception in 1958 to present day, the Agency's history is written with each unique scientific and technological achievement. We have landed people on the Moon, visited every planet in the solar system, touched the Sun, and solved some of the core mysteries of our home planet.

Today, our Nation's economic prosperity, National security, and cultural identity have links to our leadership in aeronautics, space exploration, and science. NASA accepts the challenge to continue our legacy of achievement and greatly expand the benefits we provide to mankind. Our success will be determined largely by the planning and investments we undertake today. This commitment is what drives our Vision, Mission, and overarching approach that form the core of our 2018 Strategic Plan.

NASA's historic and enduring purpose is aligned to four major strategic themes: DISCOVER, EXPLORE, DEVELOP, and ENABLE. The four themes are intended to characterize the four Strategic Goals that frame our Strategic Plan, which correspond to our missions of scientific discovery of the Earth, of other worlds, and of the cosmos as a whole.

In addition, the plan corresponds to the missions of exploration in our solar system with humans and robotic probes that expand the frontiers of human experience; and missions of development that advance new technologies in aeronautics and space systems that allow the American industry to create and expand a nascent space marketplace to serve the needs of space exploration, both here on Earth and in near-Earth environments.



**NASA maintains its continuity of purpose over time by serving the American public and supporting a number of National priorities, characterized by six major elements:**

- ▶ **Fostering New Discoveries and Expanding Human Knowledge**
- ▶ **Global Engagement and Diplomacy**
- ▶ **Interactions with the Nation's Security and Industrial Base Posture**
- ▶ **Economic Development and Growth**
- ▶ **Addressing National Challenges**
- ▶ **Leadership and Inspiration**

## AGENCY PRIORITY GOALS

Agency Priority Goals (APG) are a performance accountability structure of the GPRAMA that provide a mechanism to focus leadership priorities. NASA has identified five APGs for the FY 2018 - FY 2019 cycle. Related Performance Goals are assessed quarterly to measure each APG's progress toward achieving long-term Strategic Goals and Strategic Objectives. Additional information on NASA's Agency Priority Goals can be found at <https://www.performance.gov/>.

### Commercial Crew



**Goal leader:** **Philip McAlister**, Director of Commercial Spaceflight Development Division

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, 2019, the Commercial Crew Program, along with its industry partners, will complete at least one Certification Review, following un-crewed and crewed test flights to the ISS.

### Exploration



**Goal leader:** **Thomas Whitmeyer**, Deputy Associate Administrator (AA) of Exploration Systems Development

Achieve critical milestones in the development of new systems for the human exploration of deep space. By September 30, 2019, NASA will conduct the Ascent Abort-2 (AA-2) test of the Orion Launch Abort System, perform the green run hot-fire test of the Space Launch System's Core Stage at the Stennis Space Center, and roll the Mobile Launcher to the Vehicle Assembly Building to support the start of Exploration Mission-1 stacking operations.

### International Space Station



**Goal leader:** **Sam Scimemi**, Director of International Space Station Division

Use the International Space Station (ISS) as a testbed to demonstrate the critical systems necessary for long-duration missions. Between October 1, 2017 and September 30, 2019, NASA will initiate at least eight in-space demonstrations of technology critical to enable human exploration in deep space.

### James Webb Space Telescope



**Goal leader:** **Greg Robinson**, Program Director of James Webb Space Telescope Program

Revolutionize humankind's understanding of the Cosmos and humanity's place in it. The James Webb Space Telescope (Webb) will study every phase in the history of our universe, ranging from the first luminous glows after the Big Bang, to the formation of other stellar systems capable of supporting life on planets like Earth, to the evolution of our own solar system.

### Mars 2020



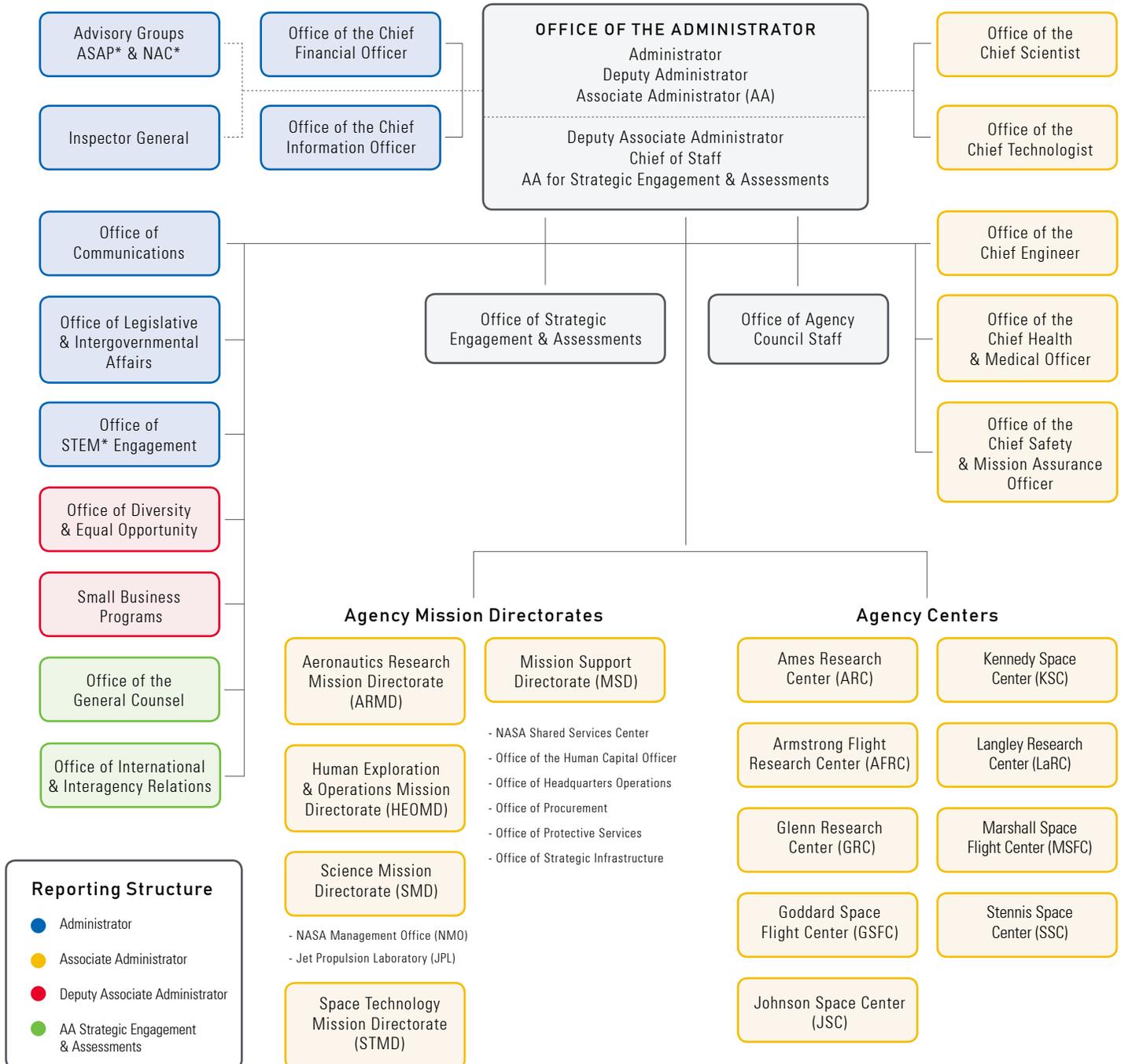
**Goal leader:** **Jim Watzin**, Program Director of Mars Exploration Program

Seeking signs of life on Mars: Explore a habitable environment, search for potential biosignatures of past life, collect and document a cache of scientifically compelling samples for eventual return to Earth, and contribute to future human exploration of Mars. By August 5, 2020, NASA will launch the Mars 2020 rover.

## ORGANIZATIONAL STRUCTURE

NASA's organizational structure comprises a top level leadership structure overseeing a matrix relationship between Mission Directorates, Mission Support offices, and Centers. This structure ensures the Agency can have both a holistic and narrowly-focused approach to business management, safety oversight, and achievement of mission and operational goals, as described in the NASA Organization, NASA Policy Directive 1000.3E. The Administrator

and senior officials lead the Agency by providing top-level strategies and direction. Mission directorate and mission support offices at Headquarters (HQ) manage decisions on programmatic investments and guide the operations of the Centers. NASA's Centers and facilities manage and execute the mission work — engineering, operations, science, and technology development — and supporting activities.

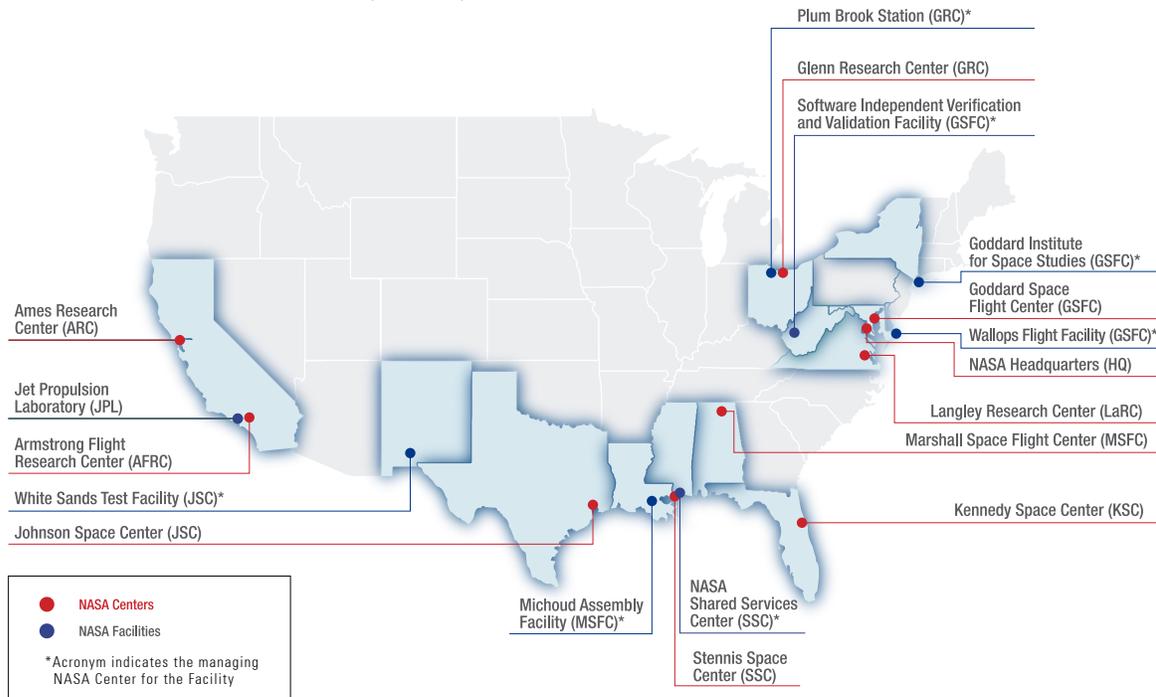


**\*Acronyms**

ASAP - Aerospace Safety Advisory Panel    NAC - NASA Advisory Council    STEM - Science, Technology, Engineering & Mathematics

## CENTERS AND FACILITIES

NASA's Headquarters, located in Washington, DC, provides the overall guidance and direction to the agency under the leadership of the Administrator. A skilled and diverse group of technical and business professionals conduct day-to-day activities throughout our ten field Centers and a variety of unique facilities.



### DID YOU KNOW

NASA has multiple centers located across the United States, many of which provide tours and/or host visitor centers that are open to the public. NASA's Visitor Centers invite you to share in America's triumphant adventures in space. Our family of world-class facilities wants your family to experience our unique blend of education and entertainment. It's an insider's view that only we can offer. Below we highlight three of our many visitor centers, for more information on all of NASA's Visitor Centers click the link here <http://www.visitnasa.com/>.



Johnson Space Center  
Houston, TX

The non-profit museum, Space Center Houston is the official visitor center of NASA Johnson Space Center (JSC). Space Center Houston is one of the only places on Earth where visitors can see astronauts train for missions, touch a real moon rock, and take a behind-the-scenes tour of NASA. Visitors can go inside the unprecedented international landmark, Independence Plaza, the only exhibit in the world with a full-scale shuttle replica mounted on top of the original shuttle carrier aircraft.



Ames Research Center  
Moffet Field, CA

Located in the heart of Silicon Valley, NASA's Ames Research Center (ARC) cordially invites you to tour its intriguing visitor center and learn about all things NASA, while exploring exciting NASA missions. During your visit, you can see a real moon rock, a martian asteroid, learn how astronauts live and work in space and much more! Open six days a week, the Visitor Center is free and features a large-screen theater showing a variety of informative presentations and films to whet your appetite for NASA.

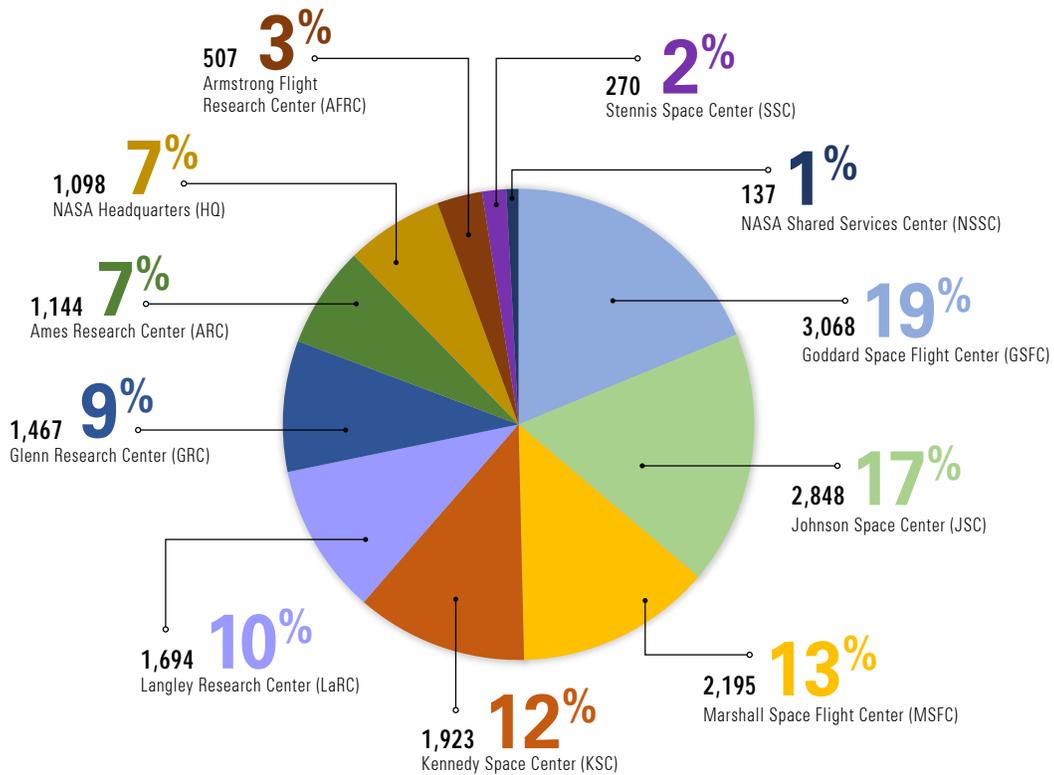
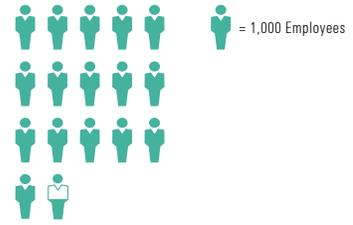


Goddard Space Flight Center  
Greenbelt, MD

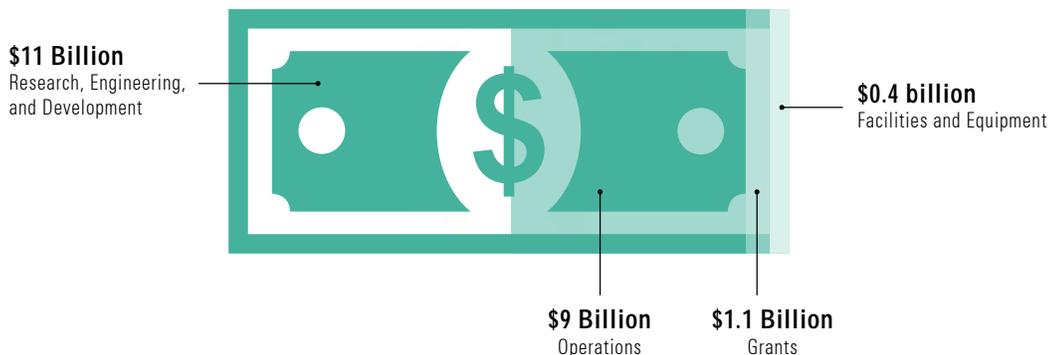
Goddard Space Flight Center's (GSFC) is a short distance from Washington, DC. The visitor center demonstrates our innovative and exciting work in Earth science, astrophysics, heliophysics, planetary science, engineering, communication and technology development. Browse the unique, informative exhibits and learn about climate change, climb inside a Gemini capsule model, encourage a child to dream as he or she pulls on our kid-sized spacesuit, or participate in one of the monthly model rocket launches.

## NASA BY THE NUMBERS

NASA'S  
CIVIL SERVICE  
WORKFORCE\*  
**16,351**



**\$21.5 Billion** budget in FY 2019



\* Full-Time Permanent Employees

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

# NASA UNVEILS 'HIDDEN FIGURES WAY' AT HEADQUARTERS TO HONOR FEMALE SPACE ICONS



On June 12, 2019, Administrator Jim Bridenstine joined U.S. Senator Ted Cruz of Texas, District of Columbia (D.C.) Council Chairman Phil Mendelson, and author Margot Lee Shetterly, for the renaming of the street in front of NASA Headquarters in Washington, D.C. – E Street SW – to 📍 “Hidden Figures Way.”  
**Photo Credit: NASA**

In a renaming ceremony outside NASA headquarters, NASA Administrator Jim Bridenstine; Sen. Ted Cruz, R-Texas; author of the “Hidden Figures” book (William Morrow, 2016), Margot Lee Shetterly; and D.C. Council Chairman Phil Mendelson unveiled the new street sign at the corner of 3rd Street and what is now Hidden Figures Way —formerly E Street SW.

“A street sign is a piece of metal, [...] but it’s [also] a lot

more than that,” said Cruz, who sponsored a bill called the Hidden Figures Way Designation Act to rename the street. “Because for years, and then decades, and then centuries, when little girls and little boys come to see NASA, they’re going to look up and see that sign, and they’re going to say ‘Hidden Figures? What’s that? What does that mean?’ And that, in turn, is going to prompt a story – a story about the unlimited human potential of

all of us. It’s not just a story of individuals but it’s also a story of, and acknowledges, the racism in this country and how we still struggle to deal with that and to overcome it,” the senator said.

Cruz said his bill was inspired by the 2016 film “Hidden Figures,” adapted from the book, which tells the story of three African American women — Katherine Johnson, Dorothy Vaughan and Mary Jackson— who worked at NASA’s

Langley Research Center in Virginia at a time when racial segregation and gender discrimination were the norm. Those women overcame these obstacles and played critical roles in launching the first U.S. astronauts into space.

Cruz said that he hopes the street’s new name will “inspire generations after generations of kids, and particularly little girls, who may be told in school, ‘You can’t do something.’”



## A SIGN OF PROGRESS HONORING NASA’S HIDDEN FIGURES

[▶ PLAY VIDEO](#)

NASA “human computer” Katherine Johnson watches the premiere of “Hidden Figures” after a reception where she was honored along with other members of the segregated West Area Computers division of Langley Research Center, on Thursday, December 1, 2016, at the Virginia Air and Space Center in Hampton, Virginia.

**Photo Credit: NASA/Aubrey Gemignani**



## MISSION PERFORMANCE



NASA's Curiosity Mars rover took this selfie on May 12, 2019 (the 2,405th Martian day, or sol, of the mission). To the lower-left of the rover are its two recent drill holes, at targets called "Aberlady" and "Kilmarie." These are Curiosity's 20th and 21st drill sites. The selfie is composed of 57 individual images taken by the rover's Mars Hand Lens Imager (MAHLI), a camera on the end of the rover's robotic arm. The images are stitched together into a panorama, and the robotic arm is digitally removed. **Photo Credit: NASA**

11

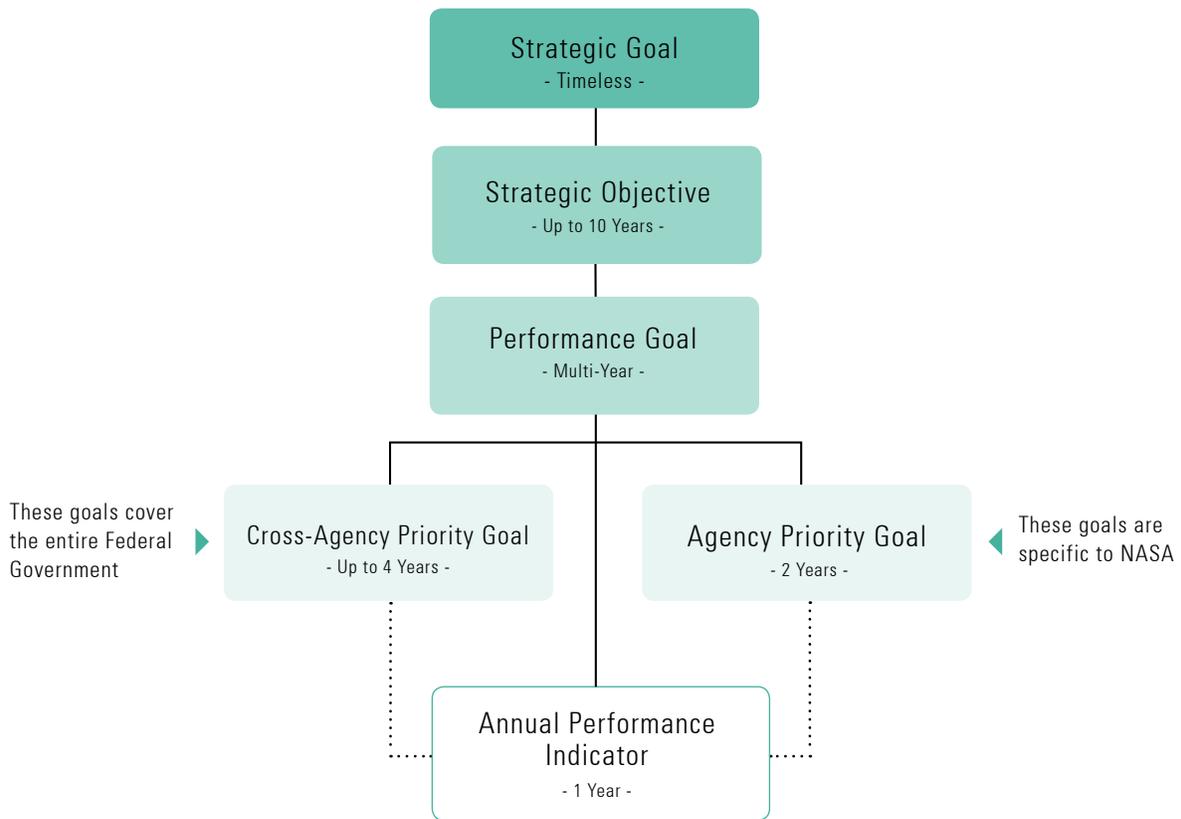
## STRATEGIC PERFORMANCE FRAMEWORK

The Government Performance and Results Act Modernization Act (GPRAMA) of 2010 requires a strategic performance framework that is structured to improve focus on agency priorities with measurable outcomes that support data-driven decision making. The framework is representative of a hierarchy that flows top-down, from Strategic Goals to Annual Performance Indicators. This relationship is representative of a parent-child connection, and described in detail in the Performance Assessment section, on page 16.

Strategic Goals identify the Agency's mission and address relevant National needs, challenges and opportunities. Strategic Objectives are long-term ambitions that provide detailed plans in support of achieving the Strategic Goals.

Performance Goals (PG) are multi-year tasks that align to the Strategic Objectives; and Annual Performance Indicators (API) are near-term activities that include targets and time-frames to define the level of performance required to achieve each PG. NASA has identified Strategic Goals, Strategic Objectives, PGs, and APIs that are in accordance with our framework and comprehensive of all agency activities.

Below is a visual illustration of NASA's Strategic Performance Framework. For the purpose of this publication we are specifically providing end-of-year assessments on PGs and APIs that support the achievement of our Strategic Objectives. For additional information on NASA's Cross-Agency Priority Goals (CAP) and Agency Priority Goals (APG) go to <https://www.performance.gov>.



**NASA'S  
PERFORMANCE  
FRAMEWORK  
BREAKDOWN**

**4**

Strategic  
Goals

**13**

Strategic  
Objectives

**68**

Performance  
Goals

**129**

Annual Performance  
Indicators

## STRATEGIC GOALS AND OBJECTIVES

As detailed in NASA's 2018 Strategic Plan our four Strategic Goals and thirteen Strategic Objectives outline the Agency's vision and mission for the future and are deliberately chosen to support a new era of space exploration; and continue America's preeminence in space, exploration, science, technology, and aeronautics.

### I. DISCOVER

#### EXPAND HUMAN KNOWLEDGE THROUGH NEW SCIENTIFIC DISCOVERIES

- 1.1 Understand the Sun, Earth, Solar System and Universe
- 1.2 Understand Responses of Physical and Biological Systems to Spaceflight

### II. EXPLORE

#### EXTEND HUMAN PRESENCE DEEPER INTO SPACE AND TO THE MOON FOR SUSTAINABLE LONG-TERM EXPLORATION AND UTILIZATION

- 2.1 Lay the Foundation for America to Maintain a Constant Human Presence in Low Earth Orbit Enabled by a Commercial Market
- 2.2 Conduct Exploration in Deep Space, Including to the Surface of the Moon

### III. DEVELOP

#### ADDRESS NATIONAL CHALLENGES AND CATALYZE ECONOMIC GROWTH

- 3.1 Develop and Transfer Revolutionary Technologies to Enable Exploration Capabilities for NASA and the Nation
- 3.2 Transform Aviation Through Revolutionary Technology Research, Development, and Transfer
- 3.3 Inspire and Engage the Public in Aeronautics, Space, and Science

### IV. ENABLE

#### OPTIMIZE CAPABILITIES AND OPERATIONS

- 4.1 Engage in Partnership Strategies
- 4.2 Enable Space Access and Services
- 4.3 Assure Safety and Mission Success
- 4.4 Manage Human Capital
- 4.5 Ensure Enterprise Protection
- 4.6 Sustain Infrastructure Capabilities and Operations



## In 2019, NASA's MODIS Satellite Imagery showed early detection of increased fire activity in the Southern Amazon



An active fire detections in Brazil as observed by Terra and Aqua Moderate Resolution Imaging Spectroradiometer (MODIS) between August 15-22, 2019. The locations of the fires, shown in orange, have been overlain on nighttime imagery acquired by Visible Infrared Imaging Suite (VIIRS).

**Image Credit: NASA**

NASA's Earth Observing System (EOS) is a coordinated series of polar-orbiting and low inclination satellites for long-term global observations of the land surface, biosphere, solid Earth, atmosphere, and oceans. As a major component of the Earth Science Division of NASA's Science Mission Directorate, EOS enables an improved understanding of the Earth as an integrated system. The Earth Observatory is an online publication created in 1999 by the EOS to serve as a source to the general public. The online site displays satellite imagery and scientific information of the Earth's climate and environmental changes. Satellites are often the first to detect fires burning in remote regions of the Amazon; NASA's primary tool for fire detections since 2002 has

been the Moderate Resolution Imaging Spectroradiometer (MODIS) instruments on the Terra and Aqua satellites.

In August 2019, during the Brazilian Amazon fire season, scientists using NASA MODIS satellites imagery to track fire activity were able to confirm an increase in the number and intensity of fires in the Amazon this year, making it the most active fire year in that region since 2010. Fire activity in the Amazon varies considerably from year-to-year and month-to-month, commonly driven by changes in economic conditions and climate. The August 2019 satellite imagery showed a noticeable increase in large, intense, and persistent fires burning along major roads in the Amazon. While

drought has played a large role in exacerbating fires in the past, the timing and location of fire detections early in the 2019 dry season are more consistent with land clearing than with regional drought. Visit the EOS Earth Observatory website for scientific imagery from the historic rainforest fires of 2019 as captured by MODIS.





# STRATEGIC GOALS AND HIGHLIGHTS



NASA astronauts Megan McArthur and Randy Bresnik are seen inside the Vehicle Assembly Building, Tuesday, June 25, 2019 at NASA's Kennedy Space Center in Florida. **Photo Credit: NASA/Joel Kowsky**

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## PERFORMANCE ASSESSMENT CRITERIA

NASA uses a color-coded scoring system to rate progress toward achieving Performance Goals (PG) and Annual Performance Indicators (API). A set of success criteria have been predetermined for both PGs and APIs and are measured for completeness based on the rating factors below. NASA determines the final ratings based on a series of internal assessments monitoring program and project performance. In addition, external entities including scientific peer review committees and aeronautic technical

evaluation bodies validate a select set of the final ratings. In some cases PGs and APIs have a status of "unrated" (grey rating). This is due to timing disconnects between the AFR deliverable date and internal reporting schedules. Final assessments and additional information will be provided in the FY 2019 Annual Performance Report (APR) as part of the NASA FY 2021 Volume of Integrated Performance (VIPer), which will be published in early February 2020.



### GREEN

#### Complete or On Target to Complete

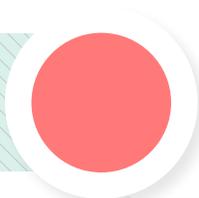
NASA has completed or is on target as planned to complete the PG and/or API



### YELLOW

#### Slightly Below Target

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



### RED

#### Significantly Below Target

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

#### Withdrawn

NASA is no longer performing activities related to the PG and/or API



### GREY

#### Unrated

NASA has not determined a final rating for the PG and/or API

## FY 2019 PERFORMANCE ASSESSMENT

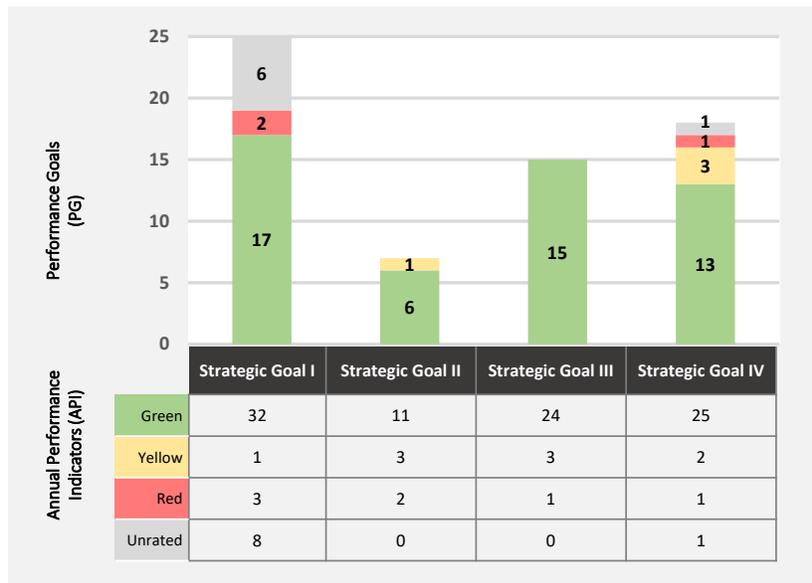
This performance assessment will provide the FY 2019 final performance ratings for the identified Performance Goals (PG) and Annual Performance Indicators (API) by Strategic Goal, per the individual Strategic Objectives. NASA's performance management system follows the NASA Strategic Performance Framework, as discussed on page 12. PGs represent the actions of a program or project over multiple years. They typically run the four year life-cycle along the Strategic Plan. As depicted in the Framework, PGs are the "parent" to the APIs, while APIs represent the "child" in the relationship and run a one year cycle. All PGs are associated with at least one lower-level API.

However, individual APIs can only be associated with one upperlevel PG. The following graphs represent the FY 2019 summary assessment by Strategic Goal, and the detailed individual Strategic Goal assessments by Strategic Objective.

The FY 2019 summary assessment below shows that in most areas NASA is on target to complete (green) the Strategic Objective PGs. As shown in the Performance Trending graph below NASA experienced both performance highlights and challenges from FY 2018 to FY 2019. This year the Agency reported an overall annual improvement in performance for Strategic Goals II and

III. The performance indicators that contributed to our success in these areas include our continuing partnership development with commercial businesses (Strategic Objective 2.1), and the accomplishments made in our Science, Technology, Engineering and Mathematic (STEM) Engagement Program (Strategic Objective 3.3). However, unforeseen challenges negatively impacted our overall performance for Strategic Goals I and IV. These contributors include in-flight irregularities slightly affecting planned research schedules on the International Space Station (ISS) (Strategic Objective 1.2), and an increase of Energy Use Intensity (EUI) in our infrastructure capabilities (Strategic Objective 4.6).

### Strategic Goal Summary Performance Assessment



### Strategic Goal Summary Performance Trend (FY 2018 to FY 2019)



# STRATEGIC GOAL I. DISCOVER

Expand Human Knowledge Through New Scientific Discoveries



Astronaut Christina Loch works in the vacuum of space while tethered near the Port 6 truss segment of the International Space Station to replace older hydrogen-nickel batteries with newer, more powerful lithium-ion batteries, during the October 11, 2019, spacewalk. Fellow NASA astronaut Andrew Morgan (out of frame) assisted Koch during the six-hour and 45-minute spacewalk. **Photo Credit: NASA**

## OVERVIEW

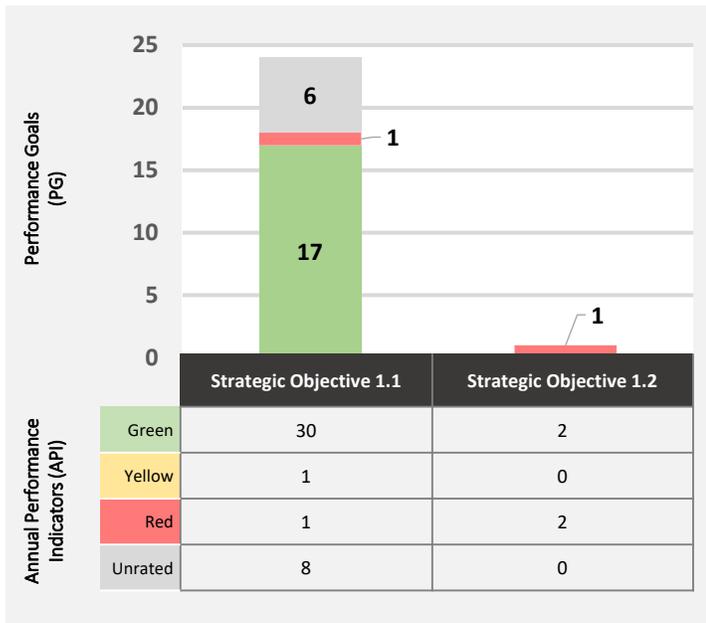
For 60 years, NASA's discoveries have been inspiring the world, rewriting textbooks, and transforming knowledge of humanity, the planet, the solar system, and the universe. Together, scientific discovery and human exploration improve and safeguard life on Earth.

Scientific research is also opening the pathway for exploration and robotic-human partnerships. NASA's Webb is poised to be the premier observatory of the next decade — unlocking the mysteries of the universe for humankind. The ISS is an orbital outpost for

humanity. It is a blueprint for global cooperation and scientific advancement, a catalyst for growing new commercial marketplaces in space, and a test bed for demonstrating new technologies. It extends where humankind lives and is the springboard for NASA's next great leaps in human space exploration, including future missions to the Moon and beyond.

Finally, NASA acts as a champion of free and open access to scientific data. The Agency's work incorporates and builds upon the work of others in a spirit of global engagement and diplomacy.

## Strategic Goal I. Performance Assessment



- 1.1 Understand the Sun, Earth, Solar System and Universe
- 1.2 Understand Responses of Physical and Biological Systems to Spaceflight

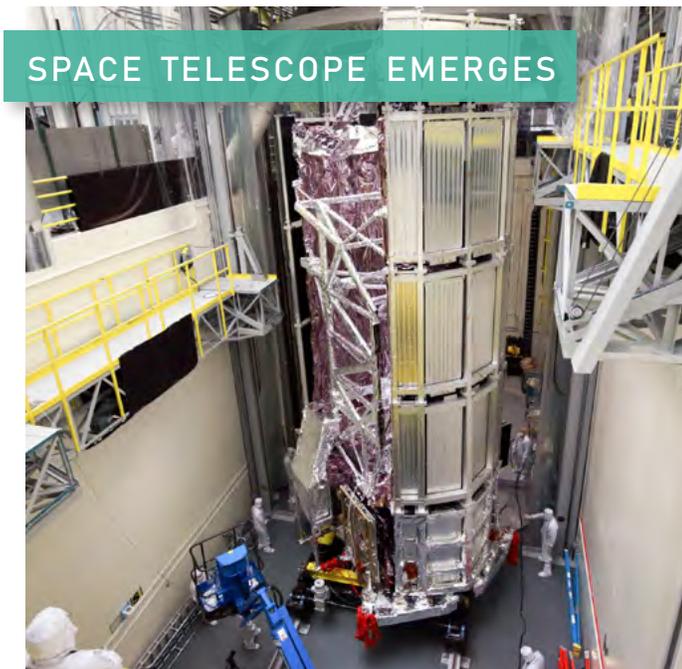
### Performance Highlight

The James Webb Space Telescope (Webb) will be the world's premier space science observatory. In FY 2019, Webb successfully cleared a critical test milestone with the completion of its final thermal vacuum testing to ensure the spacecraft will function appropriately in the vacuum of space. The spacecraft includes a "bus" to fly the telescope in space and the sunshield to protect the observatory's sensitive optics and instruments from the Sun's radiation. With this latest thermal vacuum test successfully completed, all of Webb's components have now been exposed to the varied conditions that will be encountered during launch and while in space. According to Jeanne Davis, program manager for the Webb Program, "This incredible accomplishment paves the way for the next major milestone, which is to integrate the telescope and the spacecraft elements." The next steps will be to fully assemble the observatory and complete a final round of deployments, as well as testing and evaluation prior to launch. A full deployment of the spacecraft element will verify that Webb is ready to proceed to the launch site. NASA has scheduled Webb's launch readiness date for March 2021.

### Performance Challenge

At NASA scientific investigations concerning the physical sciences and materials research are supported by an array of on-board International Space Station (ISS) facilities. Researchers are examining fundamental scientific questions from how fluids behave and crystals develop to how things burn and how smoke moves through the environment. In FY 2019, in-flight irregularities slightly affected planned research schedules that contribute to the physical sciences on-board the ISS, including:

- The Combustion Integrated Rack, used to perform sustained, systematic combustion experiments in microgravity
- The Fluids Integrated Rack (FIR), a multi-user fluid physics research facility designed to accommodate and image a wide variety of microgravity fluid experiments
- The Materials Science Research Rack (MSRR-1), a powerful multi-user facility that enables researchers by providing hardware to control the thermal, environmental and vacuum conditions of experiments



NASA's Webb emerges successfully from Final Thermal Vacuum Test. Technicians and engineers needed to take special precautions when preparing and transporting Webb's spacecraft element for entry into Northrop Grumman's environmental testing chambers. **Photo Credit: Northrop Grumman**

# STRATEGIC GOAL II. EXPLORE

Extend Human Presence Deeper Into Space and to the Moon for Sustainable Long-term Exploration and Utilization



A trail of night lights from the ISS. This image of star trails was compiled from time-lapse photography taken by NASA astronaut Christina Koch from aboard the ISS. This composite image was made from more than 400 individual photos taken over a span of about 11 minutes as the station traveled from Namibia toward the Red Sea. **Photo Credit: NASA**

## OVERVIEW

America is a Nation of explorers. In everything we do—science, technology, commerce, the arts, sports— we strive to reach higher, farther, deeper, or faster than ever before in order to create a better future for the generations to come.

NASA is also laying the foundation for America to sustain a constant commercial, human presence in low Earth orbit. From there, we will turn our attention back toward our celestial neighbors. At the same time, to support a broader strategy to explore and utilize the Moon and its surface, NASA is establish-

ing a Lunar Gateway in cis-lunar space, to include a power and propulsion element by 2022.

The United States will seek international partnership on a shared exploration agenda and spearhead the next phase of human space exploration. NASA will promote permanent human presence in space in a way that enables the 21st century space economy to thrive.

## Strategic Goal II. Performance Assessment



### Performance Highlight

NASA is opening the ISS for commercial business so U.S. industry innovation and ingenuity can accelerate a thriving commercial economy in low-Earth orbit. NASA is focused on its goal of landing the first woman and next man on the Moon by 2024, where American companies will also play an essential role in establishing a sustainable presence.

In June 2019, NASA released a plan for commercial low-Earth orbit development. The plan summarizes a five part break down of near-term actions the Agency is pursuing to encourage the growing commercial space sector, along with the long-term goal of being one of many customers in the low-Earth orbit marketplace. More than 50 companies already are conducting commercial research and development on the space station via the International Space Station U.S. National Laboratory, and their results are yielding great promise. In addition, NASA has worked with multiple companies to install commercial facilities on the station that support research and development projects for NASA and the ISS National Lab.

- 2.1 Lay the Foundation for America to Maintain a Constant Human Presence in Low Earth Orbit Enabled by a Commercial Market
- 2.2 Conduct Exploration in Deep Space, Including to the Surface of the Moon

### Performance Challenge

NASA's mobile launcher is the ground structure that will be used to assemble, process and launch the Space Launch System (SLS) rocket and Orion spacecraft from Launch Pad 39B at Kennedy Space Center for the Artemis missions. Throughout the fiscal year, NASA conducted verification and validation testing on the Mobile Launcher. However, scheduled testing was delayed due to unforeseen natural causes. This summer, the Mobile Launcher took the 10-hour trip from the Vehicle Assembly Building (VAB) to the Launch Pad. On August 30, 2019, NASA had to unexpectedly move the Mobile Launcher back to the VAB before testing was complete due to the arrival of Hurricane Dorian. The nearly 400-foot-tall structure, which is rated to withstand 110 mph winds, was taken to the VAB for safekeeping on August 30. The storm passed about 70 miles east of the spaceport during the overnight hours of September 3 and September 4. NASA's Exploration Ground Systems (EGS) returned the Mobile Launcher back to the Launch Pad in mid-September. Once in place at the pad teams will complete testing by FY 2020, Quarter 1.

### VEHICLE ASSEMBLY BUILDING



The iconic VAB at NASA's Kennedy Space Center in Florida, to the right a crane positioning the Orion crew access arm for assembly to the mobile launcher. **Photo Credit: NASA/Bill White**

# STRATEGIC GOAL III. DEVELOP

Address National Challenges and Catalyze Economic Growth



NASA is preparing to explore electric-powered flight with the X-57 Maxwell, a unique all-electric aircraft which features 14 propellers along its wing. Those very small, yet highly efficient motors will produce a tremendous amount of power and heat. but with power comes heat, and too much heat can cause issues for an aircraft. To manage the heat, engineers at NASA's Glenn Research Center devised a custom-designed "skin," or nacelle, around the aircraft's motor electronics to significantly cool them without changing the aircraft's shape or design.

Image Credit: NASA

## OVERVIEW

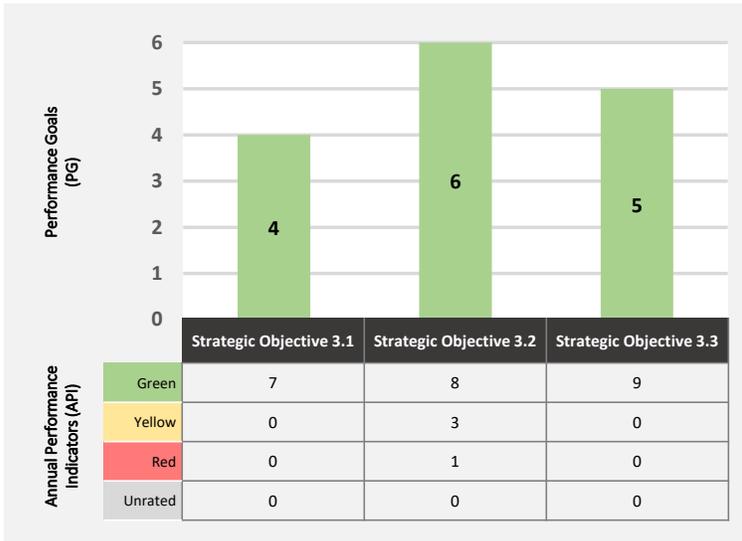
Originally tied to keeping the Nation secure and advancing U.S. leadership in aeronautics, communications satellites, and Earth remote sensing, NASA's mandate is broader today.

NASA drives economic development and growth; the National Aeronautics and Space Act of 1958 calls out this important theme, and the Agency generally invests more than 80 percent of its funds in U.S. industry and academia to carry out its missions of scientific discovery and exploration. In doing so, NASA engages and inspires young people to become scientists, technologists, engineers, and mathemati-

cians. This ensures that the Nation's vast intellectual and industrial base—shared by many other Government agencies, including the departments of Defense, Commerce, Transportation, and Interior—has a continuous supply of bright minds and skilled hands.

Today, NASA technology is found aboard every U.S. aircraft and inside every air traffic control facility in the country. This infusion can be attributed to one of the most productive public-private partnerships in U.S. history, as NASA continues to team with industry, academia, and other Government agencies.

## Strategic Goal III. Performance Assessment



- 3.1 Develop and Transfer Revolutionary Technologies to Enable Exploration Capabilities for NASA and the Nation
- 3.2 Transform Aviation Through Revolutionary Technology Research Development, and Transfer
- 3.3 Inspire and Engage the Public in Aeronautics, Space and Science

### Performance Highlight

NASA's journeys have propelled technological breakthroughs, pushed the frontiers of scientific research, and expanded our understanding of the universe. These accomplishments, and those to come, share a common genesis which is the importance of education in Science, Technology, Engineering and Mathematics (STEM). In FY 2019, an independent evaluation of NASA's higher education internships, challenges, and competitions found that the investments made to our STEM engagement program are in fact providing opportunities for students to contribute to NASA missions. While at the same time these contributions are producing knowledge, skills and products that will eventually benefit and be used by NASA in the future. Additionally, NASA conducted a feasibility analysis to determine potential approaches and methodologies for a long-term assessment of the outcomes of NASA internships. The analysis resulted in the design of three potential models that will be piloted in FY 2020.

### Performance Challenge

NASA's X-57 Maxwell is the agency's first all-electric aircraft. The first of three aircraft configurations known as Modification II or Mod II features the replacement of traditional combustion engines on a baseline Tecnam P2006T aircraft, with electric cruise motors.

In FY 2019 Quarter 4, unforeseen schedule delays slightly impacted the start of critical ground testing. Effective mitigation strategies have been implemented including transferring the aircraft to NASA ahead of schedule to begin and complete ground testing by FY 2020 Quarter 2. In addition, plans are in place to ensure that future X-57 activities will continue to progress. According to X-57 Project Manager Tom Rigney, "The X-57 Mod II aircraft delivery to NASA is a significant event, marking the beginning of a new phase in this exciting electric X-plane project. With the aircraft in our possession, the X-57 team will soon conduct extensive ground testing of the integrated electric propulsion system to ensure the aircraft is airworthy. We plan to rapidly share valuable lessons learned along the way as we progress toward flight testing, helping to inform the growing electric aircraft market."



NASA's X-57 Maxwell, the agency's first all-electric X-plane and first crewed X-planed in two decades, is delivered to NASA's Armstrong Flight Research Center in Edwards, California.

Photo Credits: NASA

# STRATEGIC GOAL IV. ENABLE

## Optimize Capabilities and Operations



Amy Ross, a spacesuit engineer at NASA's Johnson Space Center, left, and NASA Administrator Jim Bridenstine, second from left, presented the latest generation spacesuits to the world on Tuesday, October 15, 2019 at NASA Headquarters in Washington, DC. Standing next to the Administrator is Kristine Davis, a spacesuit engineer, who wore a ground prototype of NASA's new Exploration Extravehicular Mobility Unit (xEMU), and Dustin Gohmert, Orion Crew Survival Systems Project Manager, who wore the Orion Crew Survival System suit.

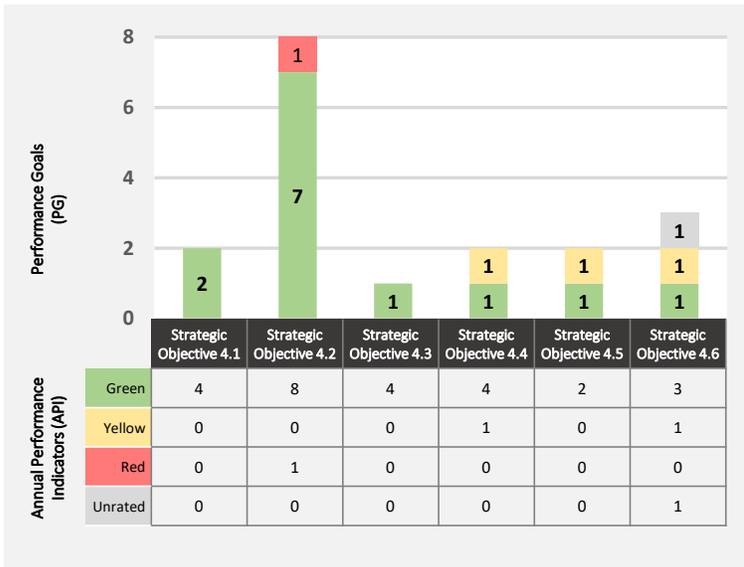
**Image Credit: NASA/Joel Kowsky**

### OVERVIEW

The Agency understands that a skilled, valued, and diverse workforce is central to creating and maintaining the capabilities to explore the solar system and beyond and for understanding our home planet. NASA will continue to maintain and ensure the availability and safety of critical capabilities and facilities necessary for advancing our space-, air-, and Earth-based activities. This hybrid goal includes both strategic objectives and management focused objectives. Recognizing the growth of technologies and innova-

tions increasing outside the Agency, NASA is instituting a robust partnership and acquisition strategy focused on leveraging and collaborating with the private sector and academia in order to benefit from their innovations. NASA's role in global engagement extends directly from the Space Act in areas such as data-sharing agreements and joint science and technology flight projects. More than two-thirds of NASA's science missions have foreign partners.

## Strategic Goal IV. Performance Assessment



- 4.1 Engage in Partnership Strategies
- 4.2 Enable Space Access and Services
- 4.3 Assure Safety and Mission Success
- 4.4 Manage Human Capital
- 4.5 Ensure Enterprise Protection
- 4.6 Sustain Infrastructure Capabilities and Operations

### Performance Highlight

NASA Office of Diversity and Equal Opportunity provides leadership to make us a model agency for diversity, inclusion, and equal opportunity, through evidence-based policies and innovations, to optimize mission success. NASA assesses grant recipient compliance with equal opportunity laws and regulations enforced by the Agency both through its assurance of compliance process and through compliance audits of select recipients.

In addition, NASA workforce diversity and inclusion efforts continue to result in improved employee perceptions relating to fairness and career advancement as measured by the most recent Federal Employee Viewpoint Survey Inclusion Index. NASA also offers Alternative Dispute Resolution at a rate of 89% at the informal stage and 59% at the formal stage, both of which are above the government-wide average. Timely completion of Equal Employment Opportunity (EEO) Counseling improved from 75% in FY 2018 to 88% in FY 2019. All investigations are 100% timely in FY 2019. Additionally, 89% of Final Agency Decisions pending at the end of FY 2018 have been resolved, reflecting an upward trend for the past two fiscal years.

### Performance Challenge

NASA's sustainability and energy scorecard enables the Agency to target and track the best opportunities to lead by example in clean energy; and to meet a range of energy, water, pollution, and waste reduction targets. Although, NASA reduced Energy Use Intensity (EUI) by 39% from the 30% baseline, EUI performance has decreased in recent periods. The primary reason for declines in energy efficiency is due to fewer remaining low-cost/high return investment opportunities; as well as, in FY 2018 a large renewable energy system failed to operate properly for part of the year. NASA received fewer credits for that system than in prior years which moved the Agency from an annual decrease in EUI to an increase. NASA continues to increase operational efficiency and reliability, reduce risk exposure, and enable mission success by implementing key initiatives, including: the launch of a cyclical Existing Building Commissioning Program, installation of new renewable solar energy systems, and the construction of four new high-performance sustainable buildings. These and other ongoing strategic measures will improve the Agency's sustainability performance goals.



NASA and the Indian Space Research Organization (ISRO) sponsor a study of the Asian Tropopause Aerosol Layer (ATAL), an area of enhanced aerosol particles that appears in the summertime. Using balloon-lofted instruments, the "Balloon measurement campaign of the Asian Tropopause Aerosol Layer (BATAL)" collects data to better understand this seasonal atmospheric phenomenon and its potential impact on water resources, ozone, weather and climate.

Photo Credit: NASA

# NASA TECHNOLOGY TRANSFER PROGRAM

For over 50 years the [NASA Technology Transfer](#) Program has partnered with private industry companies to modify and transfer NASA-originated technology for the development of commercial products and services that can benefit the public on Earth. These products and services are commonly referred to as Spinoff Technologies.

Since 1976, NASA has released an annual premier publication titled *Spinoff* that profiles new NASA technologies that have been transformed for commercial use in the public sector. Below are three of our favorite Spinoff Technologies highlighted in the 2019 publication of *Spinoff*.

## Image-Analysis Software Sees Cancer in 3D

NASA works hard to search out surprising discoveries, of course, but it works equally hard to avoid unpleasant ones related to the safety of its astronauts. In the interest of the latter, NASA has identified approximately 30 risks to humans in space, however there are still unknowns. Back to the Shuttle days Ron Midura, of the Cleveland Clinic's Lerner Research Institute, received funding from the NASA Ames Research Center to study the hypothesis that vascular remodeling precedes and impacts muscle and bone loss. This study was initiated to research sudden vision problems experienced by astronauts, believed to be related to changes in the blood flow while in microgravity. Using computer analysis to calculate the attributes of tissue samples Midura turned to a software program created by ImageIQ. The success of the Midura study using ImageIQ technology is a potential lifesaving application to support cancer research — and one day potentially help treat the disease. Specifically, technology using the filters and algorithms created for Midura, researchers can now identify the three-dimensional shape of a tumor within an image series.

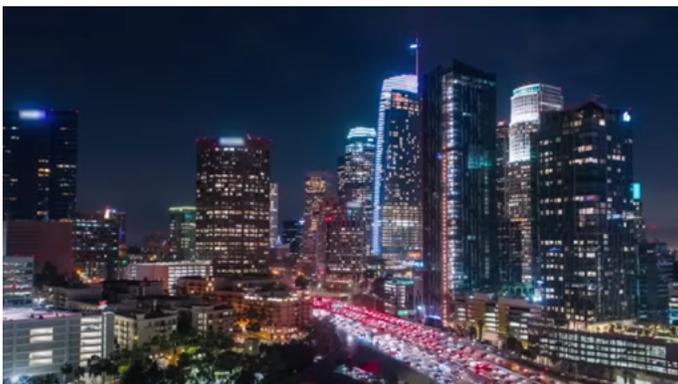
## Spacesuit Air Filters Eliminate Household Pet Odors

NASA awarded a Small Business Innovation Research (SBIR) contract in 2016, to Serionix Inc for research to design and demonstrate a lightweight, high-performing system for removing ammonia and formaldehyde from next-generation spacesuits. Further research enabled Serionix to focus on vehicle air quality challenges, mainly for NASA's Orion spacecraft. The company's patent-pending Colorfil technology, involves polyelectrolytes, a polymer substance with a permanent electrical charge incorporated. It applies a coating to the surface of a fabric-like non-woven material. The material is breathable and easily installed, like a regular air filter, and the Colorfil coating removes toxic chemicals and kills viruses, bacteria, and mold. Soon the company realized this technology, initially intended to filter the air in space, could also be a benefit to consumers here on Earth. Unpleasant household odors from cat boxes, hamster cages, and other pet spaces is due to ammonia and other related chemicals in urine. Serionix currently sells these household filters directly to consumers through the company's website. Products include a Colorfil-branded air purifier, an HVAC filter, and a cabin air filter for automobiles. All products promise to remove ammonia and other chemical odors from the air.

## Membranes Mimic Kidneys to Filter Water

When trying to solve a tough problem, it's not unusual for engineers to turn to nature for a solution. The discoveries of nature are quite efficient, and NASA has a huge requirement to filter water efficiently. Given the great cost of transporting water into space, as much moisture as possible has to be recycled into drinking water aboard spacecraft. On the International Space Station (ISS), every drop of moisture, from humidity to urine, is filtered, purified, and reused. But the current system relies on heavy filtration beds that weigh down resupply missions and have to be swapped out every 90 days. In 2007, the Advanced Water Recycling group at NASA's Ames Research Center introduced a possible solution to develop a water filtration system based on aquaporins, the proteins that enable plant roots to absorb water from soil, and human kidneys to filter fluid. Two basic types of filters are used for this concept; one for reverse osmosis and one for forward osmosis. Today the benefit of this technology includes household water purification systems; and designs under development to use reverse osmosis to desalinate seawater at higher efficiency and lower cost than existing technology.

## Bringing NASA Technology Down to Earth



The 2019 Spinoff publication provides nearly 50 examples of how NASA benefits various industries and people around the world. For example, fitness enthusiasts may be surprised to learn about NASA's contribution to the Bowflex Revolution resistance-exercise home gym. Other highlights include a crucial component of pacemakers that have helped save lives around the world, as well as reactors that use electricity "breathing" bacteria to clean wastewater and generate power at wineries and breweries.

"The variety and complexity of NASA's missions drive innovations in virtually every field of technology," said Daniel Lockney, executive of NASA's Technology Transfer program. "The result is that there's not an industry or business out there that can't make use of our groundbreaking work."

The publication also includes a "Spinoffs of Tomorrow" section that showcases 20 new NASA technologies available for license. One innovation on the list uses new materials to literally reinvent the wheel. The superelastic tires were inspired by the Apollo era and developed for future exploration of the Moon and Mars. The technology could find another purpose on Earth.



## FINANCIAL PERFORMANCE



The Northrop Grumman Antares rocket, with Cygnus resupply spacecraft onboard, is seen above the Thomas Jefferson Memorial in this long exposure, as it launches from Pad-0A, Saturday, November 17, 2018 at NASA's Wallops Flight Facility in Virginia. Northrop Grumman's 10th contracted cargo resupply mission for NASA to the International Space Station delivered about 7,400 pounds of science and research, crew supplies and vehicle hardware to the orbital laboratory and its crew.

**Photo Credit: NASA/Aubrey Gemignani**

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## 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, 2019 and September 30, 2018. It displays amounts in three primary categories.

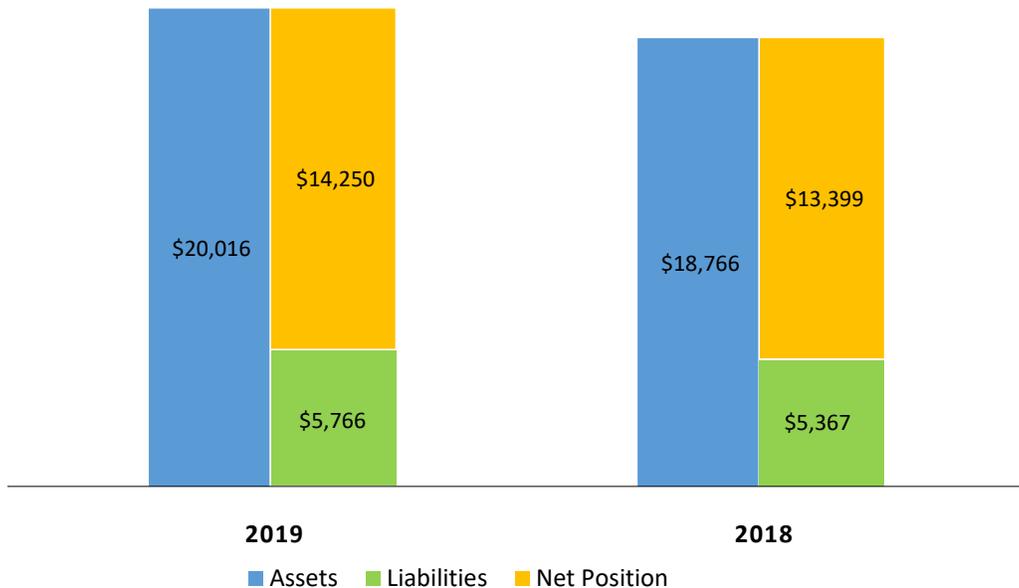
**+** **ASSETS** the current and future economic benefits owned or available for use by NASA.

**-** **LIABILITIES** the debts owed by NASA but not yet paid.



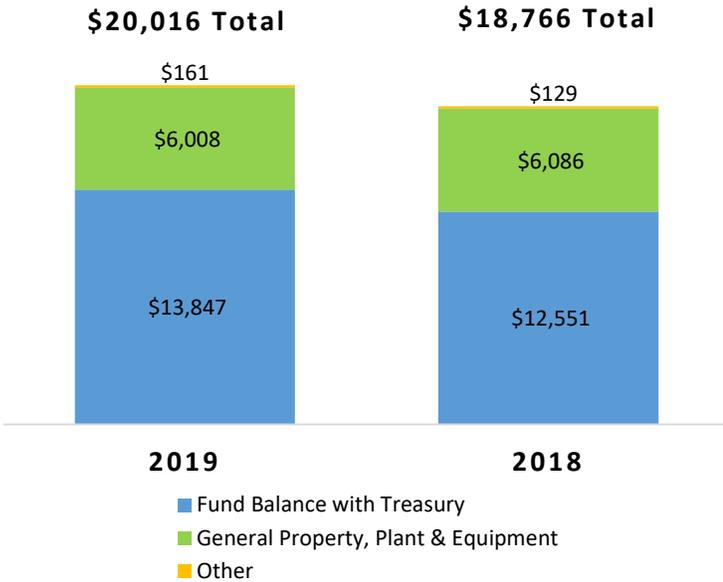
**NET POSITION** the activity between revenue and other financing sources, and costs incurred since inception.

**Balance Sheet Components FY 2019 and FY 2018**  
(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 total asset balance, as of September 30, 2019, was \$20 billion, seven percent higher than FY 2018.

**Assets by Type Comparison**  
FY 2019 and FY 2018 (in Millions of Dollars)



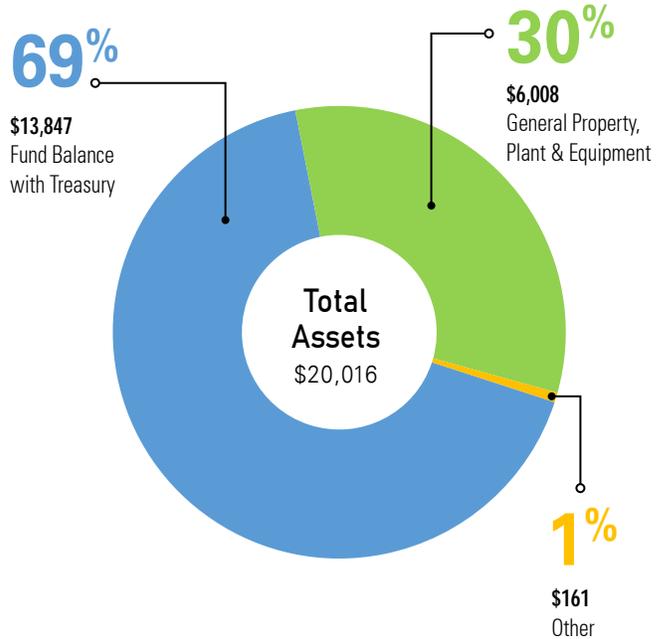
The Agency's Fund Balance with Treasury (FBWT) and its General Property, Plant and Equipment (G-PP&E) were the two primary components of the total asset balance.

FBWT, which represents NASA's cash balance with the U.S. Department of the Treasury, was the largest asset at \$13.8 billion, 69 percent of total assets. This cash balance included Congressional appropriated funds available for NASA's mission operations (for example, employee labor or purchased goods or services from contractors) that have not yet been paid.

NASA's G-PP&E had a net book value of \$6 billion as of September 30, 2019, 30 percent of total assets. The balance decreased slightly compared to FY 2018, primarily due to ongoing depreciation of existing assets, which was offset by an increase in General PP&E for NASA operation.

The Other category represents the amount of Investments, Accounts Receivable, and Other Assets as of September 30, 2019. The increase of \$32 million, or 25 percent, is primarily due to reimbursable activity for Joint Polar Satellite System (JPSS) projects, such as the Visible Infrared Imaging Radiometer Suite (VIIRS) for the JPSS-3 and JPSS-4 satellites.

**Assets by Type for FY 2019**  
(in Millions of Dollars)



**Total Liabilities**, as of September 30, 2019, were \$5.8 billion, seven percent higher than FY 2018. Environmental and Disposal Liabilities, Accounts Payable, and Other Accrued Liabilities represent the majority of NASA's liabilities.

Environmental and Disposal Liabilities of \$2 billion represent the estimated cost to clean up both known and projected environmental hazards. The increase of \$280 million, or 17 percent, is primarily due to the refinement of soil and groundwater cleanup cost estimates. The combination of revised information from regulators that increased the soil volumes required for soil cleanup and progress on identification of cleanup methods enabled the estimation of groundwater cleanup costs. As a result, it will require additional environmental clean-up costs.

Accounts Payable, which represents amounts owed to other entities, was \$1.3 billion, a decrease of \$96 million, or seven percent, compared to FY 2018. The decrease is primarily due to a reduction in activity for the JPSS-2 satellites, which will provide operational continuity of space-based weather observations to support long-life missions. The JPSS-2 satellite will be delivered in 2020 and is scheduled to launch in 2021.

Other Accrued Liabilities with public entities were \$1.7 billion, an increase of \$97 million, or six percent, compared to FY 2018. The change is primarily due to an increase in activity for the SLS, Orion, and James Webb Space Telescope (JWST) programs. Artemis I will be the first integrated test of NASA's deep space exploration system: the Orion spacecraft, SLS rocket, and the ground systems at KSC. It is scheduled to launch in 2020. JWST is scheduled to launch in 2021.

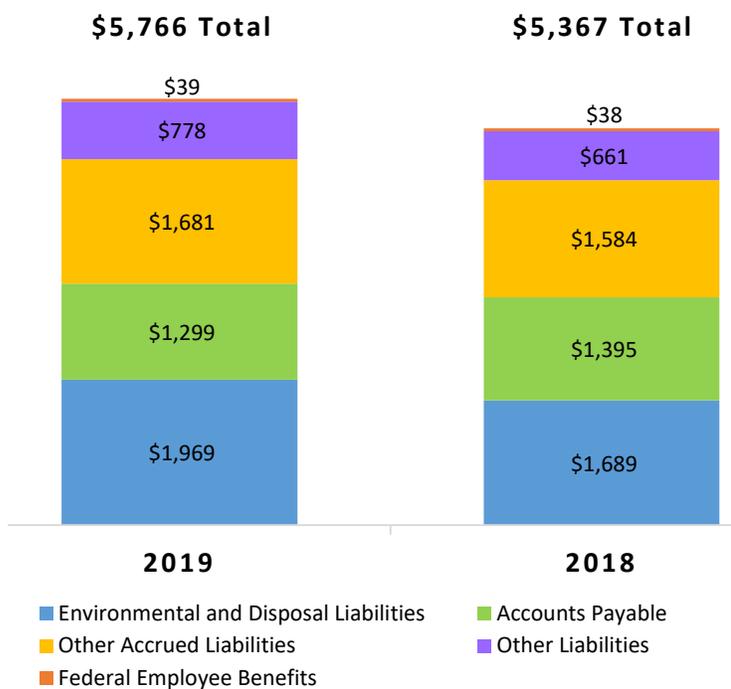
Other Liabilities, which represents various amounts including Advances from Others, Unfunded Annual Leave, and Accrued Funded Payroll, were \$778 million, an increase of \$117 million, or 18 percent, compared to FY 2018. The increase is primarily due to internal advances to NASA's

Working Capital Fund (WCF) for the IT Infrastructure Integration Program (I3P).

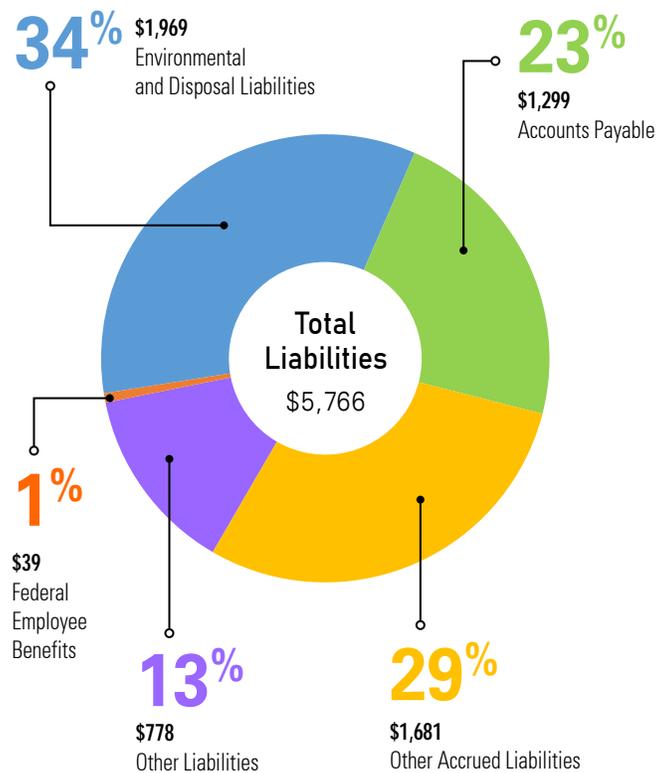
Federal Employee Benefits are amounts the Department of Labor estimates on behalf of NASA for future workers' compensation liabilities for current employees.

**Total Net Position** comprised of Unexpended Appropriations and Cumulative Results of Operations ("net worth"), increased by \$851 million, six percent higher than FY 2018. Unexpended Appropriations, at \$10.5 billion, increased by 14 percent from FY 2018. Cumulative Results of Operations, at \$3.7 billion, decreased by 10 percent from FY 2018. The change to Net Position is due to the increase in budget authority received without a correlating increase in disbursements.

**Liabilities by Type Comparison**  
FY 2019 and FY 2018 (in Millions of Dollars)



**Liabilities by Type for FY 2019**  
(in Millions of Dollars)



◀ The International Space Station Expedition 61 crew pauses for a photo as NASA Astronauts Jessica Meir and Christina Koch prepare to exit the space station to begin the first all female spacewalk in history on Oct. 18, 2019. **Photo Credit: NASA**

## Sources of Funding

The Statement of Budgetary Resources (SBR) 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 2019, the total funds available for use by the Agency were \$26.4 billion - an increase of \$925 million, or four percent, compared to FY 2018.

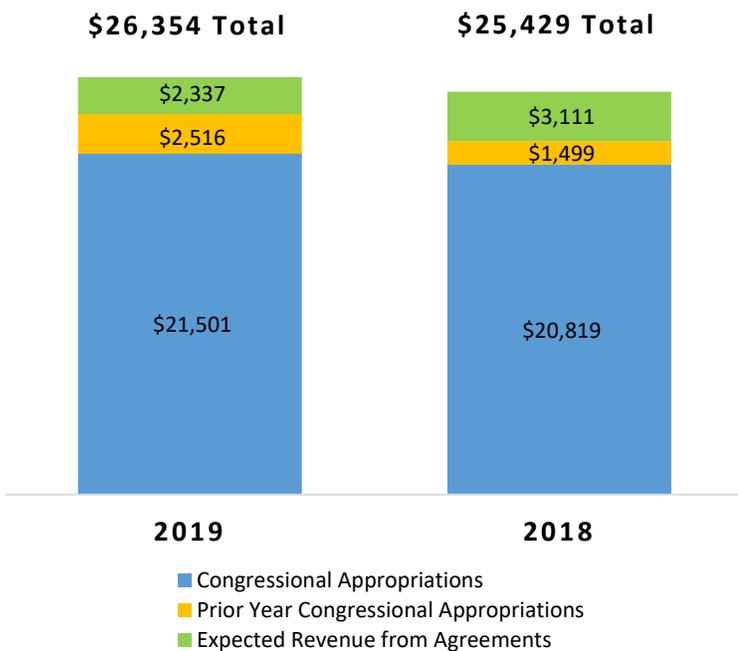
The \$21.5 billion in appropriations from Congress for FY 2019 accounted for 82 percent of the total funds available for use by the Agency. Congress designates the funding available to the Agency for a specific NASA mission. Appropriations that remained available from prior years totaled \$2.5 billion, nine percent of NASA's available resources in FY 2019.

NASA's FY 2019 funding also included \$2.3 billion of spending authority from offsetting collections, primarily

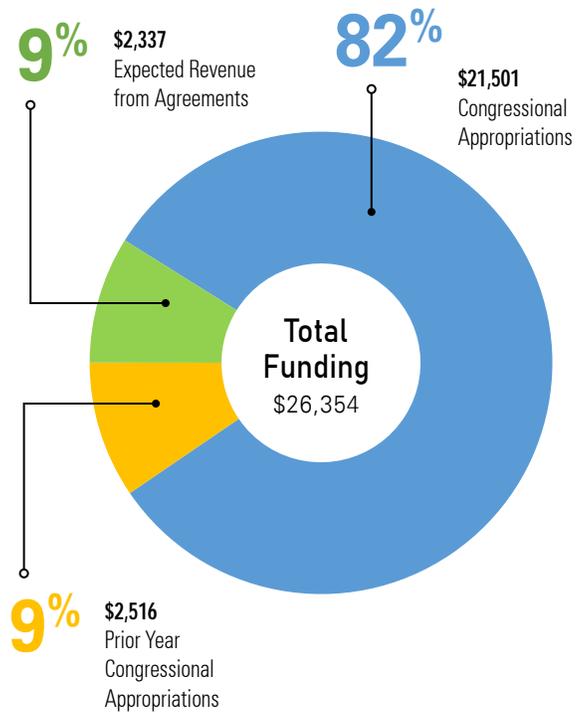
comprised of revenue earned and collected from agreements, nine percent of NASA's available resources in FY 2019. Revenue is earned under NASA's authority to provide goods, services, or use of facilities to other entities on a reimbursable basis.

In FY 2019, NASA obligated \$24 billion of the \$26.4 billion available for Agency programmatic and institutional objectives. An obligation binds the Government 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 \$2.4 billion may be obligated until the funds' periods of availability expire.

**Sources of Funding Comparison**  
FY 2019 and FY 2018 (in Millions of Dollars)



**Sources of Funding for FY 2019**  
(in Millions of Dollars)





The Orion crew module for Artemis 1 is lifted by crane on July 16, 2019, in the high bay inside the Neil Armstrong Operations and Checkout Building high bay at NASA's Kennedy Space Center in Florida. The crew module will be moved to the final assembly and test cell and work will begin to secure it atop the service module. The Orion spacecraft is being prepared for its uncrewed test flight atop NASA's Space Launch System (SLS) rocket. Artemis 1 is the first test flight of the SLS and Orion spacecraft as an integrated system. Orion will travel thousands of miles beyond the Moon during a mission that will test its systems in space. The spacecraft will return to Earth and splashdown in the Pacific Ocean where it will be retrieved and transported back to Kennedy. **Photo Credit: NASA/Ben Smegelsky**

## Results of Operations

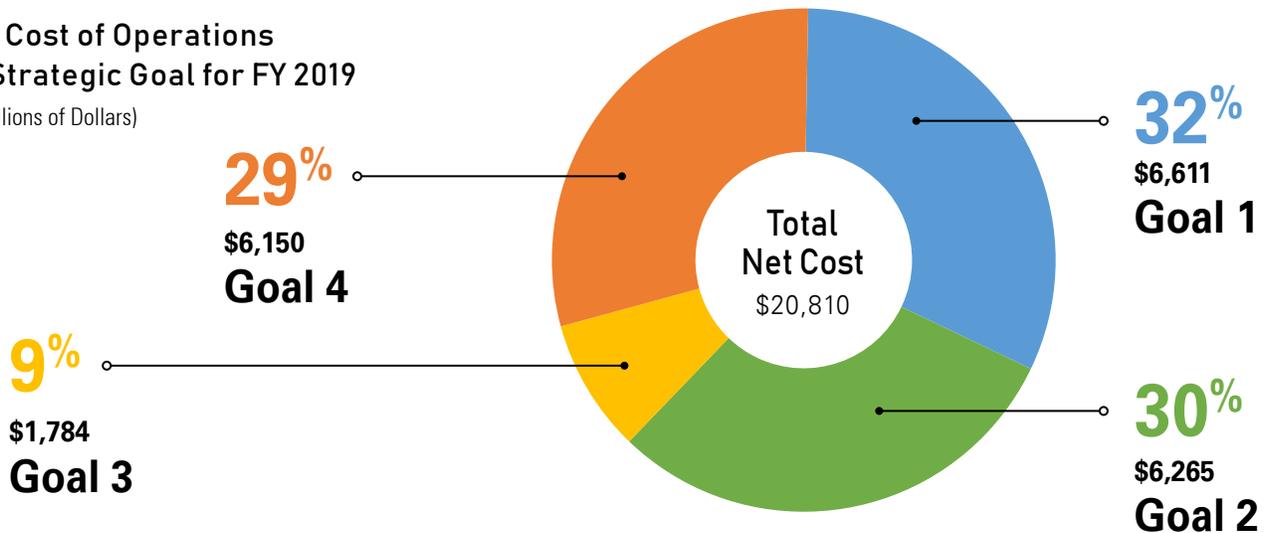
### Net Cost of Operations

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 (page 11). The Net Cost of Operations represents gross cost incurred less revenue earned for work

performed for other government organizations or private entities. As of September 30, 2019, NASA's gross costs were \$22.6 billion, an increase of \$297 million from FY 2018. Earned Revenue from other governmental organizations or private entities was \$1.8 billion, a decrease of \$396 million from FY 2018, leaving NASA with a FY 2019 net cost of \$20.8 billion, an increase of \$693 million from FY 2018.

### Net Cost of Operations by Strategic Goal for FY 2019

(in Millions of Dollars)



- Strategic Goal 1: Expand human knowledge through new scientific discoveries.
- Strategic Goal 2: Extend human presence deeper into space and to the Moon for sustainable long-term exploration and utilization.
- Strategic Goal 3: Address national challenges and catalyze economic growth.
- Strategic Goal 4: Optimize capabilities and operations.

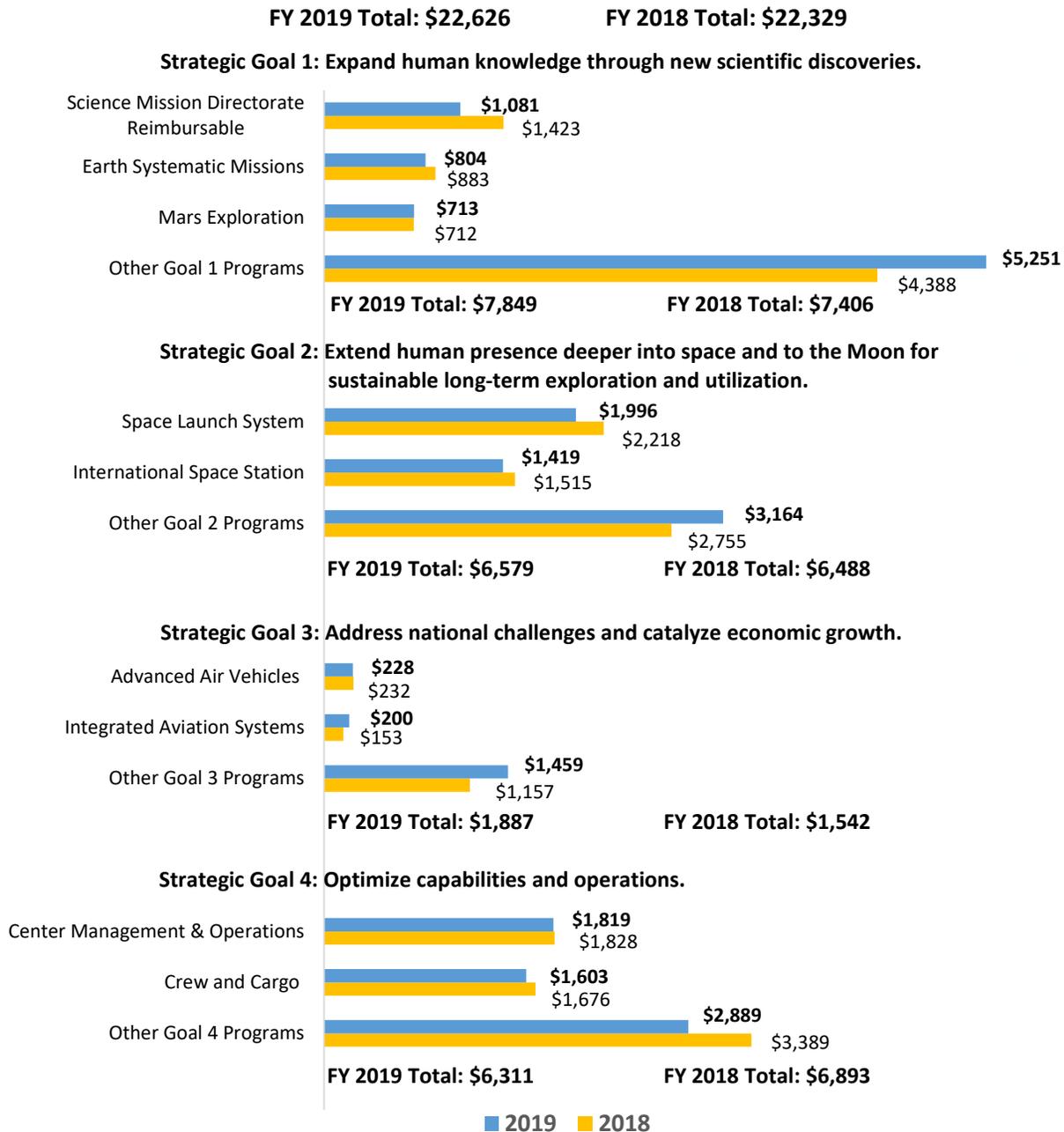
**Gross Costs of Operations**

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 (RSSI) section (page 70) 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 (pages 34-35).

**Comparative Gross Costs of Operations by Strategic Goal FY 2019 and FY 2018**

(in Millions of Dollars)



**STRATEGIC GOAL 1: Expand human knowledge through new scientific discoveries.**

Gross Costs for Strategic Goal 1 were \$7.8 billion, an increase of \$443 million, or six percent from FY 2018 costs. The costs for this strategic goal represent 35 percent of total Agency gross cost. The three primary programs that support this goal were Science Mission Directorate Reimbursable, Earth Systematic Missions, and Mars Exploration, which contributed 33 percent of the total Strategic Goal 1 cost. The primary reimbursable activities are described in the earned revenue discussion on page 35.

- The Science Mission Directorate reimbursable account incurred costs of \$1.1 billion, \$342 million less compared to FY 2018, due to reduced task activities in two Special Reimbursable Projects: JPSS and Geostationary Operational Environmental Satellite-R Series (GOES-R).

- The Earth Systematic Missions program incurred costs of \$804 million, \$79 million less compared to FY 2018. Cost fluctuations in this program are common due to the nature of spacecraft development projects. In the early development stages, year-to-year costs increase as workforce is added and hardware is procured. As the project approaches launch, year-to-year costs decrease as workload and procurements decrease. Projects under this mission and anticipated to launch within the next three years include Landsat 9, NASA-Indian Space Research Organization Synthetic Aperture Radar (NISAR), and Plankton, Aerosol, Cloud, Ocean Ecosystem (PACE). Recently launched missions include Ice, Cloud and land Elevation Satellite-2 (ICESat-2) and the Gravity Recovery and Climate Experiment Follow-On (GRACE FO).
- Mars Exploration continues to make progress towards landing another rover on the surface of Mars. Mars Exploration incurred costs of \$713 million, \$1 million higher compared to FY 2018.



 PLAY VIDEO

**EARTH: A PHOTO E-BOOK FROM NASA**

A photo-essay from NASA's Earth Science Division. Swirling white clouds, deep blue oceans, and multicolored landscapes come to life on the pages of NASA's new photo essay Earth, a collection of dramatic images captured by satellites.



**Producer:** Kathryn Hansen    **Narration:** Michael Carlowicz    **Music:** "Please" by Wayne Jones

To download *Earth* in PDF, MOBI (Kindle), or ePub formats. Purchase a hardcover copy visit:

<https://earthobservatory.nasa.gov/features/earth-book-2019>

- Other NASA programs that contribute to Strategic Goal 1 include Outer Planets, Earth Science Research, Discovery, and the James Webb Space Telescope.

### **STRATEGIC GOAL 2: Extend human presence deeper into space and to the Moon for sustainable long-term exploration and utilization.**

Gross Costs for Strategic Goal 2 were \$6.6 billion, an increase of \$91 million, or one percent over FY 2018 costs. The costs for this strategic goal represent 29 percent of total Agency gross cost. Over half of the costs incurred for Strategic Goal 2 are in support of the Space Launch System (SLS) and International Space Station (ISS) programs.

- The SLS program had costs of \$2 billion, \$222 million less compared to FY 2018. Cost fluctuations are expected in large developmental programs. SLS costs are mainly associated with the complex delivery and integration of the SLS core stage, Launch Vehicle Stage Adapter, Orion Stage Adapter, avionics and flight software, and motor segments. These elements included both flight articles as well as structural test articles. Additionally, funds were expended for Exploration Upper Stage development that was initiated in FY 2016, and continued into FY 2017 and FY 2018 as enacted by Congress. SLS cost fluctuations were caused by putting exploration upper stage work on hold to reevaluate content. Additionally, ramp up of the second set of flight articles is slower than expected, as the launch date uncertainty introduced some caution into the system.
- The ISS program had cost of \$1.4 billion, \$96 million less compared to FY 2018. This cost reduction represents Habitation Systems work transferring from the ISS program to the Advanced Exploration Systems (AES) program in FY 2019, and several smaller activities nearing or at completion in FY 2019.
- The increase in Strategic Goal 2 costs is primarily attributable to the Orion and Lunar Gateway programs, with a combined increase of \$279 million. Both programs are integral to the Moon to Mars Mission.

### **STRATEGIC GOAL 3: Address national challenges and catalyze economic growth.**

Gross Costs for Strategic Goal 3 were \$1.9 billion, an increase of \$345 million, or 22 percent from FY 2018 costs. The costs for this strategic goal represent eight percent of total Agency gross cost. The largest NASA programs supporting Strategic Goal 3 were the Advanced Air Vehicles and the Integrated Aviation Systems programs, which contributed 23 percent of total Strategic Goal 3 cost.

- The Advanced Air Vehicles Program (AAVP) had costs of \$228 million, \$4 million less compared to FY 2018. AAVP studies, evaluates and develops technologies and capabilities for new aircraft systems, and also explores far-future concepts that hold promise for revolutionary air-travel improvements.

- The Integrated Aviation Systems Program incurred costs of \$200 million, \$47 million higher compared to FY 2018. The Low-Boom Flight Demonstrator Project is in its initial phase and FY 2019 was the first full year of costing, thus the increase over FY 2018.

- Other NASA programs that contribute to Strategic Goal 3 include Technology Demonstration, Small Business Innovation Research, and Space Technology Research & Development programs.

### **STRATEGIC GOAL 4: Optimize capabilities and operations.**

Gross Costs for Strategic Goal 4 were \$6.3 billion, a decrease of \$582 million, or eight percent from FY 2018 costs. The costs for this strategic goal represent 28 percent of total Agency gross cost. The largest NASA programs supporting Strategic Goal 4 were Center Management and Operations, and Crew and Cargo Program, which contributed to nearly half of the cost of Strategic Goal 4.

- The Crew & Cargo Program had costs of \$1.6 billion, \$73 million less compared to FY 2018. These costs are primarily due to development efforts with commercial crew providers ramping up in preparation for their first Post Certification Missions planned for FY 2019. Additionally, development efforts also continue to ramp up with the new Commercial Resupply Services Phase 2 (CRS2) contractor, Sierra Nevada, in preparation for their first flight planned for FY 2020.

### **Earned Revenue**

Total earned revenue was \$1.8 billion, a decrease of \$396 million compared to FY 2018. Earned revenue primarily represented two programs - JPSS and Geostationary Operational Environmental Satellite (GOES). NASA supported both programs in partnership with the National Oceanic and Atmospheric Administration (NOAA).

- JPSS is the nation's advanced series of polar-orbiting environmental satellites. NASA supported various initiatives through FY 2019 in preparation for the JPSS-2 spacecraft scheduled to launch in 2022.
- GOES is the nation's most advanced fleet of geostationary weather satellites. NASA supported initiatives in preparation for the GOES-T planned to launch in 2021.

## 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 state-

ments 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.



### MISSION CONTROL CENTER RESTORATION

On July 20, 1969 the Apollo Mission Control Center at Johnson Space Center landed men on the Moon with only seconds of fuel left. Today, you can see the Mission Control Center, which has been restored to its Apollo-era appearance, forever preserving this National Historic Landmark. From the artifacts sitting on the consoles to the displays projected at the front of the room, every detail has been carefully put in its proper place, including ashtrays, pipes, cigarettes, and coffee mugs. Even the binders in the room are filled with authentic documents that would've been used during the Apollo missions. **Photo Credits: NASA**

To view a time-lapse of the restoration, visit:

[https://images.nasa.gov/details-jsc2019m00562\\_HistoricMCC\\_Timelapse\\_1.html](https://images.nasa.gov/details-jsc2019m00562_HistoricMCC_Timelapse_1.html).



“This is a place where history was made. The books were written here. The challenges were issued. The accepted risk is the price of progress. At time we went too far, too fast. We lost a crew. But we picked up the ball and continued to run forward, even stronger than we were the day we lost the Apollo 1 crew.”

- GENE KRANZ Retired Apollo Flight Commander



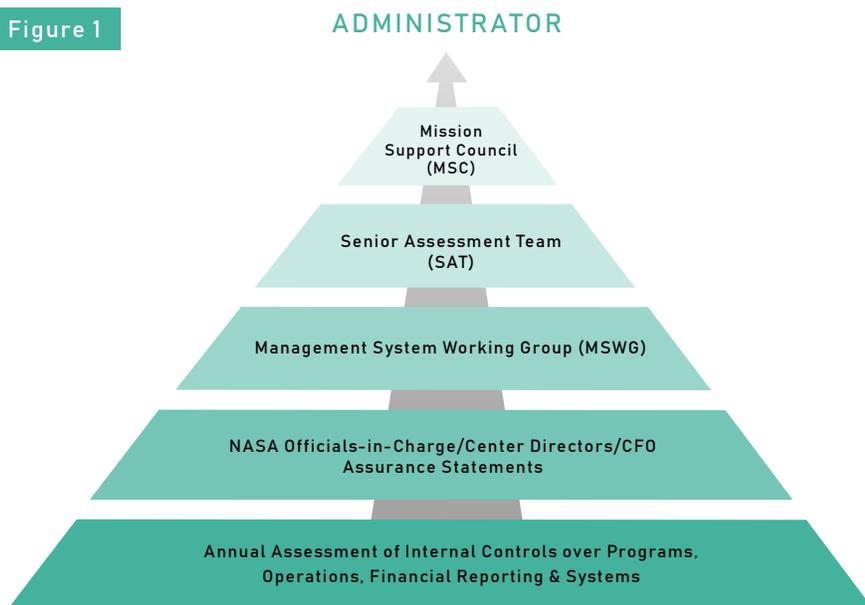
# SYSTEMS, CONTROLS, AND LEGAL COMPLIANCE



This artist concept shows the Block 2 130-metric-ton-configuration (143 tons) of NASA's Space Launch System (SLS) before launch. This future version of the SLS will be the largest launch vehicle ever built and more powerful than the Saturn V rocket that carried Apollo astronauts to the moon. This rocket will lift more than 286,000 pounds and provide 20 percent more thrust than the Saturn V. The first SLS mission — Exploration Mission 1 — in 2018 launched an uncrewed Orion spacecraft to demonstrate the integrated system performance of the SLS rocket and spacecraft prior to a crewed flight. **Photo Credit: NASA/MSFC**

## INTERNAL CONTROL FRAMEWORK

Figure 1



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**<sup>c</sup>). 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. Figure 1 depicts the Agency’s Annual Statement of Assurance process and organizational players.

### NASA FMFIA Annual Statement of Assurance Process

The *Federal Managers’ Financial Integrity Act (FMFIA)*<sup>a</sup> 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 complies with *OMB Circular No. A-123*<sup>b</sup>, *Management’s Responsibility for Enterprise Risk Management and Internal Control*,

which provides Government-wide requirements for internal control and accountability, based on the FMFIA. 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 evaluated. NASA assesses 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

<sup>a</sup> The Federal Managers’ Financial Integrity Act (FMFIA) [https://obamawhitehouse.archives.gov/omb/financial\\_fmfi1982](https://obamawhitehouse.archives.gov/omb/financial_fmfi1982)

<sup>b</sup> 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>

<sup>c</sup> Green Book <https://www.gao.gov/assets/670/665712.pdf>

## ENTERPRISE RISK MANAGEMENT

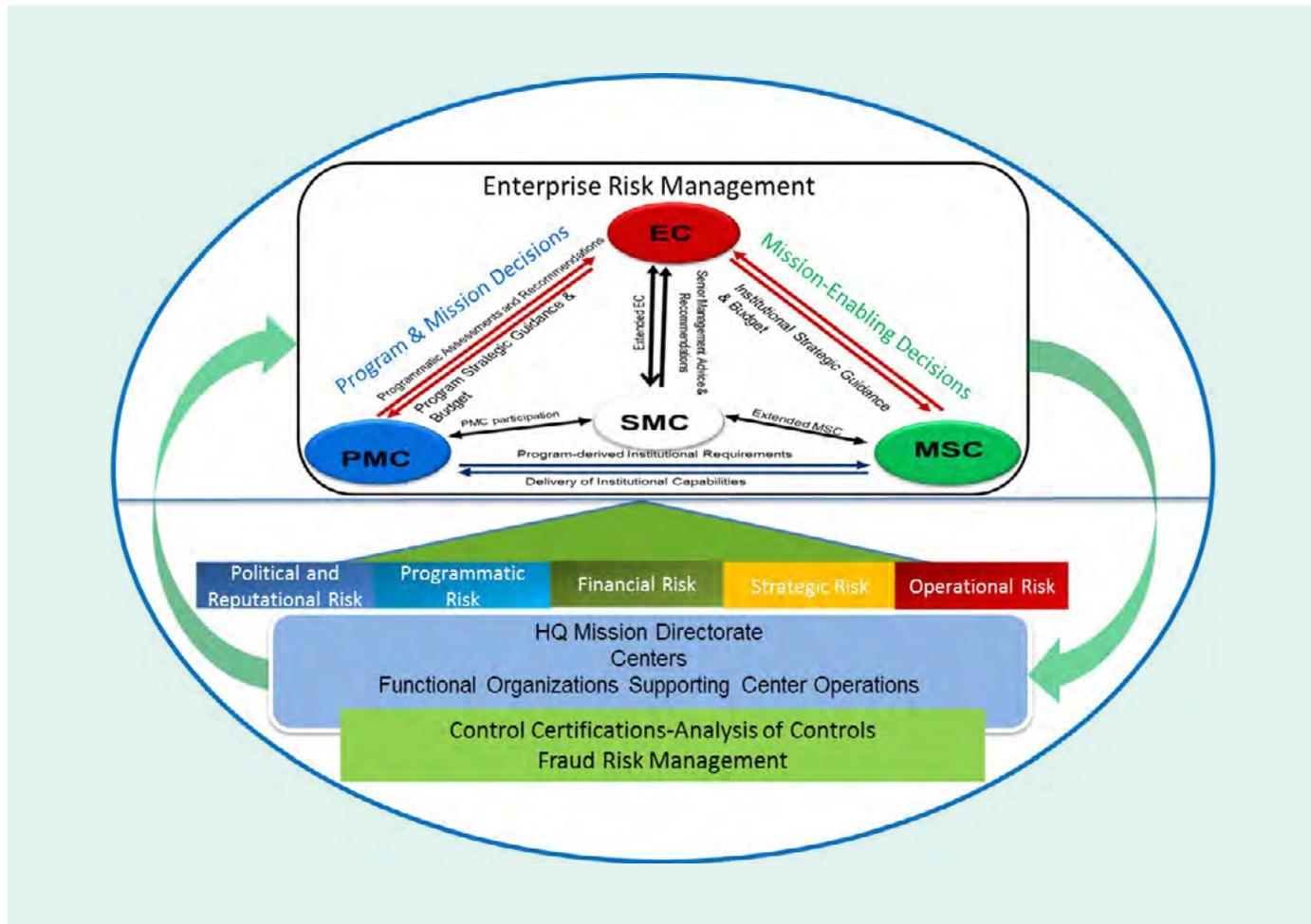
OMB Circular No. A-123, *Management's Responsibility for Enterprise Risk Management and Internal Control*, requires federal agencies to implement Enterprise Risk Management (ERM) to ensure federal managers are effectively managing risks that could affect the achievement of agency strategic objectives.

Risk management is embedded in NASA's culture, and the principles and practices are inherent in our daily operations. NASA's Office of the Chief Financial Officer, Quality Assurance Division (QAD) leads the Agency's ERM effort. The NASA Unified Comprehensive Operational Risk Network (UNICORN), is the framework for the communication and exchange of risk information between NASA's functional organizations and the Agency leadership. The UNICORN's foundation is the Agency's risk management activities and decisional councils.

**UNIFIED**  
**COMPREHENSIVE**  
**OPERATIONAL**  
**RISK**  
**NETWORK**

Figure 2

## UNICORN (ERM) IN ACTION

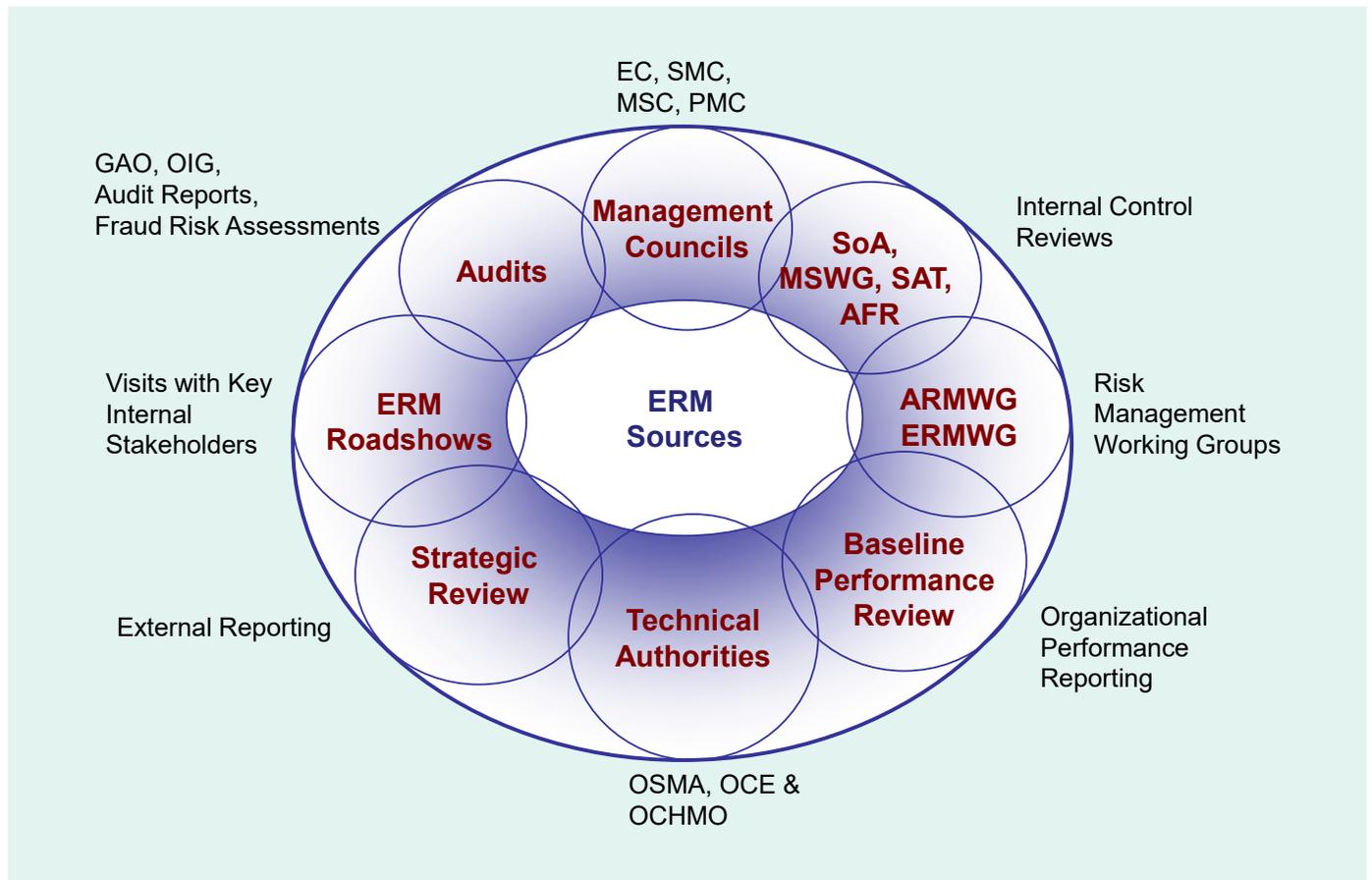


In FY 2019, NASA continued to mature in the implementation and development of its ERM processes. During FY 2019, the NASA Enterprise Risk Management Working Group (ERMWG) was established to identify enterprise-level risks and collaborate with organizations to address the identified enterprise risks. It is through this body, which is comprised of representatives from several stakeholder organizations, that enterprise-level risks are proposed for consideration and integration into the Agency Risk Profile. The Chair of the ERMWG reports on the status of ERM activities to NASA's Associate Administrator on a quarterly basis, and presents the Agency Risk Profile to the Agency Program Management Council, chaired by the Associate Administrator, annually for approval.

NASA leverages a variety of sources (see Figure 2) to identify potential enterprise risks, and relies upon the Agency governance structure of decisional councils as well as other bodies such as the Agency Risk Management Working Group (ARMWG) and Management Systems Working Group (MSWG) to facilitate the integration of risks across the Agency for appropriate consideration at the enterprise level. The ARMWG is distinct from the ERMWG in that it covers the spectrum of risk management activities at the institutional, program, and project level versus the ERMWG focus on integrating risks at the enterprise level. NASA strives to foster communication of risks and data between employees at all levels within the Agency to allow decision-makers to effectively evaluate and act upon risks and opportunities.

Figure 3

## ENTERPRISE RISK MANAGEMENT (ERM) SOURCES



### ACRONYMS

- |   |   |                                       |
|---|---|---------------------------------------|
| <b>ARMWG</b> Agency Risk Management Working Group     | <b>MSWG</b> Management System Working Group               | <b>PMC</b> Program Management Council |
| <b>EC</b> Executive Council                           | <b>OCE</b> Office of the Chief Engineer                   | <b>SAT</b> Senior Assessment Team     |
| <b>ERMWG</b> Enterprise Risk Management Working Group | <b>OCHMO</b> Office of the Chief Health & Medical Officer | <b>SMC</b> Senior Management Council  |
| <b>MSC</b> Mission Support Council                    | <b>OSMA</b> Office of Safety & Mission Assurance          | <b>SoA</b> Statement of Assurance     |

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## MANAGEMENT ASSURANCES

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### Administrator's Statement of Assurance

November 15, 2019

National Aeronautics and Space Administration (NASA) management is responsible for establishing and maintaining an effective system of internal control that meets the objectives of the Federal Managers' Financial Integrity Act (FMFIA) and Federal Financial Management Improvement Act (FFMIA) in accordance with the Government Accountability Office's *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 Office of Management and Budget (OMB) Circular A-123, *Management's Responsibility for Enterprise Risk Management and Internal Control* and NASA requirements. In accordance with GAO and OMB requirements to integrate Enterprise Risk Management (ERM) and internal control in Federal agencies, NASA reports annually on ERM 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.

In addition, NASA relies on FMFIA requirements and OMB guidance to elevate and assure the reliability of its internal controls over its financial management systems as well as Digital Accountability and Transparency Act of 2014 (DATA Act) submissions.

NASA conducted its fiscal year (FY) 2019 annual assessment of the effectiveness of management's internal controls to support reliable financial reporting, effective and efficient programmatic 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, 2019, was operating effectively and no material weaknesses were found in the design or implementation of internal controls.

NASA also conducted its evaluation of financial management systems for compliance with FFMIA in accordance with Appendix D of OMB Circular A-123, Federal Accounting Standards, and the United States Government Standard General Ledger at the transactional level. All NASA financial management systems substantially comply with FFMIA as of September 30, 2019.

In conclusion, NASA makes an unmodified statement of assurance that its internal controls for FY 2019 were operating effectively. NASA remains committed to ensuring a sound system of internal control exists over operations, reporting, and financial management systems.

Sincerely,

A handwritten signature in black ink that reads "Jim Bridenstine".

James F. Bridenstine  
Administrator

## 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 continue to strengthen an analytical, trusting, and mutually dependent CFO community that boosts its people and supports the Agency's mission. This alignment is accomplished by utilizing a standard software development model with release planning and providing oversight for implementing 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 optimized for changing policies, standards, OMB requirements, and internal assessments to ensure sound internal and system controls. As a result of NASA's efforts to optimize and continually enhance financial and budgetary system capabilities and operations, the Agency has maintained an unmodified audit opinion on financial statements for the last eight years, as well as 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 eBudget suite of tools. The CF system has served as NASA's financial accounting system of record since 2003, and the eBudget suite has supported budget formulation and Congressional justification since 2007.

NASA integrated a contract writing module, Procurement for Public Sector (PPS), as part of the SAP application, which further enhances NASA's ability to achieve its financial management and budget objectives. PPS provides improved efficiency through seamless integration with contracting, contract writing, data management, and procurement workload management. Transactions within the integrated modules and interfaces are recorded in real-time. The CF system is supported by commercial off-the-shelf (COTS) software, NASA developed applications, and interfaces with systems managed by other Federal agencies. NASA's goal is to modernize the information technology (IT) infrastructure, application capabilities and services to meet federal requirements, evolving stakeholder needs and support mission success.

NASA is utilizing the Treasury Invoice Processing Platform to meet OMB's directive M-15-19, Improving Government Efficiency and Saving Taxpayer Dollars Through Electronic Invoicing. Treasury's platform is a web-based system that provides one integrated, secure system to simplify the management of vendor invoices from purchase order (PO) through payment notification, at no charge to federal agen-

cies and their vendors. This expansion includes improved accounts payable business processes, a single Agency-wide electronic solution, and significantly reduced manual invoice data entry. NASA successfully met the FY 2018 target to implement expanded eInvoicing.

Additionally, NASA inventoried all stand-alone Center and enterprise-wide systems and applications and tools and categorized into separate portfolios by function. The objective was to obtain commonalities about stand-alone financial applications and systems so their capabilities could be leveraged to enhance business and management practices at the enterprise-level. This continuing initiative seeks to reduce duplicate systems and applications, improve efficiencies, and provide cost savings to the Agency.



NASA is using robots to mimic humans in order to gain efficiency in space related missions. These robots - referred to as humanoids – lend a hand by replicating tasks with movements similar to humans utilizing cameras and sensors. Using humanoids to perform tests in harsh conditions, such as extreme temperatures or high levels of radiation, help prepare for future settlement on Mars while reducing risks to humans.

NASA is realizing that same efficiency on Earth. In 2018, NASA began implementing a capability known as Intelligent Automation. NASA's Intelligent Automation Services (IAS) Team is utilizing Robotic Process Automation (RPA) —commonly referred to as “bots”—to standardize and processes repetitive tasks. Like humanoid robots, RPA software mimics human interaction with computers to automate processes with rules-based and formula-driven instructions without compromising underlying IT infrastructure.

The implementation of RPA supports NASA's mission of providing timely, accurate, high-quality, and customer-focused support spanning the areas of financial management, procurement, human resources, enterprise services, and agency business services. Intelligent automation such as bots help shift NASA's workload from the mundane to more complex and cognitively challenging higher-value tasks. **Photo Credit: NASA**



## LOOKING FORWARD



The pilot of NASA's X-59 Quiet SuperSonic Technology, or QueSST, aircraft will navigate the skies in a cockpit unlike any other. There won't be a forward-facing window. That's right; it's actually a 4K monitor that serves as the central window and allows the pilot to safely see traffic in his or her flight path, and provides additional visual aids for airport approaches, landings and takeoffs. The 4K monitor, which is part of the aircraft's eXternal Visibility System, or XVS, displays stitched images from two cameras outside the aircraft combined with terrain data from an advanced computing system. The two portals and traditional canopy are real windows however, and help the pilot see the horizon. The displays below the XVS will provide a variety of aircraft systems and trajectory data for the pilot to safely fly. **Photo Credit: NASA**

# LOOKING FORWARD ▶▶▶

NASA is heading back to the Moon but instead of one step, we are hoping for a much longer stay. The Apollo mission landed the first humans on the moon in 1969, but since the final Apollo mission in 1972, lunar exploration by humans has been on hold.

In 2019, after 50 years, NASA announced its plan to return to the moon by sending the first woman and returning a man to the Moon's South Pole by 2024. Through partnerships both domestic and international, NASA will bring innovation and new approaches to the advancement of our human spaceflight goals and enhance the economic development of space. The Lunar program is named "Artemis," after the Greek goddess of the Moon, and Apollo's twin sister.

Artemis will enable a mission to the Moon and other deep space missions. Artemis will include: (1) an Orion spacecraft, which will carry astronauts beyond the Earth; (2) Space Launch System (SLS), the most powerful rocket in the world; (3) Exploration Ground System (EGS), a network of Earth based structures required for launch; (4) Gateway, a lunar outpost around the Moon; (5) Lunar Landers, which will take astronauts to the surface of the Moon; (6) Commercial Launch Vehicles, which will launch the Gateway, Landers, and Logistics to the Moon; (7) Artemis Generation Spacesuits, Surface suits designed for a broad range of movement in space and on the surface of the Moon.

▶▶▶ The Orion spacecraft is built to carry crew members beyond low-Earth orbit, and is composed of three major parts: a crew module, where astronauts live and work; a launch abort system or LAS, to separate the spacecraft from the rocket if an accident occurs during launch; and a service module, which is essential to the crew as it provides life support and energy, in addition to the spacecraft's propulsion system. Ensuring the functionality of each of these components is crucial for the survival of the astronauts.

▶▶▶ The Orion capsule will hitch a ride on the SLS, NASA's next flagship exploration rocket. The SLS is designed to carry Orion into deep space, with missions to the Moon and Mars. With the Artemis 1 mission, the rocket will take its first test, making the first integrated flight with Orion and the SLS. The rocket will have enough power to carry astronauts beyond Earth's orbit and into deep space.

▶▶▶ EGS activities will allow NASA to integrate the rocket with the Orion capsule in the Vehicle Assembly Building (VAB) at Kennedy Space Center using a co-developed Design Center concept. The Program is preparing the infrastructure to support several different kinds of spacecraft and rockets that are in development, including SLS and Orion. Upon completion, the Kennedy Space Center launch site will be able to provide a more flexible, affordable, and responsive national launch capability compared to prior approaches.

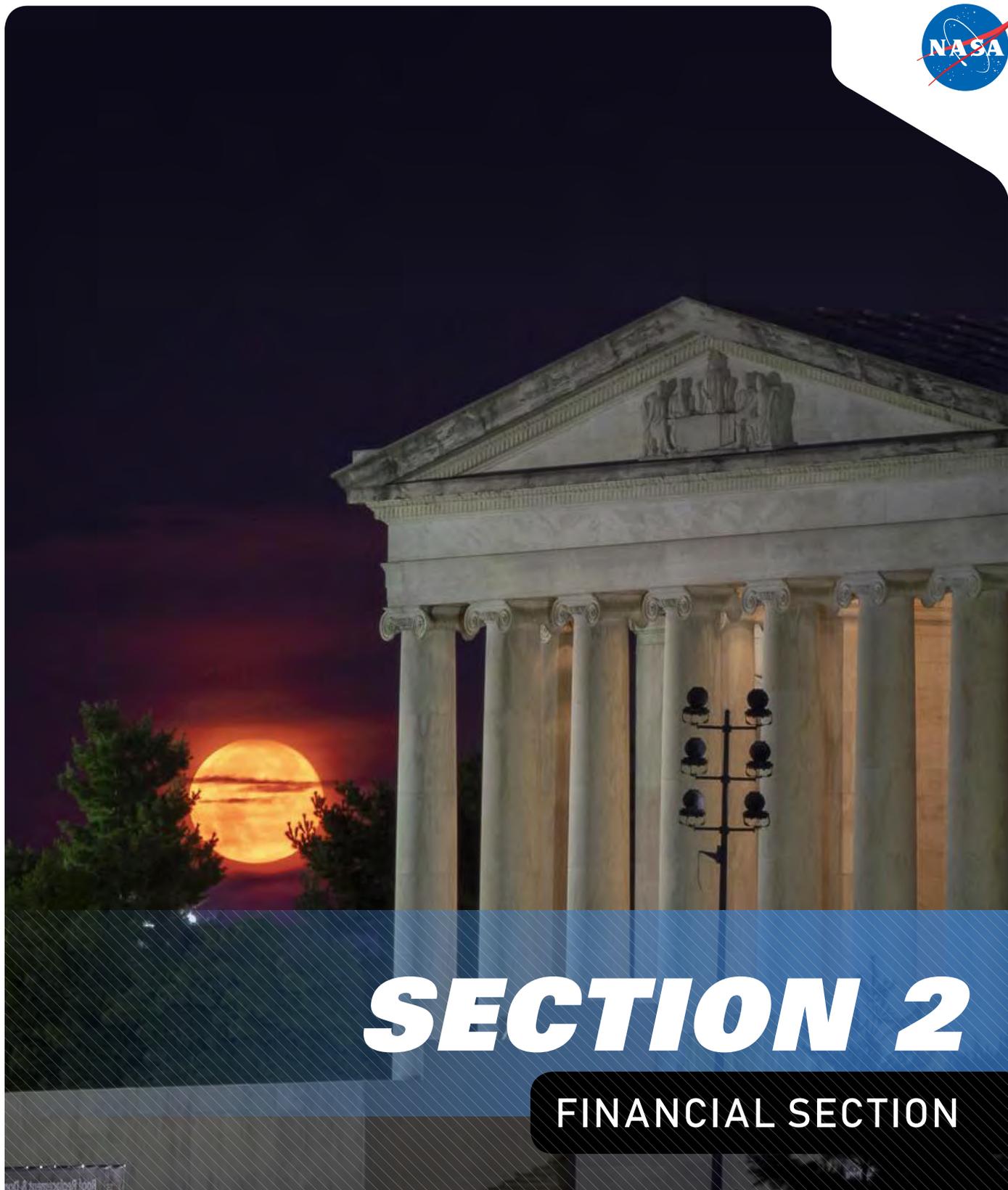
▶▶▶ Another important piece is Gateway, an element to facilitate landing astronauts on the lunar surface. Located roughly 250,000 miles away from Earth, the Gateway will be a small platform that orbits the Moon, allowing for the Orion spacecraft to dock, and serving as a base for astronauts to conduct scientific experiments, expeditions, and get accustomed to living in deep space. Crew members will visit the Gateway once a year. The Gateway will be launched on commercial rockets and, is planned to be completed in 2024.

▶▶▶ In order to visit the lunar surface, astronauts will take a lunar landing system down to the surface, and NASA is looking to the commercial sector to fulfill this need. NASA is currently seeking proposals for human lunar landing systems designed and developed by American companies for the Artemis program.

▶▶▶ Finally, the new spacesuits that will be worn on Artemis missions are called the Exploration Extravehicular Mobility Unit (xEMU). The xEMU suit improves on those previously worn on the Moon during the Apollo era and those currently in use for spacewalks outside the International Space Station, and will be worn by the first woman and next man as they explore the Moon. Additionally, the Orion suit, to be worn during flight, is designed for a custom fit and incorporates safety technology and mobility features that will help protect astronauts on launch day, in emergency situations, during high-risk parts of missions near the Moon, and during the high-speed return and re-entry to Earth.

The unmanned test mission, known as Artemis 1, is expected to launch before 2021, and should last three weeks. The first manned mission, Artemis 2 will launch in 2022, orbiting our lunar neighbor before returning to Earth. But it's in 2024 that NASA will finally revisit the lunar surface for the first time in over 50 years. In fact, Artemis 3 will deliver pioneering astronauts to the Moon's South Pole for the very first time.

The Artemis program is not just important for the lunar exploration. Preparing for life on the Gateway will allow for more studies on how the human body responds to life in deep space and provide more opportunities for exploration. Long-term, the Artemis program hopes to establish a long-term lunar presence by 2028, an essential period for validating systems and operations before undertaking a manned mission to Mars. Going to the Moon and on to Mars will be the shining moment of our generation. This moment will belong to you – the Artemis generation.



# ***SECTION 2***

## **FINANCIAL SECTION**

The Moon sets behind the Jefferson Memorial in Washington 50 years to the day after astronauts Neil Armstrong, Michael Collins, and Buzz Aldrin launched on Apollo 11, the first mission to land astronauts on the Moon, Tuesday, July 16, 2019. **Photo Credit: NASA/Bill Ingalls**



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## 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).



### Consolidated Balance Sheets

provide 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 Statements of Changes in Net Position

report 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.



### Consolidated Statements of Net Cost

report 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 the cost to taxpayers for achieving each strategic goal and Agency Mission at the entity level.



### Combined Statements of Budgetary Resources

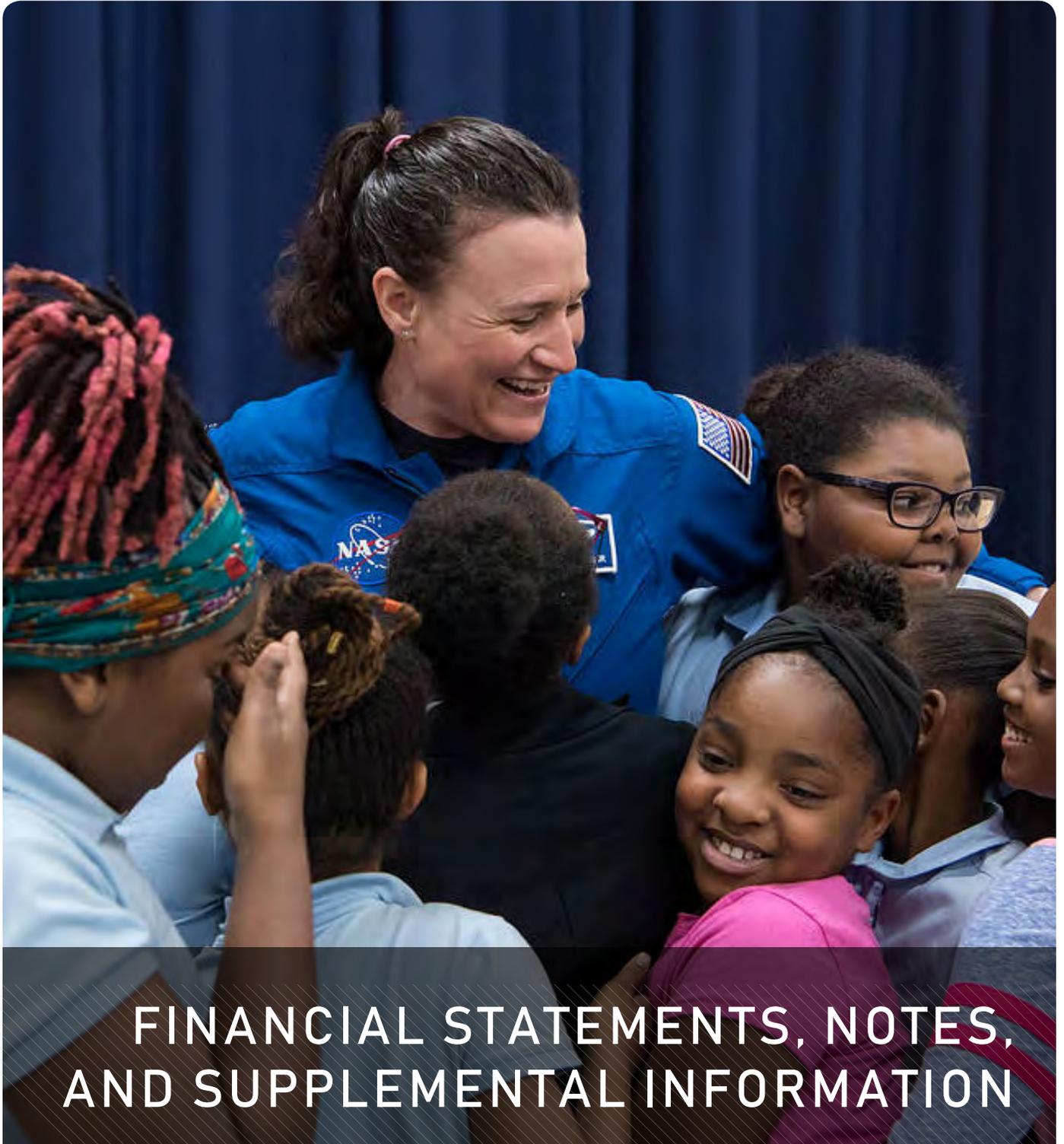
report information on the sources and status of budgetary resources for the reporting period. Information in this statement is reported on the budgetary basis of accounting, which supports compliance with budgetary controls and controlling legislation.



# DID YOU KNOW

## SEND YOUR NAME TO MARS WITH BRAD PITT

September 30, 2019 marked the final boarding call to stow your name on NASA's Mars 2020 Rover before it launches to the Red Planet. Over nine million people entered the NASA's "Send Your Name to Mars" campaign, including actor Brad Pitt (right) photographed with Jennifer Trospen (left), the Mars 2020 project systems engineer. Their names will be stenciled on a chip that will be affixed to the Mars 2020 rover. This rover is scheduled to launch as early as July 2020 and expected to touch down on Mars in February 2021. It represents the initial leg of humanity's first planned round trip to another planet. **Photo Credit: NASA**



## FINANCIAL STATEMENTS, NOTES, AND SUPPLEMENTAL INFORMATION



NASA astronaut Dr. Serena Auñón-Chancellor is hugged by students after a presentation about her experience on Expeditions 56 and 57 onboard the International Space Station (ISS) at Excel Academy Public Charter School, Monday, June 10, 2019 in Washington, DC. Auñón-Chancellor spent 197 days living and working onboard the ISS and contributed to hundreds of experiments in biology, biotechnology, physical science, and Earth science while there. She is also a doctor and started her career with NASA as a flight surgeon in 2006. **Photo Credit: NASA/Aubrey Gemignani**

**National Aeronautics and Space Administration**  
**Consolidated Balance Sheets**  
**As of September 30, 2019 and 2018**  
*(In Millions of Dollars)*

	2019	2018
<b>Assets:</b>		
Intragovernmental:		
Fund Balance with Treasury (Note 2)	\$ 13,847	\$ 12,551
Investments (Note 3)	16	17
Accounts Receivable (Note 4)	139	109
Total Intragovernmental	<u>14,002</u>	<u>12,677</u>
Accounts Receivable, Net (Note 4)	1	1
General Property, Plant and Equipment, Net (Note 5)	6,008	6,086
Other Assets (Note 7)	5	2
<b>Total Assets</b>	<b><u>\$ 20,016</u></b>	<b><u>\$ 18,766</u></b>
<b>Stewardship PP&amp;E (Note 6)</b>		
<b>Liabilities (Note 8):</b>		
Intragovernmental:		
Accounts Payable	\$ 48	\$ 61
Other Liabilities (Note 10)	205	160
Total Intragovernmental	<u>253</u>	<u>221</u>
Accounts Payable	1,251	1,334
Federal Employee Benefits (Note 8)	39	38
Environmental and Disposal Liabilities (Note 9)	1,969	1,689
Other Accrued Liabilities (Note 10)	1,681	1,584
Other Liabilities (Note 10)	573	501
<b>Total Liabilities</b>	<b><u>5,766</u></b>	<b><u>5,367</u></b>
<b>Commitments and Contingencies (Note 11)</b>		
<b>Net Position:</b>		
Unexpended Appropriations	10,542	9,285
Cumulative Results of Operations	3,708	4,114
<b>Total Net Position</b>	<b><u>14,250</u></b>	<b><u>13,399</u></b>
<b>Total Liabilities and Net Position</b>	<b><u>\$ 20,016</u></b>	<b><u>\$ 18,766</u></b>

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

**National Aeronautics and Space Administration**  
**Consolidated Statements of Net Cost**  
**For the Fiscal Years Ended September 30, 2019 and 2018**

*(In Millions of Dollars)*

	2019	2018
<b>Strategic Goal 1 – Expand human knowledge through new scientific discoveries:</b>		
Gross Costs	\$ 7,849	\$ 7,406
Less: Earned Revenue	1,238	1,608
Net Cost	<u>6,611</u>	<u>5,798</u>
<b>Strategic Goal 2 – Extend human presence deeper into space and to the Moon for sustainable long-term exploration and utilization:</b>		
Gross Costs	\$ 6,579	\$ 6,488
Less: Earned Revenue	314	378
Net Cost	<u>6,265</u>	<u>6,110</u>
<b>Strategic Goal 3 – Address national challenges and catalyze economic growth:</b>		
Gross Costs	\$ 1,887	\$ 1,542
Less: Earned Revenue	103	99
Net Cost	<u>1,784</u>	<u>1,443</u>
<b>Strategic Goal 4 - Optimize capabilities and operations:</b>		
Gross Costs	\$ 6,311	\$ 6,893
Less: Earned Revenue	161	127
Net Cost	<u>6,150</u>	<u>6,766</u>
<b>Net Cost of Operations</b>		
Total Gross Costs	\$ 22,626	\$ 22,329
Less: Total Earned Revenue	<u>1,816</u>	<u>2,212</u>
<b>Net Cost</b>	<b><u>\$ 20,810</u></b>	<b><u>\$ 20,117</u></b>

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

**National Aeronautics and Space Administration**  
**Consolidated Statements of Changes in Net Position**  
**For the Fiscal Years Ended September 30, 2019 and 2018**  
*(In Millions of Dollars)*

	2019	2018
<b>Unexpended Appropriations:</b>		
Beginning Balance	\$ 9,285	\$ 8,428
<b>Budgetary Financing Sources:</b>		
Appropriations received	21,500	20,818
Other Adjustments	(24)	(48)
Appropriations used	(20,219)	(19,913)
Total Budgetary Financing Sources	1,257	857
<b>Total Unexpended Appropriations</b>	<b>\$ 10,542</b>	<b>\$ 9,285</b>
<b>Cumulative Results of Operations:</b>		
Beginning Balance	\$ 4,114	\$ 4,175
<b>Budgetary Financing Sources:</b>		
Appropriations used	20,219	19,913
Nonexchange revenue	4	6
<b>Other Financing Sources:</b>		
Donations and forfeitures of property	2	1
Transfers in/out without reimbursement	—	(9)
Imputed financing	183	150
Other	(4)	(5)
Total financing sources	20,404	20,056
Net cost of operations	(20,810)	(20,117)
Net change	(406)	(61)
<b>Cumulative Results of Operations</b>	<b>\$ 3,708</b>	<b>\$ 4,114</b>
<b>Net Position</b>	<b>\$ 14,250</b>	<b>\$ 13,399</b>

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

**National Aeronautics and Space Administration**  
**Combined Statements of Budgetary Resources**  
**For the Fiscal Years Ended September 30, 2019 and 2018**

*(In Millions of Dollars)*

	2019	2018
<b>Budgetary Resources:</b>		
Unobligated balance from prior year budget authority, net	\$ 2,516	\$ 1,499
Appropriations	21,501	20,819
Spending authority from offsetting collections	2,337	3,111
<b>Total budgetary resources</b>	<b>\$ 26,354</b>	<b>\$ 25,429</b>
<b>Status of budgetary resources:</b>		
New obligations and upward adjustments (total)	\$ 23,971	\$ 23,375
Unobligated balance, end of year:		
Apportioned, unexpired accounts	2,270	1,906
Unapportioned, unexpired accounts	8	38
Unexpired unobligated balance, end of year	2,278	1,944
Expired unobligated balance, end of year	105	110
Unobligated balance, end of year (total)	2,383	2,054
<b>Total status of budgetary resources</b>	<b>\$ 26,354</b>	<b>\$ 25,429</b>
<b>Outlays, net:</b>		
Outlays, net (total)	\$ 20,182	\$ 19,759
Distributed offsetting receipts (-)	(3)	(5)
<b>Agency outlays, net</b>	<b>\$ 20,179</b>	<b>\$ 19,754</b>

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 Senior Management Council, Executive Council, Mission Support Council, Agency Program Management Council, Acquisition Strategy 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, and the NASA Shared Services Center (NSSC).

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.

### Disclosure Entities

The Federal Accounting Standards Advisory Board’s (FASAB) Statement of Federal Financial Accounting Stan-

dards (SFFAS) 47, Reporting Entity, is effective for the Department’s FY 2018 financial reporting (earlier implementation not permitted). This standard is intended to guide Federal agencies in recognizing complex, diverse organizations possessing varying legal designations (e.g., government agencies, not-for-profit organizations, and corporations) that are involved in addressing public policy challenges. It provides guidance for determining what organizations should be included in a Federal agency’s financial statements (consolidation entities) and footnote disclosures (disclosure entities; and related parties) for financial accountability purposes, and is not intended to establish whether an organization is or should be considered a Federal agency for legal or political purposes. See Note 15, *Disclosure Entity*, for information on NASA’s disclosure entity.

### 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 (June 2019). FASAB’s 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 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 financial 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.

Accounting standards require all reporting entities to disclose that accounting standards allow certain presentations and disclosures to be modified, if needed, to prevent disclosure of classified information.

Continued on next page →

## Note 1: Summary of Significant Accounting Policies (continued)

In FY 2019, NASA executed the requirements of Statement of Federal Financial Accounting Standards (SFFAS) No. 49, Public-Private Partnerships: Disclosure Requirements and implemented SFFAS No. 53, Budget and Accrual Reconciliation. NASA complies with SFFAS 55, Amending Inter-entity Cost Provisions.

### 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 (June 2019). Congress funds NASA's operations through nine main appropriations: Science; Aeronautics; Exploration; Space Operations; Science, Technology, Engineering and Mathematics Engagement, formerly 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.

### Exchange and Non-Exchange Revenue

NASA classified revenues as either exchange or non-exchange. Exchange revenues are those transactions in which NASA provides goods and services to another party for a price, primarily through reimbursable agreements that

are priced based on cost principles to reasonably reflect the actual cost for the goods and services provided to the customer. These revenues are presented on the Statement of Net Cost and serve to offset the costs of these goods and services. Non-exchange revenues result from donations to the Government and from the Government's right to demand payment, including taxes, fines, and penalties. These revenues are not considered to reduce the cost of NASA's operations and are reported on the Statement of Changes in Net Position.

### Application of Significant 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 (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 accounts 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 a bond. 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,

Continued on next page →

## Note 1: Summary of Significant Accounting Policies (continued)

NASA invests the biannual 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 may be invested.

### Accounts Receivable

Most of NASA's Accounts Receivable are for intragovernmental reimbursements for cost of goods and services provided to other Federal agencies; the rest are 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 capitalized assets with acquisition costs of \$500,000 or more, a useful life of two 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*.

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 two years or more.

SFFAS No. 29 *Heritage Assets and Stewardship Land* provides agencies with considerations for defining individual physical heritage assets units as a collection, or a group of assets, where appropriate. NASA revised its reporting of heritage assets in the Stewardship PP&E footnote. Prior to this change, NASA reported heritage assets at the individual item level, as opposed to reporting at the collection level. This change is designed to provide an improved understanding of the types of heritage assets owned by NASA.

### 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 transfers 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.

### Liabilities and Contingencies Not Covered by Budgetary Resources

Liabilities and Contingencies 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 canceled appropriations.

Continued on next page →

## Note 1: Summary of Significant Accounting Policies (continued)

### Federal Employee 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 to the defined benefit plan of 13.7 percent of gross pay. For employees hired January 1, 2013, and after, NASA contributes 11.9 percent of gross pay. The Agency also contributes 1.0 percent to a thrift savings plan (contribution plan) for each employee and matches employee contributions to this plan 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 (OPM) 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.

### Reclassification of FY 2018 Information

Certain reclassifications have been made to FY 2018 financial statements, notes, and supplemental information to better align with the Agency's policies and procedures effective in FY 2019, in accordance with the OMB Circular A-136.

## Note 2: Fund Balance with Treasury

The status of Fund Balance with Treasury (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 primarily comprised of amounts 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)	2019	2018
<b>Status of Fund Balances with Treasury:</b>		
Unobligated Balances		
Available	\$ 2,271	\$ 1,906
Unavailable	113	148
Obligated Balance not yet Disbursed	11,442	10,477
Non-Budgetary FBWT	21	20
<b>Total</b>	<b>\$ 13,847</b>	<b>\$ 12,551</b>

### Note 3: 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 the premium on the bond, and the straight-line method is used to amortize discounts on bills.

Interest receivable on investments was less than one-half million dollars, in FY 2019 and FY 2018. 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.

2019							
(In Millions of Dollars)	Cost	Amortization Method	Amortized (Premium) Discount	Interest Receivable	Investments, Net	Other Adjustments	Market Value Disclosure
<b>Intragovernmental Securities:</b>							
		Straight-Line Effective-interest					
Non-Marketable: Par value	\$ 17	1.837-2.524%	\$ (1)	\$ —	\$ 16	\$ —	\$ 16
<b>Total</b>	<b>\$ 17</b>		<b>\$ (1)</b>	<b>\$ —</b>	<b>\$ 16</b>	<b>\$ —</b>	<b>\$ 16</b>

2018							
(In Millions of Dollars)	Cost	Amortization Method	Amortized (Premium) Discount	Interest Receivable	Investments, Net	Other Adjustments	Market Value Disclosure
<b>Intragovernmental Securities:</b>							
		Straight-Line Effective-interest					
Non-Marketable: Par value	\$ 21	0.724 - 6.602%	\$ (4)	\$ —	\$ 17	\$ —	\$ 17
<b>Total</b>	<b>\$ 21</b>		<b>\$ (4)</b>	<b>\$ —</b>	<b>\$ 17</b>	<b>\$ —</b>	<b>\$ 17</b>

### Note 4: 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 uncollectible 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 uncollectible accounts during FY 2019 and FY 2018 is less than one-half million dollars.

2019			
(In Millions of Dollars)	Accounts Receivable	Allowance for Uncollectible Accounts	Net Amount Due
Intragovernmental	\$ 139	\$ —	\$ 139
Public	1	—	1
<b>Total</b>	<b>\$ 140</b>	<b>\$ —</b>	<b>\$ 140</b>

2018			
(In Millions of Dollars)	Accounts Receivable	Allowance for Uncollectible Accounts	Net Amount Due
Intragovernmental	\$ 109	\$ —	\$ 109
Public	1	—	1
<b>Total</b>	<b>\$ 110</b>	<b>\$ —</b>	<b>\$ 110</b>

## Note 5: General Property, Plant and Equipment, Net

There are no known restrictions to the use or convertibility of NASA G-PP&E. The composition of NASA G-PP&E as of September 30, 2019 and 2018 is presented in the table below.

2019					
(In Millions of Dollars)	Depreciation Method	Estimated Useful Life	Cost	Accumulated Depreciation	Book Value
<b>General PP&amp;E</b>					
Structures, Facilities and Leasehold Improvements	Straight-line	15–40 years	\$ 11,493	\$ (8,272)	\$ 3,221
Equipment	Straight-line	5–20 years	16,477	(14,933)	1,544
Construction In Progress - Personal Property	N/A	N/A	404	—	404
Construction In Progress - Real Property	N/A	N/A	703	—	703
Internal Use Software	Straight-line	5 years	254	(248)	6
Land	N/A	N/A	124	—	124
Internal Use Software In Development	N/A	N/A	6	—	6
<b>Total</b>			<b>\$ 29,461</b>	<b>\$ (23,453)</b>	<b>\$ 6,008</b>

2018					
(In Millions of Dollars)	Depreciation Method	Estimated Useful Life	Cost	Accumulated Depreciation	Book Value
<b>General PP&amp;E</b>					
Structures, Facilities and Leasehold Improvements	Straight-line	15–40 years	\$ 11,200	\$ (7,934)	\$ 3,266
Equipment	Straight-line	5–20 years	16,419	(14,801)	1,618
Construction In Progress - Personal Property	N/A	N/A	439	—	439
Construction In Progress - Real Property	N/A	N/A	630	—	630
Internal Use Software	Straight-line	5 years	251	(245)	6
Land	N/A	N/A	124	—	124
Internal Use Software In Development	N/A	N/A	3	—	3
<b>Total</b>			<b>\$ 29,066</b>	<b>\$ (22,980)</b>	<b>\$ 6,086</b>

## Note 6: 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 artistic (e.g., aesthetic importance); or
- Significant architectural characteristics

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## Note 6: Stewardship PP&E (continued)

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 have a heritage function and are used in NASA's day-to-day operations, are considered multi-use heritage assets. NASA's multi-use heritage assets consist of items such as launch pads, research labs, and wind tunnels still in operational use. Such assets that meet the capitalization criteria are accounted for as G-PP&E and depreciated over its estimated useful life in the same manner as other G-PP&E. Multi-use heritage assets are presented at the individual item level. As of September 30, 2019 and 2018, the total number of NASA's multi-use heritage assets was 482 and 493, respectively.

When a G-PP&E has no use in operations, but is designated as a heritage asset, its cost and accumulated depreciation are reclassified and removed from the G-PP&E asset accounts. 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.

SFFAS No. 29 provides agencies with considerations for defining individual physical heritage assets units as a collection, or a group of assets, where appropriate. NASA has reviewed and categorized its heritage assets into collection-type and non-collection-type assets. NASA's collection-type heritage assets include Air and Space Displays and Artifacts, and Art as described in the following paragraphs.

- Air and Space Displays and Artifacts collections are classified based on the physical custody of the asset. There are two collections: 1) NASA-held and 2) Contractor-held. Each collection is composed of assorted mementos of historic NASA events. Examples include items from previous missions that have historical significance to NASA and historic mission control artifacts that possess educational value and enhance the public's understanding of NASA's numerous programs.

- Art collections includes artwork inspired by the U.S. Aerospace program, as well as historical books, documents, and other library materials that document NASA's history. This collection is comprised of items created by artists who have contributed their time and talent to record their impressions of the history of the U.S. Aerospace Program through paintings, drawings, written form, and other media. These works of art not only provide a historic record of NASA projects, but they also support NASA's mission by giving the public a new and more comprehensive understanding of advancements in aerospace.

NASA's non-collection-type heritage assets include historic buildings, bunkers, towers, test stands, and properties that are listed or eligible to be listed on the National Register of Historic Places and National Historic Landmarks, and other resources.

- Non-collection-type heritage assets were established by locations for specific reasons and to pursue a variety of goals. Each is home to specific areas of expertise and support different elements of NASA's missions, taking on a unique identity. They provide the public with tangible examples of assets with historical significance or educational importance to NASA programs and missions at each location.

Total physical units, along with the additions and withdrawals for the fiscal years ended September 30, 2019 and 2018 for NASA's heritage assets are displayed in the table below:

Heritage Assets (In Physical Units)	2018	Additions	Withdrawals	2019
<b>Collection-type</b>				
Air and Space Displays and Artifacts	2	—	—	2
Art	1	—	—	1
<b>Non-Collection-type</b>				
NASA Locations	3	6	—	9
<b>Total Heritage Assets</b>	<b>6</b>	<b>6</b>	<b>—</b>	<b>12</b>

## Note 7: Other Assets

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

(In Millions of Dollars)	2019	2018
<b>Non-Intragovernmental Assets</b>		
Other Advances	\$ 2	\$ 2
G-PP&E - Removed from Service and Pending Disposal	3	—
<b>Total Other Assets</b>	<b>\$ 5</b>	<b>\$ 2</b>

## Note 8: Liabilities Not Covered by Budgetary Resources

Liabilities not covered by budgetary resources include certain environmental matters (see Note 9, *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 2.61 percent in FY 2019 and 2.72 percent in FY 2018. This liability includes the estimated future costs for claims incurred but not reported (IBNR) or approved as of the end of each year. NASA has recorded accounts payable related to canceled 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.

(In Millions of Dollars)	2019	2018
<b>Intragovernmental Liabilities:</b>		
Other Liabilities		
Workers' Compensation	\$ 8	\$ 8
Total Intragovernmental	8	8
<b>Public Liabilities:</b>		
Accounts Payable		
Accounts Payable for Cancelled Appropriations	62	58
Federal Employee Benefits		
Actuarial FECA Liability	39	38
Environmental and Disposal Liabilities	1,969	1,689
Less: Environmental and Disposal Liabilities - Funded	(125)	(114)
Other Liabilities		
Unfunded Annual Leave	249	215
Contingent Liabilities	2	5
<b>Total Liabilities Not Covered by Budgetary Resources</b>	<b>2,204</b>	<b>1,899</b>
<b>Total Liabilities Covered by Budgetary Resources</b>	<b>3,541</b>	<b>3,448</b>
<b>Total Liabilities Not Requiring Budgetary Resources</b>	<b>21</b>	<b>20</b>
<b>Total Liabilities</b>	<b>\$ 5,766</b>	<b>\$ 5,367</b>

## Note 9: 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 (more than remote but less than probable), 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.

(In Millions of Dollars)	2019	2018
<b>Environmental Liabilities</b>		
Restoration Projects	\$ 1,730	\$ 1,425
Asbestos	161	191
End of Life Disposal of Property, Plant & Equipment	78	73
<b>Total Environmental and Disposal Liabilities</b>	<b>\$ 1,969</b>	<b>\$ 1,689</b>

### Restoration Projects

NASA recorded a total estimated liability for known restoration projects of \$1.730 billion in FY 2019. This was an increase of \$305 million from \$1.425 billion recorded in FY 2018. 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 \$5 million for FY 2019 and \$160 million for FY 2018. The change in estimate is primarily due to a decrease in number of remediation projects where clean-up was deemed reasonably possible.

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, but the regulatory drivers and/or technical data that exist are not reliable enough to calculate an estimate.

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## Note 9: Environmental and Disposal Liabilities (continued)

### 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.

NASA uses actual costs incurred to clean up asbestos in NASA structures and facilities that were recently demolished or fully renovated to estimate the asbestos liability. 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 2019 asbestos cleanup cost liability of \$161 million represents a decrease of \$30 million compared to the \$191 million recorded in FY 2018.

### 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 \$78 million in FY 2019. This was an increase of \$5 million over the \$73 million recorded in FY 2018. This estimate includes both facilities with permits that require cleanup and an estimate for all remaining PP&E. As described in the following paragraphs, 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 10: 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. 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 IBNR grant program costs incurred in support of NASA's research and development and other related activities.

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## Note 10: Other Liabilities and Other Accrued Liabilities (continued)

(In Millions of Dollars)	2019			2018		
	Current	Non-Current	Total	Current	Non-Current	Total
<b>Intragovernmental Liabilities:</b>						
Advances from Others	\$ 87	\$ —	\$ 87	\$ 52	\$ —	\$ 52
Workers' Compensation	7	1	8	7	1	8
Employer Contributions and Payroll Taxes	19	—	19	17	—	17
Total Other Liabilities	113	1	114	76	1	77
Other Accrued Liabilities	91	—	91	83	—	83
<b>Total Intragovernmental</b>	<b>204</b>	<b>1</b>	<b>205</b>	<b>159</b>	<b>1</b>	<b>160</b>
<b>Public Liabilities:</b>						
Unfunded Annual Leave	—	249	249	—	215	215
Accrued Funded Payroll	95	—	95	85	—	85
Advances from Others	138	—	138	105	—	105
Employer Contributions and Payroll Taxes	10	—	10	9	—	9
Liability for Deposit and Clearing Funds	21	—	21	20	—	20
Contingent Liabilities	—	2	2	—	5	5
Capital Lease Liabilities	—	—	—	2	—	2
Other Liabilities	58	—	58	60	—	60
Total Other Liabilities	322	251	573	281	220	501
Other Accrued Liabilities	1,681	—	1,681	1,584	—	1,584
<b>Total Public</b>	<b>2,003</b>	<b>251</b>	<b>2,254</b>	<b>1,865</b>	<b>220</b>	<b>2,085</b>
<b>Total Other Liabilities and Other Accrued Liabilities</b>	<b>\$ 2,207</b>	<b>\$ 252</b>	<b>\$ 2,459</b>	<b>\$ 2,024</b>	<b>\$ 221</b>	<b>\$ 2,245</b>

## Note 11: 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 are certain cases where the likelihood of loss is deemed reasonably possible. A contingent liability is not required to be recorded for these cases; however, the estimated range of loss is disclosed below.

Additionally, there are cases reviewed by legal counsel where the likelihood of loss is deemed remote. A contingent liability is not required to be recorded for these cases.

(In Millions of Dollars)	2019	Estimated Range of Loss	
		Accrued Liabilities	Lower End
<b>Legal Contingencies</b>			
Probable	\$ 2	\$ 2	\$ 2
Reasonably Possible		\$ —	\$ 6

(In Millions of Dollars)	2018	Estimated Range of Loss	
		Accrued Liabilities	Lower End
<b>Legal Contingencies</b>			
Probable	\$ 5	\$ 5	\$ 5
Reasonably Possible		\$ —	\$ 1

## Note 12: Explanation of Differences Between the SBR and the Budget of the U.S. Government

The FY 2021 Budget of the United States Government (President's Budget), which presents the actual amounts for the year ended September 30, 2019, has not been published as of the issue date of these financial statements. Upon approval of the Administration, NASA will publish its FY 2021 President's Budget Request on the NASA Website at <https://www.nasa.gov/news/budget>.

NASA reconciled the amounts of the FY 2018 column on the SBR to the actual amounts for FY 2018 in the FY 2020 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
<b>Combined Statement of Budgetary Resources</b>	\$ 25,429	\$ 23,375	\$ (5)	\$ 19,759
Included on SBR, not in President's Budget				
Expired Accounts	(160)	(52)	—	—
Distributed Offsetting Receipts	—	—	5	—
<b>Budget of the United States Government</b>	<b>\$ 25,269</b>	<b>\$ 23,323</b>	<b>\$ —</b>	<b>\$ 19,759</b>

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 13: 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. Undelivered Orders at the end of the period totaled \$10.3 billion and \$9.4 billion as of September 30, 2019 and September 30, 2018, respectively.

(In Millions of Dollars)	2019	2018
<b>Federal</b>		
Unpaid	\$ 341	\$ 321
Paid	136	114
Total	<u>477</u>	<u>435</u>
<b>Nonfederal</b>		
Unpaid	9,867	8,918
Paid	5	5
Total	<u>9,872</u>	<u>8,923</u>
<b>Total Undelivered Orders</b>	<b><u>\$ 10,349</u></b>	<b><u>\$ 9,358</u></b>

## Note 14: Reconciliation of Net Cost of Operations to Net Outlays

Budgetary accounting is used for planning and control purposes and relates to both the receipt and use of cash, as well as reporting the Federal deficit. Financial accounting is intended to provide a picture of the Government's financial operations and financial position on an accrual basis. The accrual basis includes information about costs arising from the consumption of assets and the incurrence of liabilities. The reconciliation of net outlays is presented on a budgetary basis, and the net

cost is presented on an accrual basis, which provides an explanation of the relationship between budgetary and financial accounting information. The reconciliation serves not only to identify costs in the past and those paid in the future, but also to assure integrity between budgetary and financial accounting. The analysis below illustrates this reconciliation by listing the key differences between net cost of operations and net outlays.

2019

(In Millions of Dollars)	Intragovernmental	With the Public	Total
<b>Net Operating Cost (SNC)</b>	<b>\$ (422)</b>	<b>\$ 21,232</b>	<b>\$ 20,810</b>
<b>Components of Net Operating Cost Not Part of the Budgetary Outlays</b>			
Property, plant, and equipment depreciation	—	(575)	(575)
Property, plant, and equipment disposal & reevaluation	—	(76)	(76)
Other	—	573	573
<b>Increase/(decrease) in assets</b>			
Accounts receivable	29	1	30
Other assets	21	—	21
<b>(Increase)/decrease in liabilities not affecting Budgetary Outlays</b>			
Accounts payable	(44)	55	11
Salaries and benefits	(1)	(12)	(13)
Environmental and disposal liabilities	—	(280)	(280)
Other liabilities (Unfunded leave, unfunded FECA, actuarial FECA)	(9)	(126)	(135)
<b>Other financing sources</b>			
Federal employee retirement benefit costs paid by OPM and imputed to agency	(183)	—	(183)
<b>Total Components of Net Operating Cost Not Part of the Budgetary Outlays</b>	<b>(187)</b>	<b>(440)</b>	<b>(627)</b>
<b>Components of the Budgetary Outlays That Are Not Part of Net Operating Cost</b>			
Other	—	(4)	(4)
<b>Total Components of the Budgetary Outlays That Are Not Part of Net Operating Cost</b>	<b>—</b>	<b>(4)</b>	<b>(4)</b>
<b>Net Outlays (Calculated Total)</b>	<b>\$ (609)</b>	<b>\$ 20,788</b>	<b>\$ 20,179</b>
<b>Related Amounts on the Statement of Budgetary Resources</b>			
Outlays, net (SBR 4190)			\$ 20,182
Distributed offsetting receipts (SBR 4200)			(3)
<b>Outlays, Net (SBR 4210)</b>			<b>\$ 20,179</b>

## Note 15: Disclosure Entity

The Jet Propulsion Laboratory (JPL) is a NASA-owned facility which serves as a Federally Funded Research and Development Center (FFRDC). The facility commenced activities in the mid-1930s and at that time was sponsored by the U.S. Army to develop rocket technology and missile systems.

The California Institute of Technology (Caltech), a private, not-for-profit 501(c)(3) university, manages JPL pursuant to a sole-source, five-year, Federal Acquisition Regulation (FAR)-based contract with NASA. The value of NASA's Caltech contract for FY 2019 was \$1.8 billion. Under this contract, NASA issues task orders to Caltech for various research programs and projects conducted at JPL. The contract is subject to the usual FAR-based Federal contract oversight and reporting requirements. Caltech has managed JPL as a NASA FFRDC since 1959.

Caltech and NASA's relationship at JPL is governed by the terms and conditions of their contract which does not give NASA responsibility for or insight into Caltech's business objectives or operations at JPL. JPL staff is comprised of Caltech employees and contractors, while NASA has a resident office at the facility staffed by Federal managers who administer the NASA/Caltech contract. The physical

plant and equipment used to conduct operations under the contract are Government furnished property and material, made available to Caltech for the performance of its contract with NASA, and includes contractor-acquired property. The work performed by JPL for NASA is funded by NASA as part of one or more of NASA's major programs and supports NASA's missions and programs. Every year, JPL issues a review of its accomplishments. JPL's Annual Reports are found at <https://www.jpl.nasa.gov/about/reports.php>.

NASA has the unilateral authority to establish or amend the fundamental purpose and mission of activities at its JPL FFRDC. NASA's contract with Caltech reflects and incorporates NASA's authority into its terms and conditions. NASA also has the unilateral authority to orderly phase-down and close its FFRDC and thus, the NASA contract with Caltech. As such, the contract terms allow NASA to close the FFRDC, transfer sponsorship of the FFRDC to another sponsor (Federal agency), transition the FFRDC to another contractor (e.g., another University), or renew the contract. In the event of a termination of its contract with Caltech for the management of JPL, JPL would only receive costs that NASA deems allowable, allocable, and reasonable under the contract's terms.

## Note 16: Reclassification of Balance Sheet, Statement of Net Cost, and Statement of Changes in Net Position for FR Compilation Process

To prepare the Financial Report of the U.S. Government (FR), the Department of the Treasury requires agencies to submit an adjusted trial balance, which is a listing of amounts by U.S. Standard General Ledger account that appear in the financial statements. Treasury uses the trial balance information reported in the Governmentwide Treasury Account Symbol Adjusted Trial Balance System (GTAS) to develop a Reclassified Balance Sheet, Reclassified Statement of Net Cost, and a Reclassified Statement of Changes in Net Position for each agency, which are accessed using GTAS. Treasury eliminates all intragovernmental balances from the reclassified

statements and aggregates lines with the same title to develop the FR statements. This note shows the Agency's financial statements and the Agency's reclassified statements prior to elimination of intragovernmental balances and prior to aggregation of repeated FR line items.

The term "non-Federal" is used in this note to refer to Federal Government amounts that result from transactions with non-Federal entities. These include transactions with individuals, businesses, non-profit entities, and State, local, and foreign governments.

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## Note 16: Reclassification of Balance Sheet, Statement of Net Cost, and Statement of Changes in Net Position for FR Compilation Process (continued)

FY 2019 NASA Balance Sheet		Line Items Used to Prepare FY 2019 Government-wide Balance Sheet	
Financial Statement Line	Amounts	Amounts	Reclassified Financial Statement Line
<b>ASSETS</b>			<b>ASSETS</b>
<b>Intragovernmental Assets</b>			<b>Intragovernmental Assets</b>
Fund Balance with Treasury	\$ 13,847	\$ 13,847	Fund Balance with Treasury
Investments	16	16	Federal Investments
Accounts Receivable	139	139	Accounts Receivable
<b>Total Intragovernmental Assets</b>	<b>14,002</b>	<b>14,002</b>	<b>Total Intragovernmental Assets</b>
Accounts Receivable, Net	1	1	Accounts and Taxes Receivable, Net
General PP&E, Net	6,008	6,008	PP&E, Net
Other	5	5	Other Assets
<b>Total Assets</b>	<b>\$ 20,016</b>	<b>\$ 20,016</b>	<b>Total Assets</b>
<b>LIABILITIES</b>			<b>LIABILITIES</b>
<b>Intragovernmental Liabilities</b>			<b>Intragovernmental Liabilities</b>
Accounts Payable	\$ 48	\$ 139	Accounts Payable
Other Liabilities	91		
Other Liabilities	114	26	Benefit Program Contributions Payable
		88	Advances from Other & Deferred Credits
<b>Total Intragovernmental Liabilities</b>	<b>253</b>	<b>253</b>	<b>Total Intragovernmental Liabilities</b>
Accounts Payable	1,251	1,251	Accounts Payable
Federal Employee Benefits	39	49	Federal Employee and Veteran Benefits Payable
Other Liabilities	10		
Environmental and Disposal Liabilities	1,969	1,969	Environmental and Disposal Liabilities
Other Accrued Liabilities	1,681	2,244	Other Liabilities
Other Liabilities	563		
<b>Total Liabilities</b>	<b>5,766</b>	<b>5,766</b>	<b>Total Liabilities</b>
<b>NET POSITION</b>			<b>NET POSITION</b>
Unexpended Appropriations	10,542	10,542	Net Position - Funds Other than those from Dedicated Collections
Cumulative Results of Operations	3,708	3,708	Net Position - Funds Other than those from Dedicated Collections
<b>Total Net Position</b>	<b>14,250</b>	<b>14,250</b>	<b>Total Net Position</b>
<b>Total Liabilities &amp; Net Position</b>	<b>\$ 20,016</b>	<b>\$ 20,016</b>	<b>Total Liabilities &amp; Net Position</b>

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## Note 16: Reclassification of Balance Sheet, Statement of Net Cost, and Statement of Changes in Net Position for FR Compilation Process (continued)

FY 2019 NASA Statement of Net Cost		Line Items Used to Prepare FY 2019 Government-wide Statement of Net Cost	
Financial Statement Line	Amounts	Amounts	Reclassified Financial Statement Line
Gross Costs	\$ 22,626		<b>Non-Federal Costs</b>
		\$ 21,435	Non-Federal Gross Cost
		<b>21,435</b>	<b>Total Non-Federal Costs</b>
			<b>Intragovernmental Costs</b>
		452	Benefit Program Costs
		183	Imputed Costs
		556	Buy/Sell Costs
		<b>1,191</b>	<b>Total Intragovernmental Costs</b>
Total Gross Costs	22,626	22,626	Total Reclassified Gross Costs
Earned Revenue	1,816		<b>Non-Federal Earned Revenue</b>
		203	Non-Federal Earned Revenue
		<b>203</b>	<b>Total Non-Federal Earned Revenue</b>
			<b>Intragovernmental Earned Revenue</b>
		1,613	Buy/Sell Revenue
		<b>1,613</b>	<b>Total Intragovernmental Earned Revenue</b>
Total Earned Revenue	1,816	1,816	Total Reclassified Earned Revenue
<b>Net Cost</b>	<b>\$ 20,810</b>	<b>\$ 20,810</b>	<b>Net Cost</b>

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## Note 16: Reclassification of Balance Sheet, Statement of Net Cost, and Statement of Changes in Net Position for FR Compilation Process (continued)

FY 2019 NASA Statement of Changes in Net Position		Line Items Used to Prepare FY 2019 Government-wide Statement of Changes in Net Position	
Financial Statement Line	Amounts	Amounts	Reclassified Financial Statement Line
<b>UNEXPENDED APPROPRIATIONS</b>			
Beginning Balance	\$ 9,285	\$ 9,285	Net Position, Beginning of Period
Appropriations Received	21,500	21,476	Appropriations Received as Adjusted
Other Adjustments	(24)		
Appropriations Used	(20,219)	(20,219)	Appropriations Used (Federal)
<i>Total Budgetary Financing Sources</i>	1,257	1,257	
<b>Total Unexpended Appropriations</b>	<b>\$ 10,542</b>	<b>\$ 10,542</b>	
<b>CUMULATIVE RESULTS OF OPERATIONS</b>			
Beginning Balance	\$ 4,114	\$ 4,114	Net Position, Beginning of Period
Appropriations Used	20,219	20,219	Appropriations Expended
Non-Exchange Revenue	4	6	Other Taxes and Receipts
Donations and Forfeitures of Property	2		
<i>Total Budgetary Financing Sources</i>	20,225	20,225	
Imputed Financing	183	183	Imputed Financing Sources (Federal)
Other	(4)	(4)	Non-Entity Collections Transferred to the General Fund of the U.S. Government
<i>Total Other Financing Sources</i>	179	179	
<b>Total Financing Sources</b>	<b>\$ 20,404</b>	<b>\$ 20,404</b>	
<b>Net Cost of Operations</b>	<b>20,810</b>	<b>20,810</b>	
<b>Ending Balance – Cumulative Results of Operations</b>	<b>3,708</b>	<b>3,708</b>	<b>Net Position – Ending Balance</b>
<b>Total Net Position</b>	<b>\$ 14,250</b>	<b>\$ 14,250</b>	<b>Total Net Position</b>

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## 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)	2019	2018	2017	2016	2015
<b>Research and Development Costs</b>					
Strategic Goal 1	\$ 5,553	\$ 5,184	\$ 2,914	\$ 2,897	\$ 2,784
Strategic Goal 2	275	291	293	416	309
Strategic Goal 3	—	—	56	—	—
Strategic Goal 4	—	—	—	—	(1)
<b>Total Basic Expenses</b>	<b>\$ 5,828</b>	<b>\$ 5,475</b>	<b>\$ 3,263</b>	<b>\$ 3,313</b>	<b>\$ 3,092</b>
<b>Applied</b>					
Strategic Goal 1	\$ 309	\$ 331	\$ 274	\$ 222	\$ 207
Strategic Goal 2	1,271	1,303	1,236	1,865	1,288
Strategic Goal 3	919	839	796	774	824
Strategic Goal 4	7	30	29	55	32
<b>Total Applied Expenses</b>	<b>\$ 2,506</b>	<b>\$ 2,503</b>	<b>\$ 2,335</b>	<b>\$ 2,916</b>	<b>\$ 2,351</b>
<b>Development</b>					
Strategic Goal 1	\$ —	\$ —	\$ 1,918	\$ 1,715	\$ 1,848
Strategic Goal 2	3,820	3,704	3,574	3,357	3,232
Strategic Goal 3	302	248	169	148	187
Strategic Goal 4	382	499	948	1,560	973
<b>Total Development Expenses</b>	<b>\$ 4,504</b>	<b>\$ 4,451</b>	<b>\$ 6,609</b>	<b>\$ 6,780</b>	<b>\$ 6,240</b>
<b>Total Research and Development</b>	<b>\$ 12,838</b>	<b>\$ 12,429</b>	<b>\$ 12,207</b>	<b>\$ 13,009</b>	<b>\$ 11,683</b>
<b>Non-Research and Development Cost</b>					
Strategic Goal 1	\$ 1,987	\$ 1,891	\$ 1,591	\$ 1,495	\$ 1,568
Strategic Goal 2	1,213	1,190	1,306	1,380	3,342
Strategic Goal 3	666	455	592	573	226
Strategic Goal 4	5,922	6,364	6,028	5,354	5,042
<b>Total Non-Research and Development Expenses</b>	<b>\$ 9,788</b>	<b>\$ 9,900</b>	<b>\$ 9,517</b>	<b>\$ 8,802</b>	<b>\$ 10,178</b>
<b>Total Expenses</b>	<b>\$ 22,626</b>	<b>\$ 22,329</b>	<b>\$ 21,724</b>	<b>\$ 21,811</b>	<b>\$ 21,861</b>

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 strategic goals, codified in its 2018 Strategic Plan, establish the foundation for the Agency's performance framework. For each of its timeless strategic goals, the Agency has identified nearer-term outcomes that it strives to achieve in support of its strategic plan. Many of these outcomes require substantial R&D investments that NASA makes for the benefit of the Nation.

NASA's 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 that support the

development and application of technologies critical to the economic, scientific, and technical competitiveness of the United States.

Investment in R&D refers to those expenses incurred to support the search for new or refined knowledge and ideas, as well as the application or use of such knowledge and ideas for the development of new or improved products and processes. In each instance, the primary motivation is the continuous improvement of the Nation's economic and productive capacity, yielding untold benefits for both today and future generations.

## Major R&D Projects by Strategic Goal

### Strategic Goal 1 MARS Rover 2020

NASA's Mars 2020 science rover is a mission, planned to launch in July 2020, to collect Martian rock and soil samples for potential return to Earth in the future and to test new technology to benefit future robotic and human exploration of Mars. The rover body and other major hardware (such as the cruise stage and heat shield) is very closely based on designs from the successful Mars Science Laboratory (MSL) "Curiosity" rover in order to take advantage of engineering heritage. However, the Mars 2020 rover will carry more sophisticated, upgraded hardware and new instruments, such as the Planetary Instrument for X-ray Lithochemistry (PIXL).

In FY 2019, the Mars 2020 project made progress on both the development and testing of heritage subsystems and new elements. All the science instruments were delivered for integration with the rover, and Flight Model 1 of the sample caching system's adaptive caching assembly was completed for testing. Integration of the rover and subsystems is continuing on schedule for the July 2020 launch date.

### Strategic Goal 2 SLS Launch Vehicles

The Space Launch System program's launch vehicles work is moving toward the first SLS flight on the Artemis I mission. SLS leverages hardware designed for previous programs, including using adapted and refurbished Space Shuttle main engines, five-segment Shuttle-derived solid rocket boosters, and an interim cryogenic propulsion stage (ICPS) from a derivative of the Delta cryogenic second stage. The program benefits from NASA's half-century of experience and knowledge of liquid oxygen and hydrogen heavy-lift vehicles, large solid rocket motors, and advances in technology and manufacturing practices. The Engine Section presented particularly challenging manufacturing difficulties, which were largely resolved in FY 2018 and

FY 2019. The EM-1 core stage components including RS-25 engines, the engine section, hydrogen tank, inter-tank, and oxygen tank will complete joining in the coming months. Shipment date from Michoud Assembly Facility (MAF) to Stennis Space Center (SSC) for hot fire green run testing is under review, as is the Artemis I launch date. Green run is the term used for the hot fire testing of the flight core stage with all four engines as it is secured in the test stand at SSC. Upon the successful green run test, the core stage will ship to KSC and complete vehicle certification. With all EM-1 SLS hardware at KSC, SLS will effectively hand off all the launch components to Exploration Ground Systems (EGS). EGS will integrate the rocket with the Orion capsule in the Vehicle Assembly Building (VAB). With delivery of EM-1 hardware, the SLS program focus shifts to EM-2 and future flights. Fabrication and testing of elements of Artemis II and future mission will continue, to include Core Stage, solid rocket booster components, and additional flight elements.

### Strategic Goal 3 Small Business Innovation Research

The SBIR (Small Business Innovation Research) program was established under the Small Business Innovation Development Act of 1982 (P.L. 97-219) with the purpose of strengthening the role of innovative small business concerns in Federally-funded R&D. SBIR provides the high technology, small business sector with opportunities to develop NASA-funded space technologies that have the potential to address national needs in the aerospace industry and other sectors. The NASA SBIR program funds innovative technologies that fulfill NASA needs as described in the annual NASA Solicitations and that have significant potential for successful commercialization. Annual solicitations align subtopics to exploration focus areas to draw on small business support of NASA's Exploration Campaign objectives.

Continued on next page →

### Strategic Goal 4 Commercial Crew Program

Through NASA's Commercial Crew Program (CCP), the U.S. private sector is working to develop and operate safe, reliable, and affordable crew transportation to space, including to the International Space Station (ISS). Partnering with the commercial space industry for access to ISS and other low Earth orbit destinations bolsters American leadership, reduces our current reliance on foreign providers for this service, and helps stimulate the American aerospace industry. Crew transportation is currently provided using the Russian Soyuz vehicle. By supporting the development of U.S. hu-

man spaceflight capabilities, NASA is also contributing to the foundation of a more affordable and sustainable future for human spaceflight. NASA provides technical insight and financial support to industry partners during development of their crew transportation systems using milestone-based contracts, and will certify them to carry astronauts to and from the ISS. Under this acquisition model, NASA defines requirements upfront and pays the partner only once contract milestones are successfully completed. This approach shifts financial risk from taxpayers to the private sector, incentivizes increased cost-control, and decreases the cost of developing the systems.

## Strategic Goals and Outcomes

### Strategic Goal 1 Expand Human Knowledge through New Scientific Discoveries

- Conduct scientific studies of the Earth and Sun from space, return data and samples from other bodies in the solar system, peer out into the vast reaches of the universe, and play a catalyzing role in lunar robotic exploration by supporting innovative approaches to advancing science.
- Conduct a robust program of space-based research to advance technologies that enable space exploration, and to pioneer uses of the space environment to benefit life on Earth.

### Strategic Goal 2 Extend Human Presence Deeper Into Space and to the Moon for Sustainable Long-term Exploration and Utilization

- Enable space-based low Earth orbit economy by transitioning the ISS operations and maintenance to commercial and international partners, while continuing to leverage ISS for research, technology development, and to extend human presence in space.
- Extend human presence into cis-lunar space and the lunar surface, with capabilities that allow for sustained operations in deep space and the lunar surface.

### Strategic Goal 3 Address National Challenges and Catalyze Economic Growth

- Advance revolutionary technologies for NASA and the Nation, involving commercial space products, specifically for utilization of near-Earth space; efficient transportation through space; access to planetary surfaces; enabling human space exploration; next generation science missions; and growth and utilization of the U.S. industrial and academic base.

- Maintain and advance U.S. global leadership in aviation through application of new concepts and technologies pioneered by NASA and developed in partnership with U.S. industry that lead to transformative improvements in mobility, efficiency, and safety.
- Inspire, engage, educate, and employ the next generation of explorers through NASA-unique Science, Technology, Engineering, and Mathematics (STEM) learning opportunities.

## Strategic Goal 4 Optimize Capabilities and Operations

- Support cooperative, reimbursable, and funded initiatives through domestic and international partnerships.
- Support the communication, launch service, rocket propulsion testing, and strategic capabilities needs of NASA's programs.
- Assure effective management of NASA programs and operations to complete the mission safely and successfully.
- Cultivate a diverse and innovative workforce with the right balance of skills and experience to provide an inclu-

sive work environment in which employees that possess varying perspectives, education levels, life experiences, and backgrounds can work together and remain fully engaged in our mission.

- Increase the resiliency of NASA's enterprise systems by assessing risks and implementing comprehensive, economical, and actionable solutions.
- Enable NASA's mission by providing the facilities, tools, and services required to efficiently manage, operate, and sustain the infrastructure necessary to meet mission objectives.

### Investments in Human Capital

Human capital investments are expenses, included in NASA's Net Cost of Operations, for education and training programs that are intended to increase or maintain national economic productive capacity and produce outputs and outcomes that provide evidence of maintaining or increasing national productive capacity. These investments exclude education and training expenses for Federal civilian personnel. The following table summarizes NASA's costs that represent investments in human capital by program for FY 2015 through FY 2019.

(In Millions of Dollars)	2019	2018	2017	2016	2015
National Space Grant and College Fellowship Program	\$ 43	\$ 44	\$ 47	\$ 43	\$ 42
Established Program to Stimulate Competitive Research	18	18	20	19	22
Minority University Research & Education Program	33	32	32	25	22
<b>Total Investment in Human Capital</b>	<b>\$ 94</b>	<b>\$ 94</b>	<b>\$ 99</b>	<b>\$ 87</b>	<b>\$ 86</b>

#### National Space Grant and College Fellowship Program (Space Grant)

Space Grant was established to increase understanding, research, development, and utilization of aerospace science and technology through the Nation's universities. The competitive grant opportunity enables the active involvement of 52 consortia in 50 States, the District of Columbia, and the Commonwealth of Puerto Rico. Space Grant supports and enhances science and engineering education, and research efforts for educators and learners by leveraging the resource capabilities and technologies of over 900 affiliates from universities, colleges, industries, museums, science centers, and state and local agencies, and provides students access to research and hands-on STEM experiences.

#### Established Program to Stimulate Competitive Research (EPSCoR)

EPSCoR establishes partnerships with government, higher education and industry that are designed to affect lasting improvements in a state's or region's research infrastruc-

ture, R&D capacity and hence, it's national R&D competitiveness. The program strives to improve a jurisdiction's research infrastructure to a level such that its research and development programs contribute to its economic development. EPSCoR supports competitively funded awards and provides research and technology development opportunities for faculty and research teams.

#### Minority University Research & Education Program (MUREP)

MUREP provides financial assistance via competitive awards to Minority Serving Institutions (MSIs). NASA's MUREP investments enhance the research, academic, and technology capabilities of MSIs through multi-year awards. Awards assist faculty and students in research and provide authentic STEM engagement related to NASA missions. These competitive awards provide NASA specific knowledge and skills to historically underrepresented and underserved learners in STEM. MUREP investments also assist NASA in meeting the goal of a diverse workforce through student participation in internships, scholarships, and fellowships at NASA Centers and JPL.

## Required Supplementary Information

### Combining Statement of Budgetary Resources For the Fiscal Year Ended September 30, 2019

(In Millions of Dollars)	Space Operations	Science	Exploration	Aeronautics	Safety, Security and Mission Services	STEM Engagement
<b>Budgetary Resources:</b>						
Unobligated Balance from Prior Year Budget Authority, Net	\$ 305	\$ 554	\$ 478	\$ 33	\$ 641	\$ 13
Appropriations	4,640	6,887	5,045	725	2,755	110
Spending Authority from Offsetting Collections	—	—	—	—	1,819	—
<b>Total Budgetary Resources</b>	<b>\$ 4,945</b>	<b>\$ 7,441</b>	<b>\$ 5,523</b>	<b>\$ 758</b>	<b>\$ 5,215</b>	<b>\$ 123</b>
<b>Status of Budgetary Resources:</b>						
New Obligations and Upward Adjustments (Total)	\$ 4,792	\$ 6,684	\$ 5,316	\$ 729	\$ 4,430	\$ 110
Unobligated Balance, End of Year:						
Apportioned, Unexpired Accounts	99	744	198	27	780	9
Unapportioned, Unexpired Accounts	—	—	—	—	1	—
Unexpired Unobligated Balance, End of Year	99	744	198	27	781	9
Expired Unobligated Balance, End of Year	54	13	9	2	4	4
Unobligated Balance, End of Year (Total)	153	757	207	29	785	13
<b>Total Status of Budgetary Resources</b>	<b>\$ 4,945</b>	<b>\$ 7,441</b>	<b>\$ 5,523</b>	<b>\$ 758</b>	<b>\$ 5,215</b>	<b>\$ 123</b>
Outlays, Net (Total)	4,497	6,247	4,521	710	2,833	107
Distributed Offsetting Receipts (-)	—	—	—	—	—	—
<b>Agency Outlays, Net</b>	<b>\$ 4,497</b>	<b>\$ 6,247</b>	<b>\$ 4,521</b>	<b>\$ 710</b>	<b>\$ 2,833</b>	<b>\$ 107</b>

(continued)

(In Millions of Dollars)	Office of Inspector General	Space Technology	Construction and Environmental Compliance and Restoration	Other	Total
<b>Budgetary Resources:</b>					
Unobligated Balance from Prior Year Budget Authority, Net	\$ 3	\$ 55	\$ 406	\$ 28	\$ 2,516
Appropriations	39	927	372	1	21,501
Spending Authority from Offsetting Collections	1	—	21	496	2,337
<b>Total Budgetary Resources</b>	<b>\$ 43</b>	<b>\$ 982</b>	<b>\$ 799</b>	<b>\$ 525</b>	<b>\$ 26,354</b>
<b>Status of Budgetary Resources:</b>					
New Obligations and Upward Adjustments (Total)	\$ 41	\$ 908	\$ 478	\$ 483	\$ 23,971
Unobligated Balance, End of Year:					
Apportioned, Unexpired Accounts	1	60	320	32	2,270
Unapportioned, Unexpired Accounts	—	7	—	—	8
Unexpired Unobligated Balance, End of Year	1	67	320	32	2,278
Expired Unobligated Balance, End of Year	1	7	1	10	105
Unobligated Balance, End of Year (Total)	2	74	321	42	2,383
<b>Total Status of Budgetary Resources</b>	<b>\$ 43</b>	<b>\$ 982</b>	<b>\$ 799</b>	<b>\$ 525</b>	<b>\$ 26,354</b>
Outlays, Net (Total)	38	811	453	(35)	20,182
Distributed Offsetting Receipts (-)	—	—	—	(3)	(3)
<b>Agency Outlays, Net</b>	<b>\$ 38</b>	<b>\$ 811</b>	<b>\$ 453</b>	<b>\$ (38)</b>	<b>\$ 20,179</b>

**Required Supplementary Information** (continued)**Combining Statement of Budgetary Resources  
For the Fiscal Year Ended September 30, 2018**

(In Millions of Dollars)	Space Operations	Science	Exploration	Aeronautics	Safety, Security and Mission Services	STEM Engagement
<b>Budgetary Resources:</b>						
Unobligated Balance from Prior Year Budget Authority, Net	\$ 212	\$ 357	\$ 120	\$ 21	\$ 389	\$ 17
Appropriations	4,749	6,212	4,790	690	2,827	100
Spending Authority from Offsetting Collections	—	—	—	—	2,655	—
<b>Total Budgetary Resources</b>	<b>\$ 4,961</b>	<b>\$ 6,569</b>	<b>\$ 4,910</b>	<b>\$ 711</b>	<b>\$ 5,871</b>	<b>\$ 117</b>
<b>Status of Budgetary Resources:</b>						
New Obligations and Upward Adjustments (Total)	\$ 4,785	\$ 6,154	\$ 4,484	\$ 685	\$ 5,318	\$ 105
Unobligated Balance, End of Year:						
Apportioned, Unexpired Accounts	117	385	411	24	534	7
Unapportioned, Unexpired Accounts	—	15	6	—	16	—
Unexpired Unobligated Balance, End of Year	117	400	417	24	550	7
Expired Unobligated Balance, End of Year	59	15	9	2	3	5
Unobligated Balance, End of Year (Total)	176	415	426	26	553	12
<b>Total Status of Budgetary Resources</b>	<b>\$ 4,961</b>	<b>\$ 6,569</b>	<b>\$ 4,910</b>	<b>\$ 711</b>	<b>\$ 5,871</b>	<b>\$ 117</b>
Outlays, Net (Total)	4,728	5,847	4,481	650	2,760	109
Distributed Offsetting Receipts (-)	—	—	—	—	—	—
<b>Agency Outlays, Net</b>	<b>\$ 4,728</b>	<b>\$ 5,847</b>	<b>\$ 4,481</b>	<b>\$ 650</b>	<b>\$ 2,760</b>	<b>\$ 109</b>

(continued)

(In Millions of Dollars)	Office of Inspector General	Space Technology	Construction and Environmental Compliance and Restoration	Other	Total
<b>Budgetary Resources:</b>					
Unobligated Balance from Prior Year Budget Authority, Net	\$ 2	\$ 58	\$ 295	\$ 28	\$ 1,499
Appropriations	39	760	650	2	20,819
Spending Authority from Offsetting Collections	1	—	7	448	3,111
<b>Total Budgetary Resources</b>	<b>\$ 42</b>	<b>\$ 818</b>	<b>\$ 952</b>	<b>\$ 478</b>	<b>\$ 25,429</b>
<b>Status of Budgetary Resources:</b>					
New Obligations and Upward Adjustments (Total)	\$ 40	\$ 772	\$ 581	\$ 451	\$ 23,375
Unobligated Balance, End of Year:					
Apportioned, Unexpired Accounts	1	40	370	17	1,906
Unapportioned, Unexpired Accounts	—	—	—	1	38
Unexpired Unobligated Balance, End of Year	1	40	370	18	1,944
Expired Unobligated Balance, End of Year	1	6	1	9	110
Unobligated Balance, End of Year (Total)	2	46	371	27	2,054
<b>Total Status of Budgetary Resources</b>	<b>\$ 42</b>	<b>\$ 818</b>	<b>\$ 952</b>	<b>\$ 478</b>	<b>\$ 25,429</b>
Outlays, Net (Total)	38	732	424	(10)	19,759
Distributed Offsetting Receipts (-)	—	—	—	(5)	(5)
<b>Agency Outlays, Net</b>	<b>\$ 38</b>	<b>\$ 732</b>	<b>\$ 424</b>	<b>\$ (15)</b>	<b>\$ 19,754</b>

## Required Supplementary Information (continued)

### Deferred Maintenance and Repairs for FY 2019

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 NASA 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 (PSE). 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.

#### 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.

**Required Supplementary Information** (continued)**Deferred Maintenance and Repairs for FY 2019** (continued)**Changes from Prior Year**

As of September 30, 2019, \$2.65 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 \$91 million from September 30, 2018. The increase in the DM&R estimate can be attributed to various reasons; including changes to deterioration of facilities due to natural disasters, damage from testing to PSE in high-value assets (HVA), and large increases in Current Replacement Value (CRV) of high value infrastructure assets as upgrades progress.

NASA performs DM assessment on Real Property Assets in a two-year cycle. In FY 2018, the DM assessment was performed on half of NASA's Real Property Assets and in FY 2019, the remaining assets were assessed. These alternating assessments result in a physical assessment of all Real Property Assets in a two-year cycle.

(In Millions of Dollars)	2019	2018
<b>Asset Category</b>		
General PP&E - Real Property	\$ 2,602	\$ 2,544
Heritage Assets - Real Property	48	15
<b>Total Deferred Maintenance and Repairs</b>	<b>\$ 2,650</b>	<b>\$ 2,559</b>



## NASA OFFICE OF INSPECTOR GENERAL

### OFFICE OF AUDITS

SUITE 8U71, 300 E ST SW  
WASHINGTON, D.C. 20546-0001

November 15, 2019

TO: James F. Bridenstine  
Administrator

Jeff DeWit  
Chief Financial Officer

SUBJECT: *Audit of NASA's Fiscal Year 2019 Financial Statements* (Report No. IG-20-006;  
Assignment No. A-19-004-00)

The Office of Inspector General contracted with the independent public accounting firm CliftonLarsonAllen LLP (CLA) to audit NASA's fiscal year (FY) 2019 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. 19-03, *Audit Requirements for Federal Financial Statements*.

This audit resulted in a "clean" or unmodified opinion on NASA's FY 2019 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 2019, CLA identified one significant deficiency related to information technology management and did not report any instances of noncompliance.

In our oversight of the contract, we reviewed CLA's report and related documentation and inquired of its representatives. Our review, as differentiated from an audit of the financial statements in accordance with GAO's *Government Auditing Standards*, 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 control 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 auditor's report dated November 15, 2019,

and the conclusions expressed therein. However, 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 Kimberly F. Benoit, Assistant Inspector General for Audits, at 202-358-0378 or [kimberly.f.benoit@nasa.gov](mailto:kimberly.f.benoit@nasa.gov) if you have any questions about the enclosed report.

Handwritten signature of Paul K. Martin in black ink.

Paul K. Martin  
Inspector General

**Enclosure - 1**



CliftonLarsonAllen LLP  
CLAcconnect.com

## INDEPENDENT AUDITORS' REPORT

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, 2019 and 2018, 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. 19-03, *Audit Requirements for Federal Financial Statements* (OMB Bulletin 19-03). Those standards and OMB Bulletin 19-03 require that we plan and perform the audit 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. 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 opinions.



## INDEPENDENT AUDITORS' REPORT (Continued)

### ***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, 2019 and 2018 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's Discussion and Analysis (MD&A), Required Supplementary Information, and Required Supplementary Stewardship Information 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, 2019, 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 identified a deficiency in internal control that we consider to be a significant deficiency. This deficiency is listed below and described in **Exhibit A**:

- Information Technology Management

#### **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, 2019 disclosed no instances of noncompliance or other matters that are required to be reported in accordance with *Government Auditing Standards* or OMB Bulletin 19-03.

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

## INDEPENDENT AUDITORS' REPORT (Continued)

### ***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 finding 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 Significant Deficiency***

We have reviewed the status of NASA's corrective actions with respect to the finding included in the prior year's Independent Auditors' Report, dated November 15, 2018. The status of the prior year finding is presented in **Exhibit C**.

### ***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

## INDEPENDENT AUDITORS' REPORT (Continued)

*Government Auditing Standards* in considering NASA's internal control and compliance. Accordingly, these reports are not suitable for any other purpose.



**CliftonLarsonAllen LLP**

Greenbelt, Maryland

November 15, 2019

**INDEPENDENT AUDITORS' REPORT (Continued)**  
**EXHIBIT A**  
**Significant Deficiency**  
**September 30, 2019**

## 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) in July 2016. 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.

### 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.

Since 2015, 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 C) Unsupported Software. In addition, since 2016, 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 Deficiency**  
**September 30, 2019**

To address the prior year issues, management developed short-term and long-term corrective action plans to remediate the weaknesses. The plans included creating new and enhancing existing processes, as well as acquiring audit logging tools. To implement their plans, NASA management for example has implemented a logging tool to capture application logs, to correlate security events and to generate alerts on suspicious activity to applicable parties. In addition, management completed a project started in fiscal year 2018 to review and expand the scope and extent of NASA's financial system's SoD monitoring controls. While management has made progress in specific areas, it will take time to effectively implement and execute all their corrective action plans across the enterprise to comprehensively address their IT weaknesses. As such, we found security weaknesses similar in type and risk level to our prior year findings.

In recent years, NASA was able to remediate several prior year findings related to specific vulnerabilities and has incorporated a program aimed at reducing vulnerability totals and meeting vulnerability remediation timelines. However, unlike a mature and comprehensive vulnerability management program, NASA did not sufficiently and consistently address the timely remediation of vulnerabilities associated with the financial application and general support systems. 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** – Operating systems and applications were inadequately configured, 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 gain unauthorized access that can compromise the C-I-A of sensitive information. Failure to change weak security configurations 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 in use for an extended period of time and continued to expose NASA to vulnerabilities that cannot be sufficiently mitigated.

NASA relied on its defense in depth (DiD) approach, the intent of which was to implement controls at each layer of the 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 specific deficiencies in NASA's DiD approach. Specifically, NASA did not substantially address prior year deficiencies related to its financial systems' general application controls, outlined below:

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

**INDEPENDENT AUDITORS' REPORT (Continued)**  
**EXHIBIT A**  
**Significant Deficiency**  
**September 30, 2019**

2. **User Administration and Least Privilege** – We noted NASA did not require all types of temporary elevated access roles to be consistently logged and that there was an option for permanent assignment of temporary elevated access roles with no logging. We also noted financial supporting systems users' access rights were not consistently recertified. Finally, we noted instances where not all available application layers of security were being utilized to form a comprehensive layered “defense in depth” approach.
3. **Audit Logging and Monitoring** – NASA did not have a consistent and effective process to comprehensively review audit logs for financial systems and their supporting databases to address suspicious and potentially harmful activity.

NASA did not follow internal and Federal standards in implementing configuration management and access controls as required 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) outlines the mitigation requirements for non-mission systems as follows: expedited patches within seven business days; non-expedited patches within 30 days; high and medium vulnerabilities from monthly scans within 30 days of scan date; high and medium vulnerabilities from quarterly scans within 90 days from scan date; and 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, configuration management and access controls note the following:
  - AC-2, Account Management, states that an organization creates, modifies, disables, and removes information system accounts in accordance with organizational defined procedures.
  - AC-5, Separation of Duties, states that an organization must separate organizationally defined duties of individuals, document separation of duties of individuals, and define information system access authorizations to support separation of duties.
  - AC-6, Least Privilege, states that an organization must employ the principle of least privilege, allowing only authorized access for users (or processes acting on behalf of users) which are necessary to accomplish assigned tasks in accordance with organizational missions and business functions.

## INDEPENDENT AUDITORS' REPORT (Continued)

### EXHIBIT A

#### Significant Deficiency

September 30, 2019

- 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.
  - CA-7, Continuous Monitoring, states that the organization develops a continuous monitoring strategy and implements a continuous monitoring program that includes response actions to address results of the analysis of security-related information.
  - CM-7, Least Functionality, states that an organization configures the information system to provide only essential functions; and prohibits or restricts the use of functions, ports, protocols, and services based on organizational defined prohibited or restricted functions, ports, protocols and/or services.
  - SC-7, Boundary Protection, states that the information system monitors and controls communication at the external boundary of the system and at key internal boundaries within the system
  - 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.
  - SI-3, Malicious Code Protection, states that an organization employs malicious code protection mechanisms at information system entry and exit points to detect and eradicate malicious code.
- NIST SP 800-40, Revision 3, *Guide to Enterprise Patch Management Technologies*, states that patches 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 have provided NASA management with separate notices of findings and recommendations and a limited distribution report that further details IT control deficiencies and vulnerabilities in NASA's systems. Due to the sensitivity of the subject matter, we have not discussed those matters in detail in this report.

#### **Recommendations:**

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

1. Improve the patch and vulnerability management program.
2. Eliminate configuration weaknesses.

**INDEPENDENT AUDITORS' REPORT (Continued)**  
**EXHIBIT A**  
**Significant Deficiency**  
**September 30, 2019**

3. Improve technical controls, including controls that monitor and control communications at the boundary of information systems.
4. Improve the scope and extent of segregation of duties monitoring controls.
5. Improve user administration controls, specifically around temporary elevated access and user access recertification.
6. Utilize available layers of application security controls to enhance the existing “defense in depth” approach.
7. Improve the scope and extent of financial system audit logging and review controls.

**INDEPENDENT AUDITORS' REPORT (Continued)**  
**EXHIBIT B**  
**Management's Response**  
**September 30, 2019**

National Aeronautics and Space Administration

**Headquarters**  
Washington, DC 20546-0001



November 15, 2019

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 Fiscal Year (FY) 2018 and FY 2019. The Office of the Chief Financial Officer (OCFO) commitment to sound financial management is clearly reflected in the audit opinion. For the ninth year in a row, the OCFO has led NASA to receive 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 one significant deficiency, related to NASA's vulnerability management process and the financial systems' general application controls. NASA's response to this deficiency is provided below.

**NASA's Vulnerability Management Process**

The annual financial statement audit provides NASA with valuable insight into enhancement opportunities to protect the confidentiality, integrity, and availability of Agency financial data. NASA continues improvements of the vulnerability management program by holding system owners accountable, increasing management visibility, and refining vulnerability detection efforts.

While the vulnerability management process tracks and addresses all vulnerabilities, immediate emphasis remains on any Critical and High vulnerabilities identified through critical work such as the annual financial statement audit. NASA was pleased to learn that the FY19 Vulnerability Assessment and Penetration Testing Report noted significant reductions in vulnerabilities totals from prior years.

NASA appreciates that CLA revised its approach for Common Vulnerabilities and Exposures (CVE) calculations. The revised CVE calculation reflected significantly more favorable trends that NASA feels are a more accurate visualization of the data. Additional noted accomplishments since prior year testing include the decrease in configuration weaknesses and unsupported software.

**INDEPENDENT AUDITORS' REPORT (Continued)**  
**EXHIBIT B**  
**Management's Response**  
**September 30, 2019**

**Financial Systems' IT General Application Controls**

CLA's Auditors' Report Exhibit A, indicates the following deficiencies in NASA's Defense in Depth (DiD) related to its financial systems' general application controls: 1) SAP Segregation of Duties (SOD) Enforcement and Monitoring, 2) User Administration and Least Privilege, and 3) Audit Logging and Monitoring. NASA continues to make improvements in this area as evidenced by the actions outlined below:

**1. SAP Segregation of Duties (SOD) Enforcement and Monitoring**

NASA has implemented a number of countermeasures to reduce the likelihood and overall risk associated with identifying, responding to, and resolving unauthorized sensitive activities in a timely manner. During FY 2019, an additional layer of SOD controls were implemented at the transaction code level after a thorough analysis of the transactions being utilized in NASA's environment. NASA takes issue with the fact that CLA has never found, nor brought to NASA's attention any specific missing SOD conflicts at any level (role level, transaction level, nor authorization object level) to support this finding.

**2. User Administration and Least Privilege**

NASA takes access and authorization to NASA's SAP Core Financial system seriously. We continue to make improvements in the Temporary Elevated Access Grant (TAG) management process. In FY 2019, we implemented a new automated TAG workflow, which enforces a number of countermeasures that reduces the likelihood of users gaining unauthorized access. It is important to note that not all TAGs requests result in elevated or privilege access whereas global system-wide changes could be made or security-relevant functions could be performed.

**3. Audit Logging and Monitoring**

NASA has taken steps to address auditable event logging and monitoring requirements for the SAP environment via the implementation and configuration of AlienVault. The current use of AlienVault is an interim solution, which will be retired once event logging and monitoring is migrated to the Agency's Security Information and Event Management solution. CLA's review identified potential opportunities to strengthen NASA's DiD controls, some of which have already been addressed and the remainder are being evaluated. NASA will continue to work with the auditors to address and resolve this issue in the coming fiscal year.

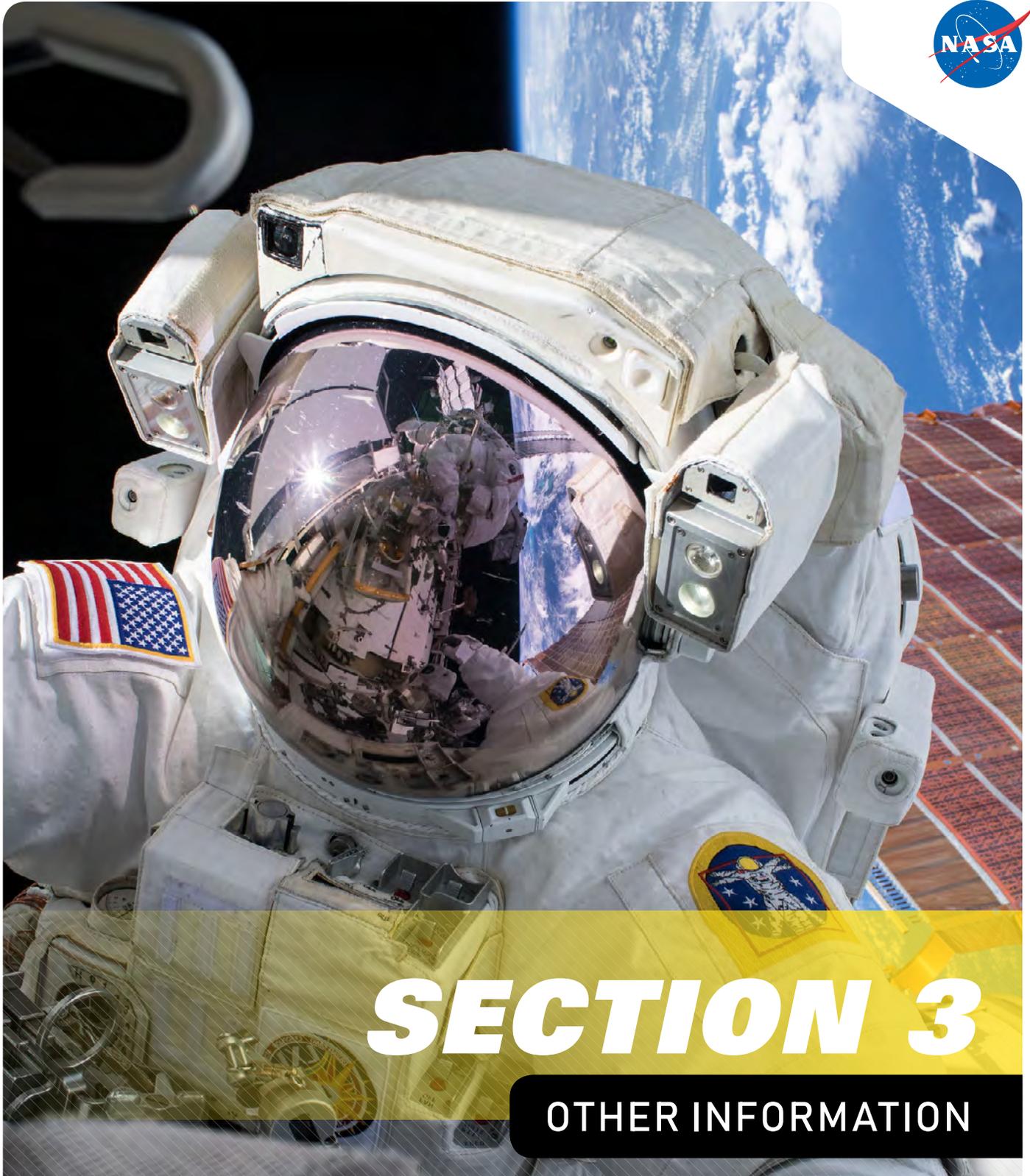
I appreciate the efforts and leadership of NASA's OIG and of the auditors throughout the audit of NASA's financial statements and related internal controls over financial reporting. Please convey my sincere appreciation and thanks to your team for the professionalism and cooperation exhibited during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

  
 Jeff DeWit  
 Chief Financial Officer

**INDEPENDENT AUDITORS' REPORT (Continued)**  
**EXHIBIT C**  
**Status of Prior Year's Significant Deficiency**  
**September 30, 2019**

Our assessment of the current status of the prior year control deficiency is presented below:

<b>Fiscal Year 2018 Finding</b>	<b>Fiscal Year 2019 Status</b>
<b>Significant Deficiency 1 – Information Technology Management</b>	Repeat – See Exhibit A.



# SECTION 3

## OTHER INFORMATION

NASA astronaut Andrew Morgan conducts a spacewalk at the Port- 6 (P6) truss structure work site to upgrade International Space Station power systems. He was photographed by fellow NASA astronaut Christina Koch as they worked outside in the vacuum of space for seven hours to begin the latest round of upgrading the station's large nickel-hydrogen batteries with newer, more powerful lithium-ion batteries. **Photo Credit: NASA**



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**NASA**

National Aeronautics and Space Administration

**Office of Inspector General**

# 2019 REPORT ON NASA'S TOP MANAGEMENT AND PERFORMANCE CHALLENGES

**November 13, 2019**







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# MESSAGE FROM THE INSPECTOR GENERAL

Throughout its 60-year history, NASA has stood at the forefront of aeronautics, science, and space exploration, responsible for numerous scientific discoveries and technological innovations. In NASA’s first half century, long-term space flight priorities such as Apollo, the Space Shuttle Program, and the International Space Station (ISS or Station) progressed through formulation, development, and operation over the course of decades and multiple presidential administrations and congresses. However, over the past 10 years the Agency’s space exploration priorities have shifted from the Constellation Program’s lunar ambitions to an asteroid retrieval effort focused on developing technologies to enable a human mission to Mars and then back to a planned but recently expedited crewed return to the Moon. While human exploration of Mars has remained a consensus long-term exploration goal throughout the past decade, the lack of stable mid-term human exploration priorities has left NASA lurching from major program to major program, expending time and resources to plan and replan instead of focusing on a clear, unified, and sustaining vision. Consequently, achieving a constancy of purpose is perhaps the greatest overall challenge facing NASA.

As required by the Reports Consolidation Act of 2000, this report presents the Office of Inspector General’s (OIG) independent assessment of the top management and performance challenges facing NASA. Looking to 2020, we identified seven challenges and linked each challenge to one of NASA’s strategic objectives (see Table 1).<sup>1</sup>

**Table 1: NASA Top Management and Performance Challenges for 2020**

Challenge	NASA Strategic Objective
Landing Humans on the Moon by 2024	<i>NASA Strategic Objective 2.2:</i> Conduct exploration in deep space, including to the surface of the Moon
Improving Management of Major Projects	<i>NASA Strategic Objective 1:</i> Expand human knowledge through new scientific discoveries <i>NASA Strategic Objective 2:</i> Extend human presence deeper into space and to the Moon for sustainable long-term exploration and utilization <i>NASA Strategic Objective 4.3:</i> Assure safety and mission success
Attracting and Retaining a Highly Skilled Workforce	<i>NASA Strategic Objective 4.4:</i> Manage human capital
Sustaining a Human Presence in Low Earth Orbit	<i>NASA Strategic Objective 2.1:</i> Lay the foundation for America to maintain a constant human presence in low Earth orbit enabled by a commercial market
Improving Oversight of Contracts, Grants, and Cooperative Agreements	<i>NASA Strategic Objective 4.1:</i> Engage in partnership strategies
Addressing Long-standing IT Governance and Security Concerns	<i>NASA Strategic Objective 4.5:</i> Ensure enterprise protection
Sustaining Infrastructure and Facilities	<i>NASA Strategic Objective 4.6:</i> Sustain infrastructure capabilities and operations

Source: NASA OIG analysis.

<sup>1</sup> NASA, *NASA Strategic Plan 2018* (February 12, 2018). See: [https://www.nasa.gov/sites/default/files/atoms/files/nasa\\_2018\\_strategic\\_plan.pdf](https://www.nasa.gov/sites/default/files/atoms/files/nasa_2018_strategic_plan.pdf) (last accessed September 18, 2019).

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 NASA’s part. Rather, all of these issues are long-standing and inherently difficult challenges central to the Agency’s mission and, as such, will likely remain challenges for many years. Consequently, these issues require consistent, focused attention from NASA management and ongoing engagement on the part of Congress, the public, and other stakeholders.

Not surprisingly, given the importance and scope of the issues, this year’s list includes many of the same themes discussed in previous reports. However, for this report we updated our approach to presenting the challenges to highlight progress NASA has made in addressing these issues and the work the Agency still needs to complete. To further aid the Agency, we have also linked each challenge to a NASA strategic objective, as noted above in Table 1.

In this report and in all its undertakings, the OIG is committed to providing independent, aggressive, and objective oversight of NASA programs and projects with the singular goal of improving the Agency. To that end, we plan to conduct audits and investigations in the coming year that focus on NASA’s continuing efforts to meet these and other challenges.



Paul K. Martin  
Inspector General



compared to each program's baseline cost commitments.<sup>2</sup> Artemis 1 is scheduled to launch and orbit the Moon by November 2020, while Artemis 2 is planned to orbit the Moon by 2023. However, the Artemis 1 date may slip further and that, in turn, may impact the Artemis 2 launch date. NASA's third SLS mission—Artemis 3—is scheduled to land crew on the Moon's surface in 2024 using a lunar lander that docks with Orion and the Gateway.

In 2018, we found that SLS Core Stage development was significantly behind schedule and the associated contract with The Boeing Company (Boeing) would need to be increased by more than \$2 billion to complete the production of two Core Stages without even finishing development work on the Exploration Upper Stage. Additionally, we found NASA's award fees overly generous in light of the program's significant cost increases and schedule slippage and recommended reforms to ensure poor contractor performance is reported to the award fee rating officials. Orion has also struggled to meet its schedule due in part to delays tied to development of its Service Module, a critical element that provides propulsion, air, water, and power to the crew module while in space. For its part, the EGS Program is working to complete launch control software while also managing late requirements changes and cost overruns. The new, second Mobile Launcher and an upgraded version of the SLS rocket present longer-term challenges to EGS.

NASA is moving forward to either develop or purchase the additional capabilities needed to meet its goal of landing humans on the Moon by 2024. In May 2019, NASA awarded a contract to Maxar Technologies to develop power, propulsion, and communications capabilities for the Gateway. NASA is also in early stages of awarding a sole-source contract to Northrop Grumman Aerospace Systems to develop and deliver the Gateway's habitation module. In August 2019, the Agency also announced plans for Marshall Space Flight Center to lead the development of the lunar lander program with Johnson Space Center responsible for developing the lunar ascent spacecraft.

## ● Key Implemented Recommendations

Establish more rigorous cost and schedule estimates for the SLS and EGS programs for the Artemis 2 mission mapped to available resources and future budget assumptions and independently reviewed by the Office of the Chief Financial Officer (IG-17-017).

## Work That Needs to Be Done

Achieving the ambitious goals of landing humans on the Moon by 2024 and Mars in the 2030s will require strong, consistent, and sustained leadership by the President, Congress, and NASA. For its part, NASA must determine the long-term costs, set realistic schedules, define system requirements and mission planning, form or firm up international partnerships, and leverage commercial space capabilities. To this end, our oversight work has found NASA consistently struggling over the past decade to set realistic program cost and schedule goals. Therefore, the accelerated timetable for a lunar landing set out in the Artemis program further increases the risk of inefficient development programs or contract awards with increased costs due to limited competition or unstable program requirements.

<sup>2</sup> GAO, *NASA Human Space Exploration: Persistent Delays and Cost Growth Reinforce Concerns over Management of Programs* (GAO-19-377, June 19, 2019).



# Improving Management of Major Projects

## Why This Is a Challenge

While NASA continues to stand at the forefront of aeronautics, science, and space exploration, many of the Agency's major projects—those with an estimated life-cycle cost of more than \$250 million—cost significantly more and take much longer to complete than originally planned. Cost increases and schedule slippage with major ongoing projects such as the Mars 2020 mission, James Webb Space Telescope (JWST), and the SLS can have a cascading effect across other NASA projects. For example, for the past 2 years the Agency has proposed terminating funding for the Wide Field Infrared Survey Telescope (WFIRST), NASA's next major astrophysics telescope, largely due to increased funding requirements and continued delays for JWST, which as of May 2019 was \$4.4 billion over budget and 81 months delayed.<sup>3</sup> The Agency has argued that funding both JWST and WFIRST at the same time would require redirecting money from other programs, thereby disrupting the balance of the Agency's overall science portfolio. To date, Congress has disagreed and in FY 2019 appropriated \$312.2 million for WFIRST.

Cost increases and schedule delays are long-standing challenges for the Agency. Since its first annual assessment in 2009, GAO has consistently reported on cost growth and schedule delays in the Agency's major projects.<sup>4</sup> For example, in its 2019 assessment GAO found that cost and schedule performance of major projects had deteriorated over the prior year with 9 of 17 projects in development reporting an average cost growth of 27.6 percent over the Agency Baseline Commitment and average launch delays of approximately 13 months.<sup>5</sup> GAO noted the deterioration in cost and schedule performance was largely due to integration and test challenges on JWST and continued production challenges for the SLS.

In our oversight work over the years, we have identified several factors that affect NASA's ability to complete major projects within planned cost and schedule, including

- *Culture of Optimism.* Although optimism encourages innovation, it may also prevent leaders from making critical assessments of requirements, budgets, and schedules to determine what a project can realistically accomplish within a set budget and timetable. Furthermore, few projects in NASA's recent past have been canceled because of poor cost and schedule performance, and this reality fosters a "too big to fail" mentality that pervades Agency thinking when it comes to NASA's larger and most important missions. However, this culture may be beginning to change. In July 2019, the Administrator cited unrealistic cost and schedule estimates as a reason for removing two top executives within the Human Exploration and Operations Mission Directorate.

<sup>3</sup> GAO, *NASA: Assessments of Major Projects* (GAO-19-262SP, May 30, 2019).

<sup>4</sup> GAO, *NASA: Assessments of Selected Large-Scale Projects* (GAO-09-306SP, March 2, 2009).

<sup>5</sup> GAO-19-262SP. The Agency Baseline Commitment contains the cost and schedule parameters NASA submits and is held accountable by the Office of Management and Budget and Congress.



appropriate insight and oversight.<sup>7</sup> Among other things, NASA plans to strengthen Earned Value Management practices, improve the Human Exploration and Operations Mission Directorate's internal portfolio analysis and planning, and enhance the Agency's annual strategic review process.<sup>8</sup> The Agency has also used Independent Review Boards (IRB) or Teams to evaluate projects and make recommendations to improve project management and a mission's chance of success. For example, the October 2017 IRB review of the WFIRST project determined that reductions in scope and complexity were needed to fit the project's budget profile, while the June 2018 IRB review of JWST found that technical issues, including human errors, greatly impacted the project's development schedule. The JWST IRB review offered recommendations to maximize the mission's probability of success, including that NASA conduct an audit of designs, processes, and tests to identify undiscovered problems. The review also recommended that Northrop Grumman Aerospace Systems (the telescope's primary contractor) establish corrective actions in its training, personnel certification, and individual accountability processes as well as a robust testing, analysis, and inspection process.

Finally, domestic and international partnerships are playing an increasingly important role in NASA's development of major programs and projects. These collaborations can reduce NASA's investment through sharing of capabilities, expertise, and scientific research while cultivating positive relations among nations. For instance, NASA has partnered with several commercial companies through its commercial crew and cargo programs to develop safe, reliable, and cost-effective space transportation capabilities to support the ISS and other Agency needs in low Earth orbit. In addition, as the first major step to return astronauts to the Moon, NASA is working with nine U.S. companies to develop delivery services to the lunar surface through Commercial Lunar Payload Services contracts. Additionally, Canada has pledged to contribute a robotic arm to repair and maintain NASA's proposed Gateway, a lunar space station that will assist in ferrying astronauts to the surface of the Moon.

## ● Key Implemented Recommendations

Reassess the [Europa] Clipper JCL with launch vehicle risks for the Delta IV Heavy, Falcon Heavy, and SLS prior to Key Decision Point C and establishing the Agency Baseline Commitment (IG-19-019).

Establish more rigorous cost and schedule estimates for the SLS and EGS programs for the Artemis 2 mission mapped to available resources and future budget assumptions and independently reviewed by the Office of the Chief Financial Officer (IG-17-017).

Design a strategy for collaborating with international space agencies in their cislunar space exploration efforts with a focus on advancing key systems and capabilities needed for Mars exploration (IG-17-017).

Continue to work with international partners facing project funding issues, including developing alternate options to mitigate delivery delays and potentially reduce technical capability or non-inclusion of the instruments (IG-17-009).

<sup>7</sup> GAO first cited the Agency's acquisition management as a high risk in 1990. GAO, *High-Risk Series: Substantial Efforts Needed to Achieve Greater Progress on High-Risk Areas* (GAO-19-157SP, March 6, 2019), is the most recent in which NASA's acquisition management is cited as a high risk. NASA's corrective action plan is located at [https://www.nasa.gov/sites/default/files/atoms/files/nasa\\_high\\_risk\\_corrective\\_action\\_plan\\_2018.pdf](https://www.nasa.gov/sites/default/files/atoms/files/nasa_high_risk_corrective_action_plan_2018.pdf) (last accessed September 3, 2019).

<sup>8</sup> Earned Value Management is an integrated management control system for assessing, understanding, and quantifying what a contractor or field activity is achieving with program dollars.

## Work That Needs to Be Done

NASA must redouble its efforts to ensure that its science and space exploration projects meet cost, schedule, and performance goals. Given a limited budget to fund multiple ambitious projects, it is critical that NASA implement planned changes to its JCL policy, as well as demonstrate sustained progress completing initiatives in its December 2018 corrective action plan. Furthermore, as the Agency seeks to implement an expedited timetable with the Artemis program to land humans on the Moon by 2024, this challenge presents NASA with an opportunity to fundamentally change how it develops and manages major projects. NASA's Administrator has challenged leaders to temper the Agency's culture of optimism by requiring more realistic cost and schedule estimates, specifically citing the need to better manage the cost and schedule for Artemis. Those estimates can only be obtained by establishing well-defined and stable requirements and maturing technologies early in project development. In addition, Congress should ensure that funding is adequate, stable, and properly phased. Likewise, project managers must identify funding instability as a risk and account for it in risk mitigation strategies. Finally, the Agency needs to create a culture where leaders and staff are incentivized to develop realistic cost and schedule estimates and take steps to recognize, mitigate, and communicate risks to those estimates as soon as practicable.

### ○ Key Unimplemented Recommendations

Evaluate the impact on the entire Planetary Science Division budget portfolio if [Europa] Clipper's increased funding levels were disrupted and develop mitigation strategies (IG-19-019).

Require all Standing Review Boards to explicitly monitor and document variances from NASA's JCL policy—specifically regarding international partners and launch vehicle risks—and their potential cost and schedule impacts (IG-18-011).

Include cost as a factor in NASA's Journey to Mars feasibility studies when assessing various missions and systems (IG-17-017).

### *Ongoing and Anticipated Future Audit Work*

#### **NASA's Management of the Mobile Launcher**

This audit is examining the status of Mobile Launcher 1 as well as NASA's development plans for Mobile Launcher 2 and the extent to which the EGS Program is meeting cost, schedule, and performance goals related to the Mobile Launchers.

#### **NASA's Efforts to Manage Space Launch System Program Costs and Contracts**

This audit is evaluating how the SLS Program is tracking and reporting overall costs as well as NASA's effectiveness in controlling cost growth for four major SLS contracts, including the RS-25 engines, solid rocket boosters, and upper stage.

#### **Audit of Orion Multi-Purpose Crew Vehicle**

This audit is examining NASA's management of the Orion Program and its prime contractor, Lockheed Martin Corporation, and the extent to which NASA is meeting cost, schedule, performance, and affordability goals for the Artemis program.

**Management of the Stratospheric Observatory for Infrared Astronomy (SOFIA) Airborne Observatory**

This audit is assessing NASA's management of the SOFIA airborne observatory during its ongoing prime operations phase relative to cost, technical performance, and scientific achievements.

**Management of the Low-Boom Flight Demonstrator Project**

This audit is assessing to what extent NASA is managing the Demonstrator project to accomplish its technical objectives while meeting established milestones and controlling costs.

Additionally, we plan to initiate multiple reviews examining NASA's progress toward returning humans to the Moon under the Artemis program and continue reviewing the Agency's management of individual science missions.



Exacerbating NASA's workforce supply challenges is a potential retirement wave that could result in a significant loss of institutional knowledge and skills. Over the past 4 years, NASA's civil servant headcount has remained constant at around 17,000 employees, with about 65 percent of this workforce falling under the occupation category "science and engineering" (S&E). Within S&E, roughly half of the employees are over 50 years old. More concerning is that 28 percent of the total S&E employees, or roughly 3,000, are currently eligible to retire, with an additional 2,000 employees becoming eligible to retire within the next 5 years. NASA's current human resources modeling predicts only a small reduction in the Agency's S&E workforce given that many NASA employees continue to work well past their retirement eligibility date. However, before a large wave of retirements occur, it is imperative that NASA hire and begin developing the next generation of employees with the skills to manage its highly technical and largely contractor-driven space, science, and aeronautics projects.

## Progress in Addressing the Challenge

Over the past few years, NASA has taken several steps to improve workforce planning across the Agency. In 2012, the Agency began a broad look at its operating model, including reviewing mission support functions through the BSA. Additionally, the Agency created the Technical Capabilities and Assessment Team initiative, which helped assess NASA's technical capabilities, including workforce, and made recommendations for investing in, consolidating, or eliminating duplicative capabilities based on current and future mission requirements. As that process matured, NASA Headquarters assigned responsibility of monitoring technical capability to the Centers based on their technical specialties as they relate to STEM (i.e., science, technology, engineering, and math). The Centers work with capability leaders to provide workforce information and analyses on their specific discipline. Moreover, Technical Discipline Teams work across the Centers to look outside of the Agency, including academia, to strategically assess where NASA and the aerospace industry are heading and gauge the future supply of workers and skills based on technology development. The Agency highlights the opportunity to work on exciting missions and the goodwill of the NASA brand as potent recruiting and retention tools.

One of NASA's strategic goals is to inspire and engage the public as improved support of the education community and young professionals is critical to maintaining a sufficiently talented aerospace workforce supply.<sup>12</sup> To encourage the next generation of employees into aerospace and STEM, NASA is actively engaged in partnerships with nonprofit organizations and educational institutions using grants and fellowships. Funding to these groups comes through either the traditional education portfolio, managed by the Office of STEM Engagement, or the Mission Directorates. For the past 3 years, the Agency has proposed eliminating NASA's traditional education programs, which included funds for internships provided by Space Grants, minority engagement in K-12 education in the New Minority University Research and Education Project, university participation in the Established Program to Stimulate Competitive Research, and general STEM engagement in STEM Education and Accountability Projects.<sup>13</sup> Congress has disagreed and instead continues to fund these education programs. NASA's Mission Directorates also continue to engage the community through initiatives related to their space and science work. For example, the Launch Service Program's CubeSat Launch Initiative (CSLI) provides rideshare opportunities for small satellite payloads to fly on launches when space is available. These partnerships have provided regular educational opportunities for students in STEM disciplines. In FY 2018, NASA launched 21 CSLI CubeSats. Additionally, the Agency's Robotics Alliance Project (RAP)

<sup>12</sup> NASA Strategic Plan 2018.

<sup>13</sup> In FY 2019, the Office of STEM Engagement received \$110 million in funding that was not requested by NASA but appropriated by Congress.



NASA has access to several special hiring authorities that can help address its workforce gaps in highly specialized, critical skill areas. For example, the National Aeronautics and Space Act authorizes the Administrator to hire up to 425 scientific, engineering, or administrative employees (NASA excepted, or “NEX”) without regard to the Classification Act of 1949 rules for classifying positions and assigning pay rates. NASA is currently using less than 20 of these positions.<sup>16</sup> Given the Agency’s ambitious mission goals, it is important that NASA takes full advantage of such tools to meet its future workforce needs.

## ○ Key Unimplemented Recommendations

Associate Administrator for Science Mission Directorate to evaluate current and future critical technical staffing requirements by project over the next 5 years (IG-19-019).

The JPL Director to evaluate current and future critical technical staffing requirements, make staffing adjustments to the Europa Clipper project as necessary, and reassess Lander commitments (IG-19-019).

### *Ongoing and Anticipated Future Audit Work*

We will continue to monitor progress on the Agency’s 5-year workforce master plan and may initiate an audit to assess NASA’s workforce challenges. We will also continue to examine specific workforce issues as part of broader audits and reviews. For example:

#### **Management of the Stratospheric Observatory for Infrared Astronomy (SOFIA) Airborne Observatory**

The overall objective is to assess NASA’s management of the SOFIA airborne observatory during its ongoing prime operations phase relative to cost, technical performance, and scientific achievements.

#### **Management of the Low-Boom Flight Demonstrator Project**

The overall objective is to assess whether NASA is managing the Demonstrator project to accomplish its technical objectives while meeting established milestones and controlling costs.

#### **Management of NASA’s Planetary Science Portfolio**

The overall objective is to assess NASA’s management of its planetary science portfolio and examine whether it is achieving established goals and priorities.

#### **Audit of Orion Multi-Purpose Crew Vehicle**

This audit is examining NASA’s management of the Orion Program and its prime contractor, Lockheed Martin Corporation, and the extent to which NASA is meeting cost, schedule, performance, and affordability goals for the Artemis program.

<sup>16</sup> The National Aeronautics and Space Act, 51 U.S.C. § 20113(b) and the Classification Act of 1949, Title 5 U.S.C. Chapter 51.



consumer products. While human research and technology gaps remain, the Agency has studied and mitigated a number of health concerns associated with space travel.

Most significantly, NASA has matured the commercial launch market by introducing competition and helping develop new domestic space transportation capabilities. In April 2018, we reported that NASA had awarded \$17.8 billion towards development of commercial vehicles to deliver crew and cargo to the ISS through 2024. To date, these efforts include a successful, uncrewed test flight of Space Exploration Technologies Corporation's (SpaceX) crew vehicle to the ISS in March 2019. Boeing's uncrewed test flight currently is planned for late 2019 with crewed flights to follow in early 2020, dates we believe are unrealistic.

In June 2019, the Agency issued its Plan for Commercial Low Earth Orbit Development seeking to enable a commercially driven economy in a low-Earth orbit comprised of privately-owned, human-tended, or permanently-crewed platforms supported by U.S. crew and cargo transportation capabilities, no longer exclusively managed by the U.S. government.<sup>18</sup> In particular, NASA said it would make 5 percent of its ISS utilization resources available for commercial efforts and provided a pricing policy for delivering cargo to and supporting crew aboard the ISS for commercial activities. Furthermore, the Agency issued the Next Space Technologies for Exploration Partnerships Broad Agency Announcement in July 2019 that will allow commercial entities to enter into public-private partnerships to develop commercial destination technologies—including habitable modules, external platforms, and deployable structures—to the ISS.<sup>19</sup>

While all these actions are positive steps, the new commercialization policy does not have performance metrics to evaluate how effectively NASA is nurturing commercial markets, although the Agency did agree with a recommendation we submitted during our review of the interim directive to add language establishing future metrics. Further, additional clarity may be needed on how to manage commercial mission and private astronaut requests and how their activities could impact commercial crew and cargo missions and crew capacity on the ISS.

## ● Key Implemented Recommendations

Ensure there is a contingency plan for each human health risk not scheduled to be mitigated prior to 2024 (IG-18-021).

Establish goals for CASIS raising non-NASA funds to offset operating expenses (IG-18-010).

Improve coordination with other federal agencies involved in commercial space (IG-16-025).

<sup>18</sup> NASA, *NASA Plan for Commercial LEO Development* (June 7, 2019).

<sup>19</sup> NASA, *Next Space Technologies for Exploration Partnerships-2: Broad Agency Announcement NNH16ZCQ001K* (July 16, 2019). NASA released the initial *Next Space Technologies for Exploration Partnerships Broad Agency Announcement* in 2014 and made selections in 2015.



Moving forward, NASA will need to establish the framework for private operators to support and sustain ISS operations. This includes working with other agencies to ensure that the adoption of regulations for the commercial use of space promote economic growth while minimizing uncertainty for taxpayers, investors, and private industry.<sup>22</sup> More broadly, whether NASA decides to extend, increase commercialization of , or retire the ISS, the timing of each of these decisions has a cascading effect on the funding available to support space flight operations in low Earth orbit, ambitions for establishing a permanent presence on the Moon, and ultimately sending humans to Mars. The sooner NASA, the Administration, and Congress agree on a definitive path forward for the future of the ISS, the better NASA will be able to plan for that future.

## ○ Key Unimplemented Recommendations

Ensure there is a contingency plan for each exploration-enabling technology demonstration not scheduled to be fully tested by 2024 (IG-18-021).

Complete all end-of-mission critical systems and open work related to nominal and contingency deorbit operations (IG-18-021).

### *Ongoing and Anticipated Future Audit Work*

#### **NASA's Management of Crew Transportation to the International Space Station**

This audit examines contractor schedule delays and related safety concerns, NASA's plans for continuity of transportation to the ISS, and NASA's pricing and timing strategies for missions using contractor transportation.

In addition, we will continue to examine issues related to the Agency's efforts to facilitate commercialization in low Earth orbit.

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<sup>22</sup> 83 Fed. Reg. 24901, *Space Policy Directive 2: Streamlining Regulations on Commercial Use of Space* (May 30, 2018).



example, in 2012 we found the U.S. Space and Rocket Center in Huntsville, Alabama, used grant funds to maintain office space for the direct benefit of NASA civil service personnel contrary to federal and NASA regulations. In a separate 2016 audit, we found that the Texas Space Grant Consortium inappropriately awarded scholarships to students who were not U.S. citizens. Furthermore, NASA's persistent failure to adequately manage its cooperative agreement with CASIS to support the National Laboratory aboard the ISS has had a negative impact on the Agency's goal of building a commercial space economy in low Earth orbit. More recently, NASA improperly allowed the National Space Biomedical Research Institute to use \$7.8 million of cooperative agreement research funds to renovate and pay rent for laboratory space in a private building, an expenditure contrary to federal appropriations law.

NASA's contracts, grants, and cooperative agreements are also at risk of fraud and misconduct. In particular, the Agency's Small Business Innovation Research (SBIR)/Small Business Technology Transfer programs are a long-standing OIG concern. For example, a Delaware company and one of its co-owners agreed to pay \$2.75 million in a civil settlement to resolve allegations the company mischarged labor costs and falsely certified work it performed by duplicating the same work under multiple SBIR/Small Business Technology Transfer contracts. In another investigation, a subcontractor lab supervisor pled guilty to mail fraud for his participation in a decades-long scheme to defraud NASA and the Department of Defense's Missile Defense Agency (MDA). The criminal behavior involved the fraudulent alteration of material properties test results for parts manufactured for use in rockets and military hardware, poor materials that NASA maintains caused two satellite launch failures resulting in losses exceeding \$700 million.<sup>24</sup> The aluminum manufacturing company agreed to pay \$34.1 million in combined restitution to NASA, MDA, and commercial customers, and also agreed to forfeit \$1.8 million in ill-gotten gains. In another case, a software developer was sentenced to 3 months in federal prison after misrepresenting his company's financial condition in order to fraudulently obtain \$200,000 in grant funds from NASA and the National Science Foundation. Finally, the owners of a California-based nonprofit educational organization primarily funded through a cooperative agreement with NASA are currently on trial for conspiring to embezzle hundreds of thousands of dollars from the organization.

Collectively, our audit and investigative work has consistently shown that NASA's poor management and oversight of contracts, grants, and cooperative agreements has resulted in inappropriate expenditures, wasted taxpayer dollars, and negatively impacted the Agency's mission.

## Progress in Addressing the Challenge

While NASA has made some enterprise-wide changes to address challenges related to its procurement oversight and acquisition management, substantial progress appears slow. In what we view as a positive trend, NASA's use of award-fee contracts has diminished as a percentage of procurement dollars paid to businesses from 56 percent in FY 2014 to 48 percent in FY 2018. Furthermore, in 2016 the Agency revised the NASA Federal Acquisition Regulation Supplement to address a number of questionable practices we identified in a 2013 report, including award fees not justified by contractor performance and high ratings not supported by technical, cost, and/or schedule performance. However, NASA continues to struggle with proper oversight and application of award fees. For example, an October 2018 OIG audit found contract managers overseeing the SLS Stages Contract provided Boeing with \$64 million in questionable award fees between 2014 and 2017 despite the contractor being significantly

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<sup>24</sup> NASA's Orbiting Carbon Observatory launched in February 2009 and Glory satellite launched in March 2011 both failed to reach their orbits when their respective Taurus XL launch vehicles failed due to faulty materials provided by aluminum manufacturer, Sapa Profiles, Inc.



operations, and the limited authority of Headquarters to control budgets and implement change at the Center level. We have similar concerns with the Agency's ability to reorganize procurement management authority, operations, and oversight into a Headquarters-based, enterprise-level function.

## ○ Key Unimplemented Recommendations

Include requirements in the pending IT Transition Plan associated with NASA's contract with Caltech for implementation of continuous monitoring tools that provide the Agency's Security Operations Center with oversight of JPL network security practices to ensure they adequately protect NASA data, systems, and applications (IG-19-022).

Develop a community of practice to analyze what contract structure changes lead to the greatest efficiencies and to share these lessons learned with the Agency's procurement community (IG-19-014).

Establish policies and procedures as part of the *NASA Grant and Cooperative Agreement Manual* to periodically review a recipient's actual cost match and document award requirements are met prior to obligating the next increment of funding (IG-16-013).

### ***Ongoing and Anticipated Future Audit Work***

The Offices of Audits and Investigations, in conjunction with the OIG's Advanced Data Analytics Program, will continue to assist NASA in its acquisition oversight efforts by examining Agency-wide procurement and grant-making processes. These efforts will include steps NASA is taking to identify and mitigate grant fraud risks; auditing individual contracts, grants, and cooperative agreements; and investigating potential misuse of contract and grant funds. Examples of ongoing audits include:

#### **Management of the Stratospheric Observatory for Infrared Astronomy (SOFIA) Airborne Observatory**

The overall objective is to assess NASA's management of the SOFIA airborne observatory during its ongoing prime operations phase relative to cost, technical performance, and scientific achievements.

#### **NASA's Efforts to Manage Space Launch System Program Costs and Contracts**

This audit is evaluating how the SLS Program is tracking and reporting overall costs as well as NASA's effectiveness in controlling cost growth for four major SLS contracts, including the RS-25 engines, solid rocket boosters, and upper stage.

#### **NASA's Management of the Mobile Launcher**

This audit is examining the status of Mobile Launcher 1 as well as NASA's development plans for Mobile Launcher 2 and the extent to which the EGS Program is meeting cost, schedule, and performance goals related to the Mobile Launchers.

Additionally, we will continue to assess the impact of NASA's management and oversight of contracts, grants, and cooperative agreements relative to the Agency accomplishing its aeronautics, space, and science missions, as well as its ability to adequately protect its IT systems and data.



its critical data. For example, the failure to apply timely software patches increases the risk that known vulnerabilities will be exploited and unauthorized access could be gained, resulting in successful attacks on NASA's systems. In March 2017, a JPL server that runs source code used in ground operations for scientific spacecraft was compromised by foreign hackers because the system had not been patched on time and the system owner failed to timely review the application log to identify suspect activities. As a result, the intruders remotely executed a code on the server without authentication and were able to upload, manipulate, and execute files and commands.

## Progress in Addressing the Challenge

NASA has taken several actions to improve its IT governance structure over the past few years, such as revising its governance boards; updating board charters; defining the roles and responsibilities of positions within the OCIO IT structure; and hiring four senior leadership positions in IT security, including a permanent Senior Agency Information Security Officer (SAISO).<sup>28</sup> However, after changing its organizational structure to make the Agency CIO a direct report to the NASA Administrator in 2013 in response to an OIG recommendation, the Agency in May 2019 moved that position under the Mission Support Directorate. According to NASA, the change was made to support improved management of Agency IT as a strategic resource and facilitate resource allocation to needed areas of emphasis within OCIO. This change impacted NASA's FITARA grade and added another layer of management over the OCIO that could have once again negatively impacted the governance, authority, and insight issues they have been trying to correct.<sup>29</sup> Shortly after the June 2019 FITARA scorecard was released, NASA reversed this decision and the CIO again reports directly to the Administrator.

While NASA has taken steps to improve the Agency's overall security posture, including making progress in implementing cybersecurity initiatives and increasing Security Operations Center (SOC) capabilities, its overall information security program struggles to adequately protect NASA data from cyberattacks. In March 2015, we found that NASA's SOC was not adequately integrated into JPL's computer network operations resulting in a lack of oversight for some JPL systems. 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 report's recommendations, the Agency promised to improve SOC oversight at JPL. However, in April 2018 JPL discovered an account belonging to an external user had been compromised and used to illegally access its mission network. Given the network's architecture, the attackers were able to expand their access upon entry and move laterally across the JPL network. Classified as an advanced persistent threat, the attack exploited weaknesses in JPL's system of security controls and moved undetected within the network for approximately 10 months. Prior to detection and containment, the attacker exfiltrated approximately 500 megabytes of data from 23 files, 2 of which contained International Traffic in Arms Regulations information related to the Mars Science Laboratory mission. More recently, another Center experienced an intrusion where personally identifiable information was compromised. NASA is still reviewing the nature and extent of the intrusion.

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<sup>28</sup> Since 2007, 10 individuals had served as the Agency SAISO either in an acting or permanent role. The SAISO is responsible for Agency-wide IT security.

<sup>29</sup> The June 2019 FITARA grade was a D-. The minus attached to the grade denotes that the Agency CIO was no longer a direct report to the head of their agency.



## ***Ongoing and Anticipated Future Audit Work***

### **Audit of NASA's Distributed Active Archive Data Centers**

The objective of this audit is to assess NASA's management of the Distributed Active Archive Data Centers and the Earth Observing System Data and Information System's cloud transition efforts.

### **NASA's Policy and Practices Regarding the Use of Non-Agency IT Devices**

This audit is assessing NASA's policy and plans regarding the risks of using, or prohibiting the use of, personal IT devices to conduct Agency business.

### **Evaluation of NASA's Information Security Program under the Federal Information Security Modernization Act for Fiscal Year 2019**

As required by FISMA, this review will evaluate NASA's information security program for FY 2019.

In addition to our audit work, Special Agents in our Office of Investigations continue to investigate breaches of NASA's IT systems. The OIG works closely with NASA's Office of Counterintelligence, the OCIO, and the SOC to monitor and investigate network intrusions as well as other criminal and administrative issues. For example, the SAISO has been instrumental in providing the necessary access to NASA intrusion data as our Office of Investigations launched a threat hunting initiative in August 2019 to identify and track advanced cyber threats.



Irma, the Agency may face significant unplanned expenses for facility repairs following storms and other climate events. The impact of such events on NASA facilities could be mitigated to some extent by addressing deferred maintenance and making enhancements such as elevating buildings and improving storm water drainage.

## Progress in Addressing the Challenge

NASA's Construction of Facilities program focuses on modernizing the Agency's infrastructure into fewer, more sustainable facilities and repairing failing infrastructure to reduce overall maintenance costs. This has resulted in an increasing number of construction projects to eliminate or repurpose old or unused facilities. For example, in April 2019, NASA's Marshall Space Flight Center completed Building 4221, part of the refurbishment of the "4200 Complex" that included the demolition and replacement of old buildings with sustainable facilities. Additionally, as we reported in October 2018, the Agency is utilizing \$18 million in historic property lease proceeds at Ames to maintain facilities including the Unitary Planned Wind Tunnel, Arc Jet Complex, and Vertical Motion Simulator.

Furthermore, the Agency has initiated a number of significant infrastructure projects to support its Artemis program, such as refurbishing Kennedy Space Center's Vehicle Assembly Building and Launch Complex 39B for the launch of Artemis 1; activation of Stennis Space Center's B-2 Test Stand in preparation for the SLS rocket's Green Run testing; and constructing the new Modular Supercomputing Facility at Ames to run complex simulations in support of the Artemis program.

### ● Key Implemented Recommendation

Complete the ongoing comprehensive technical capabilities assessment and ensure the process is established into policy (IG-13-008).

## Work That Needs to Be Done

We have assessed a variety of infrastructure issues, including the Agency's environmental remediation efforts; management of NASA's historic real and personal property; efforts to "rightsized" the NASA workforce, facilities, and other supporting assets; construction of new assets such as test stands; and NASA's efforts to reduce unneeded infrastructure and facilities. Common themes from these reviews are NASA's slow implementation of corrective actions, inconsistent implementation of Agency policies, and a need for stronger life-cycle cost considerations in facility construction decisions.

In March 2017, we reported that after more than 4 years the Agency had yet to make key decisions about its capabilities or decide whether to consolidate or dispose of unused and unneeded facilities and other assets. 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.



## APPENDIX A: RELEVANT OIG REPORTS

### Landing Humans on the Moon by 2024

*NASA's Management of the Space Launch System Stages Contract* (IG-19-001, October 10, 2018)

*NASA's Plans for Human Exploration Beyond Low Earth Orbit* (IG-17-017, April 13, 2017)

### Improving Management of Major Projects

*NASA's Management of the Space Launch System Stages Contract* (IG-19-001, October 10, 2018)

*NASA's Surface Water and Ocean Topography Mission* (IG-18-011, January 17, 2018)

*NASA's Plans for Human Exploration Beyond Low Earth Orbit* (IG-17-017, April 13, 2017)

*NASA's Mars 2020 Project* (IG-17-009, January 30, 2017)

*NASA's Challenges to Meeting Cost, Schedule, and Performance Goals* (IG-12-021, September 27, 2012)

### Attracting and Retaining a Highly Skilled Workforce

*Management of NASA's Europa Mission* (IG-19-019, May 29, 2019)

*NASA's Surface Water and Ocean Topography Mission* (IG-18-011, January 17, 2018)

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

### Sustaining a Human Presence in Low Earth Orbit

*NASA's Management and Utilization of the International Space Station* (IG-18-021, July 30, 2018)

*NASA's Management of the Center for the Advancement of Science in Space* (IG-18-010, January 11, 2018)

*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)

*NASA's Efforts to Maximize Research on the International Space Station* (IG-13-019, July 8, 2013)

### Improving Oversight of Contracts, Grants, and Cooperative Agreements

*Cybersecurity Management and Oversight at the Jet Propulsion Laboratory* (IG-19-022, June 18, 2019)

*Ames Research Center Protective Services Contract* (IG-19-017, April 25, 2019)

*NASA's Strategic Assessment Contract (IG-19-015, March 28, 2019)*

*NASA's Engineering and Technical Services Contracts (IG-19-014, March 26, 2019)*

*NASA's Management of the Space Launch System Stages Contract (IG-19-001, October 10, 2018)*

*Audit of the National Space Biomedical Research Institute (IG-18-012, February 1, 2018)*

*NASA's Management of the Center for the Advancement of Science in Space (IG-18-010, January 11, 2018)*

*NASA's Efforts to Improve the Agency's Information Technology Governance (IG-18-002, October 19, 2017)*

*Audit of NASA Space Grant Awarded to the University of Texas at Austin (IG-16-013, February 18, 2016)*

*Extending the Operational Life of the International Space Station Until 2024 (IG-14-031, September 18, 2014)*

*NASA's Use of Award-fee Contracts (IG-14-003, November 19, 2013)*

*NASA's Efforts to Maximize Research on the International Space Station (IG-13-019, July 8, 2013)*

*Audit of NASA Grant Awarded to HudsonAlpha Institute for Biotechnology (IG-12-019, August 3, 2012)*

*Audit of NASA Grants Awarded to the Philadelphia College Opportunity Resources for Education (IG-12-018, July 26, 2012)*

*Audit of NASA Grants Awarded to the Alabama Space Science Exhibit Commission's U.S. Space and Rocket Center (IG-12-016, June 22, 2012)*

*NASA Should Reconsider the Award Evaluation Process and Contract Type for the Operation of the Jet Propulsion Laboratory (IG-09-022, September 25, 2009).*

## **Addressing Long-standing IT Governance and Security Concerns**

*Cybersecurity Management and Oversight at the Jet Propulsion Laboratory (IG-19-022, June 18, 2019)*

*Audit of NASA's Security Operations Center (IG-18-020, May 23, 2018)*

*NASA's Efforts to Improve the Agency's Information Technology Governance (IG-18-002, October 19, 2017)*

*NASA's Information Technology Governance (IG-13-015, June 5, 2013)*

## **Sustaining Infrastructure and Facilities**

*NASA's Progress with Environmental Remediation Activities at the Santa Susana Field Laboratory* (IG-19-013, March 19, 2019)

*Audit of NASA's Historic Property* (IG-19-002, October 22, 2018)

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

*NASA's Efforts to Reduce Unneeded Infrastructure and Facilities* (IG-13-008, February 12, 2013)



**National Aeronautics and Space Administration**

**Office of the Administrator**  
Washington, DC 20546-0001

November 6, 2019

**TO:** Inspector General

**FROM:** Administrator

**SUBJECT:** Agency Response to Office of Inspector General Report, “2019 Report on NASA’s 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 (OIG) report entitled, “2019 Report on NASA’s 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 2019 Report on NASA’s Top Management and Performance Challenges.

While we fundamentally agree that the seven areas outlined in your 2019 report constitute significant challenges for the Agency, we would like to highlight the following mitigation and remediation efforts relative to each challenge outlined in your report that have either been taken or are currently underway. We believe these efforts substantively demonstrate NASA’s commitment to addressing its most significant management and performance challenges faced by the Agency:

**Challenge 1: Landing Humans on the Moon by 2024**

NASA agrees that landing humans on the Moon by 2024 is a top management and performance challenge.

Significant progress has been made towards the launch of Artemis I, the first integrated test of NASA’s deep space exploration systems: the Orion spacecraft, Space Launch System (SLS) rocket and the ground systems at Kennedy Space Center (KSC) in Cape Canaveral, Florida. The Orion crew and service module is expected to ship to Plum Brook Station in November 2019 for environmental testing prior to being shipped to

KSC. SLS engines, boosters, Orion Stage Adapter, Interim Cryogenic Propulsion Stage, and Launch Vehicle Stage Adapter are all complete. The Core Stage will be completed and shipped to Stennis Space Center for Green Run testing in December 2019. Also in December, the Mobile Launcher will complete multi-element verification and validation and return to the Vehicle Assembly Building to support stacking.

NASA has continued to progress towards Artemis I while concurrently building flight hardware for Artemis II, and beginning long-lead procurements and planning for Artemis III.

NASA has also initiated activity for the commercial development of lunar human landing systems; a Gateway configuration aligned with minimally required systems for 2024 landing support for short duration surface missions; and lunar surface suit systems development with initial ground- and ISS-based testing.

For Gateway, NASA has accelerated plans and procurements for the lunar landing in 2024 by focusing development on the initial critical elements required to support Artemis III: the Power and Propulsion Element (PPE), the Habitation and Logistics Outpost (HALO), and logistics delivery services. NASA awarded the contract for PPE to Maxar Technologies in May 2019, and released requests for proposals for HALO to Northrup Grumman Innovation Systems in September 2019 and for Gateway Logistics Services in August 2019. Finally, a request for information for lunar surface suits under the Exploration Extra-Vehicular Activity project was released in October 2019.

For Human Landing Systems to the lunar surface, NASA plans to evolve an initial capability, focused on missions in 2024 and 2025, into a sustainable transportation system that will provide frequent access to the lunar surface for both crew and cargo delivery services. NASA further intends for public and private investments in lunar exploration capabilities to eventually expand to include surface elements necessary to support prolonged human exploration to accomplish increasingly advanced exploration goals, including a mission to Mars. To this end, NASA released a series of two solicitations under the Agency's Next Space Technologies for Exploration Partnerships (NextSTEP) Broad Agency Announcement (BAA) vehicle. In May 2019, NASA awarded contracts to eleven companies for human lunar lander studies under the NextSTEP Appendix E solicitation. In July and August 2019, NASA released draft BAAs for NextSTEP Appendix H, for the development and demonstration of systems to carry humans to the lunar surface by 2024. NASA received over 1,150 comments to these first two drafts, which the Agency used to update and streamline the partnership approach and empower industry to meet NASA's functional requirements, which were included in the final Appendix H solicitation issued in September 2019, with proposals due in early November 2019 and awards planned for late December 2019/early January 2020.

**Key Unimplemented Recommendations:*****Develop a corrective action plan for completing the two Core Stages and Exploration Upper Stage and brief that plan to Boeing and senior NASA officials to gain their approval (IG-19-001)***

In May of 2019, NASA and the OIG agreed on a path forward towards implementation of this recommendation. NASA provided documentation to the OIG in October 2019 in support of closure of this recommendation.

***Establish objectives, need-by dates for key systems, and phase transition mission dates for the Journey to Mars (IG-17-017)***

NASA agreed with this OIG recommendation and provided documentation in support of closure to the OIG in October 2019.

***Include cost as a factor in NASA's Journey to Mars feasibility studies when assessing various missions and systems (IG-17-017)***

NASA agreed that cost should be considered as a factor when assessing missions and systems for NASA's Moon to Mars efforts. The Agency is studying this and will provide details to the OIG, including cost estimates, as this work progresses.

**Challenge 2: Improving Management of Major Projects**

NASA is intensely focused on its mission of exploration. In support of this mission, the Agency has developed a rigorous process for program formulation, approval, implementation and evaluation. We view excellence in program management as a core capability, critical for enabling exploration. NASA's program management expertise brings together the people, resources and processes necessary to execute the most challenging and complex programs as we explore our world and our universe.

As NASA carries out the Administration's exploration plans, the Agency has been making steady progress on improving program planning and control, and increasing transparency for external stakeholders. NASA leadership continues to evaluate the considerable progress made to-date on implementation of the Agency's High Risk Corrective Action Plan (CAP) intended to address long-standing issues in this area, and is proceeding forward with a potential update to the CAP in 2020. NASA is also making substantial progress in the implementation of the Program Management Improvement and Accountability Act, specifically with regards to the assessment and improvement of program and project management practices for flight missions. The Agency is committed to pursuing the most critical changes to increase transparency, improve cost and schedule estimation, and maintain focus on accountability.

We take our responsibility as stewards of limited Federal resources very seriously and we will continue to apply all available authorities to accomplish our mission efficiently. At the same time, the Nation expects NASA to embrace big challenges it is presented with, consequently NASA must continue to accept risk. Our missions will continue to incorporate the leading edge of technology in the hostile environment of space. NASA missions must do things that have never been done before. Our missions will employ technologies that must be developed and tested on Earth, but can only be demonstrated in space. Innovation must remain at the core of everything NASA does, and we cannot encourage innovation and discovery without accepting some risk and some uncertainty.

NASA's challenge is to develop and improve the processes necessary to ensure both efficiency and accountability in what is inevitably a dynamic development environment. We appreciate that, in order to retain the confidence of Congress and the American people, we must execute; delivering missions on-cost and on-schedule while identifying and characterizing risks and related mitigation activities. NASA's monthly internal Baseline Performance Review chaired by the NASA Associate Administrator has been revamped to better reflect portfolio performance against external commitments, focus discussion on issues requiring leadership awareness, and accelerate the identification of solutions to challenges as they arise. NASA has also recently formed the NASA Acquisition Strategy Council to address acquisition decisions holistically under a single Decision Authority. NASA's renewed emphasis on strategic acquisitions will improve the Agency's efficacy in intelligently moving forward on large acquisitions and making data-driven decisions, ensuring a universal view of the aerospace industrial base, international partners, and NASA in-house performance and capacity.

Furthermore, the Science Mission Directorate (SMD) is launching an approximately seven-month Large Mission Study (LMS) in order to make and implement selected recommendations to ensure that SMD is more successful at delivering large strategic missions on time and within budget. The study will examine how NASA makes critical decisions during pre-formulation and formulation (Pre-Phase-A through Phase B) that either enable or prevent mission success. And it will examine how NASA addresses problems during implementation (Phases C through F) when solution space is limited and delays are expensive.

As we strive to return humans to the surface of the moon in 2024, NASA will continue to foster a culture where leaders and staff are incentivized to develop realistic cost and schedule estimates; take steps to recognize, mitigate, and communicate those estimates; and demonstrate progress in our program management improvement efforts.

**Key Unimplemented Recommendations:**

***Evaluate the impact on the entire Planetary Science Division budget portfolio if [Europa] Clipper's increased funding levels were disrupted and developed mitigation strategies (IG-19-019)***

***Require all Standing Review Boards to explicitly monitor and document variances from NASA's JCL policy –specifically regarding international partners and launch vehicle risk – and their potential cost and schedule impacts (IG-18-011)***

***Include cost as a factor in NASA's Journey to Mars feasibility studies when accessing various missions and systems (IG-17-017)***

With regard to the Key Unimplemented Recommendations cited above, SMD continues actively pursuing implementation, including but not limited to the Planetary Science Division's (PSD) on-going assessment of the impact of the Europa Lander mission, if selected, on the PSD's portfolio.

### **Challenge 3: Attracting and Retaining a Highly Skilled Workforce**

NASA agrees with the challenges identified in the *Attracting and Retaining a Highly Skilled Workforce* section of the report. One area of clarification is in regards to a reference to the Jet Propulsion Laboratory's (JPL) Clipper workforce being understaffed in critical skill areas. NASA would like to note that JPL is a Federally Funded Research and Development Center (FFRDC) and as such employs, its own workforce (non-civil servant) to achieve work contracted by NASA. NASA has no responsibility or authority over the JPL workforce.

There is agreement that as the Agency continues to implement the Artemis program, there will be greater stress placed on the workforce and Human Capital program. NASA is working with OPM to identify and implement as many hiring flexibilities as possible to allow the Agency to hire, retain, and reward the personnel necessary to ensure Artemis' success.

In reference to the American Institute of Aeronautics and Astronautics Congressional testimony regarding a nationwide shortage of workers for jobs requiring science, technology, engineering, arts, and mathematics impacting the entire aerospace community, NASA completely agrees. To that end, the Office of the Chief Human Capital Officer (OCHCO) continually looks for ways to more broadly recruit employees. Most recently, the Agency has embraced using LinkedIn as a way to more broadly advertise open positions, ensuring a broader reach of potential candidates who are actively and passively seeking opportunities.

Over the past year, NASA has been working to institute a new Workforce Master Plan as part of the Agency's Strategic Workforce Planning program. Mission Directorates and Centers were asked to complete a comprehensive review of the skills and workforce that is currently onboard and what will be needed in 5 years in the future. These submissions were rolled up and will be discussed at a future Senior Leadership Meeting. Additionally, the intent is to conduct this activity on an annual basis in order to continually refine the Agency's workforce needs.

Finally, OCHCO has been working to increase the use of the various hiring flexibilities that have been granted by OPM. In October 2019, a Human Resources Business Partner (HRBP) community meeting will be held at KSC. This workshop will include educational opportunities for HRBPs to continue to learn how and when best to use the various hiring flexibilities available. As NASA perfects the use of these flexibilities, it is also working with OPM to get additional flexibilities that will allow the Agency to be more agile and in line with private sector best practices.

**Key Unimplemented Recommendations:**

***Associate Administrator for Science Mission Directorate to evaluate current and future critical technical staffing requirements by project over the next 5 years (IG-19-019)***

***The JPL Director to evaluate current and future critical technical staffing requirements, make staffing adjustments to the Europa Clipper project as necessary, and reassess Lander commitments (IG-19-019)***

Regarding the Key Unimplemented Recommendations in the OIG's report IG-19-019 noted above, SMD is in the process of evaluating staffing procedures and requirements and anticipates to provide a detailed analysis in early 2020.

**Challenge 4: Sustaining a Human Presence in Low Earth Orbit**

The International Space Station (ISS) International Partnership and the ISS National Lab continue to 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 FY18 to FY19, crew time increased from 2820 to 2944 hours, an increase of 4.4 percent. In addition, the number of investigations increased from 2390 at the end of FY17 to 2872 at the end of FY19, an increase of 20 percent.

This is made possible by the combined ongoing efforts of the ISS Program, the ISS National Lab operator, 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 gained 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 are providing dividends in returning benefits to humanity, enabling the development of a commercial market and enabling deep space long duration exploration. Research clients are able to insert experiments into orbit in as little as four months. In recognizing that different resources are required for different types of research, NASA continues to evaluate the needs of the research community and add resources to alleviate limitations whenever possible.

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 here on Earth as reflected in the third version of the ISS Benefits to Humanity Document, which was released in June 2019 ([www.nasa.gov/stationbenefits](http://www.nasa.gov/stationbenefits)).

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 because of 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 Low Earth Orbit (LEO).

Over the past year, NASA has made significant progress with the SpaceX and Boeing on the certification effort of their respective crew transportation vehicles including the flight of the first SpaceX demonstration mission. In addition, NASA has secured limited seats on Soyuz vehicles for 2020 to allow for a continued U.S. Orbital Segment astronaut presence on the ISS through October of 2020.

In the area of commercialization, NASA has released a 5-part plan to enable economic development of LEO. NASA has released solicitations to enable commercial and marketing activities on ISS; flights of private astronaut missions; use of the ISS Node 2 forward port for a commercial element attached to ISS; a draft solicitation for free flying commercial LEO platforms; and multiple solicitations for ideas that would enable sustainable, scalable commercial demand for use of LEO.

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 of 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. The ISS Program continues to evaluate commercial crew readiness schedules and is working to identify options that ensure the U.S. has uninterrupted access to the ISS for U.S. and partner astronauts.

**Key Unimplemented Recommendations:**

***Ensure there is a contingency plan for each exploration-enabling technology demonstration not scheduled to be fully tested by 2024 (IG-18-021)***

In response to the OIG's recommendation, NASA requested closure in July 2019. However, a subsequent discussion to provide clarification to the OIG is pending.

***Complete all end of mission critical systems and open work related to nominal and contingency deorbit operations (IG-18-021)***

NASA is committed to developing a Space Station Program 51066 "ISS Deorbit Strategy and Contingency Action Plan" in cooperation with international partners. Efforts to develop the action plan are currently in progress.

**Challenge 5: Improving Oversight of Contracts, Grants, and Cooperative Agreements**

NASA's Office of Procurement (OP) continues to make strides intended to improve the contracting processes throughout the Agency and appreciates the investigative and audit work conducted by the OIG.

OP received approval by NASA's Mission Support Council (MSC) to implement its Mission Support Future Architecture Program (MAP) transformation approach which includes an enterprise approach to governance, hiring, training, performance metrics, new and improved IT tools, and knowledge sharing among the Procurement Workforce. The transformation included a realignment of OP's historical decentralized budget (labor, travel, and procurement) to a centrally controlled budget managed by NASA Headquarters' Office of Procurement. Supervision of the local Procurement Directors has also been realigned to Headquarters enabling consistency in management of procurement processes.

NASA continues to strengthen its overall procurement processes and policy by utilizing 23 designated institutional-related services categories. This strategic approach to procuring and managing the Contract Portfolio requires the contracting officer to coordinate the requirement(s) with the Procurement Portfolio Manager in the Office of Procurement and the Enterprise Requirement Manager in the Mission Directorate or requirements owning organization before moving forward with the acquisition. All major acquisitions are reviewed as a part of this process to determine whether a procurement will be centralized, regionalized or remain localized. This approach enables consistency in streamlined strategies, seeks to reduce unnecessary duplication, leverages Spend under Management, and enables insight into procurement operating cost.

Other key initiatives underway include strengthening acquisition planning to ensure that the right contract vehicle is utilized for the requirement; a strategic sourcing policy and web site to assist in optimizing the use of existing contract vehicles; and the NASA FAR Supplement (NFS) Quality Review Process which is a systematic approach for continually reviewing and updating relevant NFS parts and eliminating outdated and unnecessary policy.

NASA remains dedicated to ensuring and monitoring the coordination of criminal, civil, contractual, and administrative (suspension and debarment) fraud remedies through the Agency's Office of the General Counsel and with the representatives of the NASA Acquisition Integrity Program (AIP). NASA's AIP is responsible for ensuring that significant allegations of fraud on contracts, grants, cooperative agreements, funding instruments, and other commitments are identified, investigated, and prosecuted.

NASA is continuing its efforts to identify and implement activities and processes to strengthen the overall administration and management of its Federal financial assistance awards. Following the transition of the Grants Policy and Compliance Branch from OP to the Office of the Chief Financial Officer (OCFO), NASA has shifted its focus to developing clear lines of delineation between Contracting Officers and Grant Officers and Specialists. This focus enables NASA staff to hone Federal-wide grants management knowledge as it relates to the grants management regulations (2 CFR 200 and 2 CFR 1800), as well as practical day-to-day activities. In keeping with this new focus, OCFO is sunseting legacy Center processes and reinforcing the role of the NASA Shared Services Center to award and manage all grants and cooperative agreements. Enforcing the awarding and management of grants and cooperative agreements to be centralized at one Center enables better focus on training efforts and required skills for grants subject matter experts. This year NASA has developed and rolled out new agency wide training modules and mandatory templates and other job aids to assist in standardizing key processes.

Another major initiative underway includes the implementation of an enterprise-wide, end-to-end grants management system. The implementation of this system will increase agency efficiency, transparency and accountability as it relates to the management of Federal financial assistance awards.

**Key Unimplemented Recommendations:**

***Include requirements in the pending IT Transition Plan associated with NASA's contract with Caltech for implementation of continuous monitoring tools that provide the Agency's Security Operations Center with oversight of JPL network security practices to ensure they adequately protect NASA data, systems, and application (IG-19-022)***

NASA's Office of Procurement reasserts its commitment to assisting the Agency CIO with regard to ensuring implementation of this OIG recommendation.

***Develop a community of practice to analyze what contract structure changes lead to the greatest efficiencies and to share these lessons learned with the Agency's procurement community (IG-19-014)***

NASA's Office of Procurement continues efforts towards the implementation of all recommendations associated with this OIG audit report.

***Establish policies and procedures as part of the NASA Grant and Cooperative Agreement Manual to periodically review a recipient's actual cost match and document award requirements are met prior to obligating the next increment of funding (IG-16-013)***

OCFO is in the process of revamping the Grant and Cooperative Agreement Manual (GCAM), which is utilized by NASA Program Managers, Technical Officers and Grant Officers as internal guidance to implement government-wide and NASA-specific regulations. When done, the updated GCAM will address several open OIG recommendation, including the above referenced recommendation.

### **Challenge 6: Addressing Long-standing IT Governance and Security Concerns**

NASA's Information Technology (IT) provides foundational capabilities necessary to accomplish NASA's missions. NASA remains firmly committed to managing IT as a strategic resource to enable mission success, ensure effective communications and collaboration, and safeguard both the IT environment and the resources that support the Agency's priorities. NASA's focus on IT as a strategic resource began in 2014, establishing a basis for the work that continues today.

Several critical elements inform the deliberate process by which NASA continues improving the IT infrastructure and environment. These elements include making assessments to ensure that all NASA IT can be identified, monitored, protected, and, if necessary, removed from the environment and reducing duplications and inefficiencies, resulting in appropriate enterprise solutions. Simultaneously and in coordination with the above, the Office of the Chief Information Officer (OCIO) is executing the Agency's IT governance processes so that they are robust and a deliberative collaboration between the OCIO and every NASA stakeholder that complies with all laws, directives and requirements.

Building upon the foundation provided by NASA's Business Services Assessment (BSA) for IT initiated in 2015, the OCIO has, through streamlined governance which includes our key stakeholders, successfully transitioned to a new end user services contract; migrated to Office 365 (which provides improved, cloud-based collaboration tools); begun addressing NASA's legacy IT systems and applications through a targeted IT modernization Investment Fund; and, led change management efforts to restructure the process to Authorize Systems to Operate within NASA's IT environment. NASA's IT Governance also continues to drive portfolio value. Current governance processes approved an Agency Software Management Plan that yielded a \$55.37M cost avoidance (through the third quarter) for FY 2019 through smart buys and management of software licenses. For the third consecutive year, the current IT Governance processes also facilitated increased insight into NASA's \$2.17B FY 2021 IT portfolio and budget, broadening the mission's ability to participate, advocate and ultimately utilize Agency-wide resources. Additionally, in FY 2019, NASA named its first Chief Data Officer to lead data governance and lifecycle data management.

OCIO's increased participation in mission governance, boards, councils, and working groups has resulted in improvements to NASA IT management as well. The OCIO, in partnership with Mission Directorate and Center leadership, is actively working to strengthen how NASA plans for and operates IT, including cybersecurity, throughout the mission program and project lifecycle. As such, the NASA OCIO is an engaged member of Agency councils, such as the Agency Program Management Council and the newly established NASA Acquisition Management Board where the OCIO fosters communication, ensures mission alignment with IT objectives and conducts oversight of cybersecurity and IT spend in acquisitions.

In addition to increased participation in NASA mission governance boards, the OCIO has collaborated with missions to develop guidelines and reference materials to support addressing cybersecurity in the program and project management lifecycle. For example, the OCIO and SMD conducted extensive outreach briefings across the Agency to educate program and project managers on the criticality of cybersecurity and the resources available through the OCIO.

In FY 2019, the Agency continued work towards an even stronger Agency cybersecurity posture and continues to be a full partner in the Agency's Enterprise Protection Program, ensuring all layers of IT including those supporting mission projects, corporate services, and physical infrastructure are secure. NASA maintained the highest Federal Information Security Management Act rating of "Managing Risk" in FY 2019 while using the governance process to provide oversight for Agency-wide IT risk management. The OCIO's systematic approach led to the identification of board-approved risks that are reported at the NASA Baseline Performance Review quarterly.

Similarly, the NASA CIO's efforts to manage risk have resulted in proactive cybersecurity improvements that also lessen the implementation burden to NASA missions and customers. As an example, the IT environment at NASA's Michoud Assembly Facility was secured to enable manufacturing excellence "on the floor" in support of Artemis, providing safe and effective partner access. Another example is that suspicious/malicious emails are now blocked before reaching email inboxes, and web links embedded in delivered messages are pre-scanned, thereby allowing navigation to only those deemed safe and protecting mission information in the process.

OCIO improvements allowed for more proactive partnerships in cybersecurity to further support NASA missions and have been recognized within the Federal government for excellence. Recently, NASA's Senior Advisor for Cybersecurity was detailed to the Human Exploration and Operations Mission Directorate's Artemis Program to collaborate on cybersecurity. The OCIO has also been working with SMD for more than a year to streamline and clarify requirements and processes for developing system security plans for holistic mission security. Additionally, work is underway to secure partner access for collaborative work with the National Oceanic Atmospheric Administration and the European Space Agency.

NASA's Identity, Credential and Access Management program, a cross-Agency program responsible for multiple aspects of cyber- and physical security, earned second runner up for the National Security Agency's prestigious Frank B. Rowlett Award, which recognizes outstanding Federal Government excellence in the field of cybersecurity. NASA's award submission included letters of recommendation from Department of Homeland Security and the General Services Administration. In addition, NASA exceeded the Federal cybersecurity Cross-Agency Priority (CAP) goal for Intrusion Detection and Prevention by certifying that 100 percent of Government-furnished devices are scanned for malware before connecting to the network, enhancing NASA's ability to detect and prevent network intrusions. NASA also exceeded the CAP goal for Personal Identify Verification (PIV) card authentication by achieving 90 percent PIV card authentication for unprivileged users, 100 percent for privileged users, and developing PIV solutions for a variety of unique NASA systems via Continuous Diagnostics and Monitoring efforts, further solidifying the security of identity management and access on the Agency's network.

**Key Unimplemented Recommendations:**

***Include requirements in the pending IT Transition Plan for implementation of continuous monitoring tools that provide the NASA SOC with oversight of JPL network security practices to ensure they adequately protect NASA data, systems, and applications (IG-19-022)***

***Develop a charter and set of authorities signed by the NASA constituent executives, (including the NASA Administrator) that addresses the SOC's organizational placement, purpose, authority, and responsibilities (IG-18-002)***

***Reevaluate and implement necessary changes to the annual capital investment review process, its reporting requirements, and approval thresholds to ensure the Agency CIO gains adequate visibility and authority over all NASA IT assets (IG-18-022)***

With regard to the above, unimplemented recommendations, there is continued work to be done to achieve fully integrated IT governance, particularly IT Authority and Investment Management for NASA's full IT portfolio and for management of cyber risk. This work includes addressing the remaining audit recommendations in OIG reports IG-19-022; IG-18-020; and IG-18-002 in a way that enables continued mission success and aligns with Federal requirements. The OCIO recognizes this success is dependent on the Agency's continued support, partnership and collaboration with internal and external partners. With the execution of the Mission Support Future Architecture Program initiative, the OCIO looks forward to sustained IT transformation and the expected benefits of implementing an even more efficient IT operating model, while implementing a consistent enterprise architecture providing greater simplicity and effectiveness. Through robust partnerships and governance, NASA OCIO welcomes the opportunity to continue collaborating with mission and

mission support organizations to continue the improvements already under way to manage the full lifecycle of IT.

## **Challenge 7: Sustaining Infrastructure and Facilities**

NASA agrees with the characterization of this challenge and acknowledges that the underlying issues relate largely to the age and condition of our inventory. To address the challenges with obsolete facilities and structures, we have implemented a multi-pronged approach to either remove facilities from our inventory altogether or replace them through our renewal or recapitalization program. Over the past several years, NASA has gradually increased its funding for demolition of facilities and has had great success with a dedicated demolition program manager. NASA continues to invest in its recapitalization program to replace and consolidate into fewer, more modern and energy efficient facilities. Consistent with guidance from NASA's Business Services Assessment, NASA updated its prioritization process for repair and recapitalization. The Agency is also developing an Agency Master Plan to guide NASA Center updates of their Master Plans that will help drive the Agency's consolidation and footprint reduction efforts and drive investment in enduring capabilities.

NASA has also identified investment strategies in backlogged maintenance and reliability center maintenance efforts, such as condition-based maintenance to improve the condition of important building systems and facilities across the Agency, which will improve the reliability of NASA facilities to meet mission needs. Through investments in maintenance, demolition, repair and recapitalization, NASA strives to right-size the Agency's infrastructure to more modern and efficient facilities that will continue to meet NASA mission objectives.

### **Key Unimplemented Recommendations:**

***Pursue all available options—administrative, legal, or political—to ensure NASA's SSFL soil cleanup is performed in an environmentally and financially responsible manner based on the intended future use of the property (IG-19-013)***

The corresponding report (IG-19-013), identifies a variety of issues and concerns with implementing a soil cleanup at Santa Susana Field Laboratory (SSFL) as prescribed in the Administrative Order on Consent (AOC) utilizing the provisional Lookup Table (LUT) the State of California Department of Toxic Substance Control (DTSC) developed. Because of the significant increase in the soil volumes from NASA's 2013 Environmental Impact Statement (EIS) to the volumes reported in DTSC's Programmatic Environmental Impact Report (PEIR), NASA will supplement its soil evaluation in accordance with the National Environmental Policy Act (NEPA) to evaluate the issues identified by the OIG. The draft is expected to be available for public review in November 2019 and is scheduled to be completed by June 2020. NASA will continue to monitor DTSC's progress on its PEIR and final LUT for the cleanup phase.

NASA remains firmly committed to achieving a cleanup at SSFL that is protective of public health and the environment. NASA will continue to work with DTSC and all interested stakeholders to implement a cleanup that is based in science, technically achievable, protective of the surrounding community, and eliminates or greatly reduces significant damage to SSFL's habitat and cultural resources and the impacts to the community.

***Ensure NASA policies and procedures for using the proceeds from facilities leased under National Historic Preservation Act authority appropriately aligns with Agency goals to minimize excess facilities (IG-19-002)***

NASA's policy under the NASA Interim Directive 8800.114 for National Historic Preservation Act (NHPA) leases is consistent with the statute of NHPA, Section 111(b) (now 54 U.S.C. §306121(b)). The intent of Section 111 was to encourage Agencies to preserve historic properties that they steward and afford an Agency an opportunity to outgrant facilities they do not need for their missions as a means to support their continued preservation. Section 111 also provided the Agency the opportunity to invest NHPA lease proceeds towards the preservation of historic properties that would otherwise require diverting mission funds to the preservation of other historic properties stewarded by the Agency. As stewards of these historic properties, NASA continues to evaluate the viability of outgrants versus excess versus demolition of all of its facilities in an ongoing basis and has and will continue to demolish or divest of those properties that are deemed excess to the Agency's needs.

***Evaluate Capability Leadership Model assessments and teams to better ensure independence (IG-17-015)***

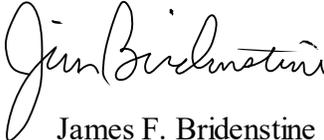
Capability Portfolio assessments need to be thorough and consistent to sustain the technical capabilities needed to successfully achieve mission objectives, inform Agency decisions, and reduce unneeded infrastructure and facilities. A significant milestone to addressing this was the recent approval of two Agency policy documents, NASA Policy Directive 8600.1, *Capability Portfolio Management*, and NASA Procedural Requirement 8600.1, *NASA Capability Portfolio Management Requirements*, which codify the principles, requirements, and processes necessary to inform Agency decisions to invest, divest, or consolidate unneeded infrastructure.

***Perform a comprehensive review of Program-funded construction projects to ensure adequate analysis, including all life-cycle costs, is completed prior to project initiation (IG-17-021)***

NASA Procedural Requirements (NPR) 8820, "Facility Project Requirements" mandates an analysis of life-cycle cost versus first cost to determine the best economic solution. NASA's Business Case Guide for Facilities Projects outlines the requirements to reflect OMB Circular A-94, "Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs" requirements. For discrete projects over

\$10 million, the Life-cycle Cost Analyses (LCAA) are submitted along with the budget narrative during development of the Congressional Justification, which is generally two years prior to the project initiation. Additionally, in accordance with OMB requirements and NASA's NPR, programs and projects with a life-cycle cost of \$250 million or greater shall be managed by program and project managers who have been certified in compliance with OMB's promulgated Federal acquisition program/project management certification requirements. NASA's NPR applies to all construction projects, both institutional or program funded.

If you have any questions regarding NASA's response to the 2019 Top Management and Performance Challenges, please contact Anthony Mitchell, Audit Liaison Project Manager, on (202) 358-1758.



James F. Bridenstine

cc:

Chief Financial Officer/Mr. DeWit

Chief Information Officer/Ms. Wynn

Chief Human Capital Officer/Mr. Gibbs

Associate Administrator for Human Exploration and Operations Mission Directorate/  
Mr. Bowersox (Acting)

Assistant Administrator for Procurement/Ms. Manning

Assistant Administrator for Strategic Infrastructure/Mr. Williams

## FY 2019 INSPECTOR GENERAL ACT AMENDMENTS REPORT

### Background

The Inspector General Act Amendments of 1988 (P.L. 100-504) require that Federal agencies report on the actions taken in response to Office of Inspector General (OIG) audit reports and corresponding audit recommendations. Specifically, the 1988 Amendments require agencies to report on: 1) Management Action Taken on OIG Reports containing Monetary Benefits and; 2) Management Action Not Taken on OIG Audit Reports in Excess of One-Year.

In addition, the Office of Management and Budget (OMB) outlines specific “action requirements” on Federal agencies in its Circular No. A-50, “Audit Follow-up.” The Circular requires that agencies ensure final management decisions on OIG audit recommendations are reached within 180-days after the issuance of an audit report and that corresponding corrective actions begin as soon as practicable.

Key terminology specific to NASA’s FY 2019 reporting under the Inspector General Act Amendments of 1988 follows:

**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, which 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 utilizes 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 implement 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.

Consistent with the requirements outlined in OMB Circular A-50, MSD monitors audit recommendations issued by the OIG to ensure that a final management decision is reached within 180-days of the issuance of a final audit report. A final management decision is reached when either: 1) Management agrees to implement corrective actions in response to an OIG audit recommendation; or 2) Management determines that implementing a particular audit recommendation is imprudent, impractical, or not cost beneficial. 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 A-50.

When a final management decision to implement an audit recommendation has been made, 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 actions, or unexpected delays in the formulation, review, and approval of NASA policies, procedural requirements, or regulations. In these instances, MSD engages with the OIG and respective NASA Component (e.g., 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 2019 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: 1) Questioned Costs; or 2) Funds to be Put to Better Use (FPTBU), as defined above. NASA's FY 2019 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 2019 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 A-50 requires

that final management decisions on OIG audit recommendations be made within 180-days of the issuance of a final audit report. Results of final management decisions made during FY 2019 are found in Section 3 of this report.

NASA's overall FY 2019 reporting in conjunction with the requirements of the Inspector General Act Amendments of 1988 and OMB Circular A-50, follows:

### 1. Management Action on OIG Reports with Monetary Benefits

The cumulative prior year carry-over amount of OIG identified monetary benefits pending final management action at the beginning of FY 2019, consisted of \$26,640,954 in questioned costs which were initially identified in two OIG audit reports issued in FY 2017<sup>1</sup>, and three OIG audit reports issued in FY 2018<sup>2</sup>.

During the course of FY 2019, the OIG issued two audit reports to NASA containing monetary benefits consisting of \$63,754,441 in questioned costs<sup>3</sup>; and one audit report containing \$211,742,117 in funds to be put to better use (FPTBU)<sup>4</sup>. Also during FY 2019, final management action was taken by NASA on \$8,057,300 in questioned costs initially identified by the OIG in one audit report issued in FY 2017 and three audit reports issued in FY 2018<sup>5</sup>.

Final management action remaining to be taken by NASA on current and prior-year OIG identified monetary benefits as of September 30, 2019, consists of a total of \$294,080,212 which is comprised of \$82,338,095 in questioned costs, and \$211,742,117 in FPTBU. These monetary benefits were identified in one OIG audit report issued to NASA in FY 2017<sup>6</sup>; one audit report issued to NASA in FY 2018<sup>7</sup>; and three audit reports issued in FY 2019<sup>8</sup>.

<sup>1</sup> "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).

<sup>2</sup> "Audit of the National Space Biomedical Research Institute" (IG-18-012; February 1, 2018); "NASA's Management of GISS: The Goddard Institute for Space Studies" (IG-18-015; April 5, 2018); and "Audit of NASA's Information Technology Supply Chain Risk Management Efforts" (IG-18-019; May 24, 2019).

<sup>3</sup> "NASA's Management of the Space Launch System Stages Contract" (IG-19-001; October 10, 2018); and "Audit of NASA's Management of Extended Temporary Duty Travel" (IG-19-007; November 28, 2018).

<sup>4</sup> "NASA's Progress with Environmental Remediation Activities at the Santa Susana Field Laboratory" (IG-19-013; March 19, 2019).

<sup>5</sup> "NASA's Research Efforts and Management of Unmanned Aircraft Systems" (IG-17-025; September 18, 2017); "Audit of the National Space Biomedical Research Institute" (IG-18-012; February 1, 2018); "NASA's Management of GISS: The Goddard Institute for Space Studies" (IG-18-015; April 5, 2018); and "Audit of NASA's Information Technology Supply Chain Risk Management Efforts" (IG-18-019; May 24, 2019).

<sup>6</sup> "Construction of Test Stands 4693 and 4697 at Marshall Space Flight Center" (IG-17-021; May 17, 2017).

<sup>7</sup> "NASA's Management of the Goddard Institute for Space Studies" (IG-18-015; April 5, 2018).

<sup>8</sup> "NASA's Management of the Space Launch System Stages Contract" (IG-19-001; October 10, 2018); "Audit of NASA's Management of Extended Temporary Duty Travel" (IG-19-007; November 28, 2018); and "NASA's Progress with Environmental Remediation Activities at the Santa Susana Field Laboratory" (IG-19-013; March 19, 2019).

**Table 1** summarizes NASA's actions taken with respect to monetary benefits identified in OIG audit reports issued during FY 2019, as well as residual (carry-over) monetary benefits identified in OIG audit reports issued in prior fiscal years, that required management action during FY 2019.

**Table 1: Management Action on OIG Audit Reports with Monetary Benefits  
For the Year Ended September 30, 2019**

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 2019)	5	\$26,640,954	0	\$0	\$26,640,954
Line 2 Plus: Audit reports with monetary benefits issued during FY 2019 requiring final management action	2	\$63,754,441	1	\$211,742,117	\$275,496,558
Line 3 Total audit reports with monetary benefits requiring final management action during FY 2019 [line 1 + 2]	7	\$90,395,395	1	\$211,742,117	\$302,137,512
Line 4 Audit reports with monetary benefits on which final management action was taken during FY 2019	4	\$8,057,300	0	\$0	\$8,057,300
Line 5 Ending Balance: Audit reports with monetary benefits awaiting final management action at the end of FY 2019 (carry-over into FY 2020)	4	\$82,338,095	1	\$211,742,117	\$294,080,212

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

As of September 30, 2019, a total of 62 recommendations in 31 OIG audit reports remain open in excess of one year since the issuance of the corresponding final audit reports. These 62 recommendations represent about 35 percent of the universe of 175 total open OIG recommendation as of September 30, 2019, and fall across seven broad functional areas:

- Human Explorations and Operations (13 recommendations);
- IT/Cybersecurity (13 recommendations);
- Infrastructure Management (11 recommendations);
- Acquisition Management (9 recommendations);
- Budget/Financial Management (7 recommendations);
- Earth/Space Science (5 recommendations); and
- Health/Safety/Security Management (4 recommendations)

Although these recommendations remain open in excess of one year after issuance of the corresponding audit reports, NASA management either has, or continues to, aggressively pursue those actions needed to fully implement the OIG's recommendations. NASA has completed corrective actions on 8 of the 62 recommendations (13 percent), and is currently awaiting the OIG's determination with regard to sufficiency of those actions for closure. Final management action on the remaining 54 OIG recommendations open in excess of one year since the issuance of the corresponding final audit reports are planned for completion between the first-quarter of FY 2020 and first-quarter of FY 2022.

By way of comparison and perspective, as of September 30, 2018, a total of 64 recommendations in 26 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.

**Table 2** summarizes those OIG audit reports and associated recommendations issued prior to FY 2019 that remain open in excess of one year after the issuance of the corresponding final audit reports.

**Table 2: OIG Audit Reports and Recommendations Open in Excess of One-Year  
(As of September 30, 2019)**

Report Date	Report No.	Report Title	Recommendations		
			Open	Closed	Total
8/8/2012	IG-12-017	<i>Review of NASA's Computer Security Incident Detection and Handling Capability</i>	2	1	3
7/22/2014	IG-14-026	<i>Audit of the Space Network's Physical and Information Technology Security Risks</i>	1	3	4
5/15/2015	IG-15-015	<i>NASA's Compliance with the Improper Payments Information Act for Fiscal Year 2014</i>	1	9	10
9/17/2015	IG-15-023	<i>NASA's Response to Orbital's October 2014 Launch Failure: Impacts on Commercial Resupply of the International Space Station</i>	1	6	7
2/18/2016	IG-16-013	<i>Audit of a NASA Space Grant Awarded to the University of Texas at Austin</i>	1	3	4
3/17/2016	IG-16-014	<i>NASA's Management of the Near Earth Network</i>	1	13	14
3/28/2016	IG-16-015	<i>Audit of the Spaceport Command and Control System</i>	1	0	1
5/12/2016	IG-16-021	<i>NASA's Compliance with the Improper Payments Information Act for Fiscal Year 2015</i>	1	4	5
6/28/2016	IG-16-025	<i>NASA's Response to SpaceX's June 2015 Launch Failure: Impacts on Commercial Resupply of the International Space Station</i>	2	4	6
11/2/2016	IG-17-003	<i>NASA's Earth Science Mission Portfolio</i>	1	1	2
2/7/2017	IG-17-010	<i>Security of NASA's Cloud Computing Services</i>	4	2	6
2/8/2017	IG-17-011	<i>Audit of Industrial Control System Security within NASA's Critical and Supporting Infrastructure</i>	5	1	6
3/9/2017	IG-17-012	<i>NASA's Management of Electromagnetic Spectrum</i>	1	1	2
3/21/2017	IG-17-015	<i>NASA's Efforts to "Rightsize" its Workforce, Facilities, and Other Supporting Assets</i>	1	3	4
3/29/2017	IG-17-016	<i>NASA's Parts Quality Control Process</i>	2	6	8
4/13/2017	IG-17-017	<i>NASA's Plans for Human Exploration beyond Low Earth Orbit</i>	2	4	6
5/15/2017	IG-17-020	<i>NASA's Compliance with the Improper Payments Information Act for Fiscal Year 2016</i>	1	8	9
5/17/2017	IG-17-021	<i>Construction of Test Stands 4693 and 4697 at Marshall Space Flight Center</i>	3	0	3
9/18/2017	IG-17-025	<i>NASA's Research Efforts and Management of Unmanned Aircraft Systems</i>	1	5	6
10/5/2017	IG-18-001	<i>NASA's Management of Spare Parts for its Flight Projects</i>	2	5	7
10/19/2017	IG-18-002	<i>NASA's Efforts to Improve the Agency's Information Technology Governance.</i>	1	4	5
1/11/2018	IG-18-010	<i>NASA's Management of the Center for the Advancement of Science in Space</i>	1	6	7
1/17/2018	IG-18-011	<i>NASA's Surface Water and Ocean Topography Mission</i>	1	5	6
2/28/2018	IG-18-014	<i>Review of NASA's Purchase and Travel Charge Card Programs</i>	1	4	5
4/5/2018	IG-18-015	<i>NASA's Management of GISS: The Goddard Institute for Space Studies</i>	3	5	8
4/26/2018	IG-18-016	<i>Audit of Commercial Resupply Services to the International Space Station</i>	1	4	5
5/14/2018	IG-18-017	<i>NASA's Compliance with the Improper Payments Information Act for Fiscal Year 2017</i>	3	0	3
5/29/2018	IG-18-018	<i>NASA's Management of Reimbursable Agreements</i>	8	3	11
5/24/2018	IG-18-019	<i>Audit of NASA's Information Technology Supply Chain Risk Management Efforts</i>	2	5	7
5/23/2018	IG-18-020	<i>Audit of NASA's Security Operations Center</i>	4	2	6
7/30/2018	IG-18-021	<i>NASA's Management and Utilization of the International Space Station</i>	3	2	5
<b>Totals</b>		<b>31</b>	<b>62</b>	<b>119</b>	<b>181</b>

### 3. Final Management Decisions Made Within 180-Days of Report Date

During FY 2019, the OIG issued 16 audit reports containing 124 recommendations addressed to NASA which required a final management decision within 180-days of the respective final report dates, in accordance with OMB Circular A-50. Final management decisions were made within 180-days of issuance of the corresponding final audit reports on 123 of the 124 (99 percent) OIG recommendations issued during FY 2019.

The one outstanding/unresolved recommendation issued during FY 2019 still pending resolution pertains to the OIG's June 2019 report entitled, "Cybersecurity Management and Oversight at the Jet Propulsion Laboratory" (IG-19-022; June 18, 2019). In the report, the OIG recommended among other things, that Jet Propulsion Laboratory (JPL) implement a threat-hunting process. NASA initially non-concurred with the recommendation since the OIG directed the recommendation at the JPL contractor (Caltech) versus NASA. During subsequent resolution activities, the recommendation has been properly re-attributed to NASA versus Caltech. A final management decision and corresponding resolution on the recommendation is expected during the 1st quarter of FY 2020.

For the five-year period ended September 30, 2019, 772 OIG audit recommendations in 87 audit reports were issued to NASA 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 771 (99 percent) of these recommendations, including the currently unresolved recommendation relating to JPL Cybersecurity, as noted above.

### 4. Audit Recommendation Closure Efficiency

During the course of FY 2019, a total of 135 OIG audit recommendations (including 124 recommendations issued in prior fiscal years) were closed based on responsive management action taken by NASA. Of the OIG recommendations closed during FY 2019, 76 percent relate to OIG audit reports issued during FY 2018 and FY 2019. The remaining 24 percent of OIG recommendations closed during FY 2019, relate to audit reports issued prior to FY 2018.

Of the 135 audit recommendations closed by the OIG during FY 2019:

- 78 recommendations (58 percent) were closed within one year of issuance of the associated audit reports;
- 40 recommendations (30 percent) were closed between one and two years of issuance of the associated audit reports; and
- 17 recommendations (12 percent) were closed in excess of two years of issuance of the associated audit reports

For comparative purposes, during FY 2018, a total of 192 OIG audit recommendations (including 146 recommendations issued in prior fiscal years) were closed based on responsive management action taken by NASA. Of the 192 recommendations closed by the OIG during FY 2018:

- 143 recommendations (74 percent) were closed within one year of issuance of the associated audit report;
- 34 recommendations (18 percent) were closed between one and two years of issuance of the associated audit report; and
- 15 recommendations (8 percent) were closed in excess of two years of issuance of the associated audit report

## IMPROPER PAYMENTS INFORMATION ACT (IPIA) ASSESSMENT

### Payment Integrity

Under the parameters set forth in Improper Payments Information Act (IPIA), Improper Payments Elimination and Recovery Act (IPERA), and Improper Payments Elimination and Recovery Improvements Act (IPERIA), agencies are required to perform a risk assessment of all programs and activities, identify programs and activities that are susceptible to significant improper payments, sample and estimate annual improper payments for susceptible programs and activities, and report the results to the President and Congress via the Agency Financial Report (AFR) or Performance and Accountability Report (PAR). Throughout the evolution of improper payment legislation and reporting, NASA has worked diligently to prevent and reduce improper payments, while maintaining compliance with legislative requirements through its Improper Payments Program. In FY 2019, the Agency executed the aforementioned responsibilities via the Improper Payment Risk Assessment. For additional details related to NASA Improper Payments, including all information previously reported in the AFR that is not included in the FY 2019 AFR, please visit <https://paymentaccuracy.gov/><sup>A</sup>.

Initially, the [Improper Payments Information Act of 2002 \(IPIA\) \(Public Law \(P.L.\) 107-300\)](#)<sup>B</sup> was enacted to detect and prevent improper payments made by Federal Government agencies in order to verify that taxpayer dollars are spent properly and efficiently. Congress amended the IPIA to enact the [Improper Payments Elimination and Recovery Act of 2010 \(IPERA\) \(P.L. 111-204\)](#)<sup>C</sup>. IPERA, as compared to IPIA, expanded the scope and level of detail required for improper payment reporting amongst executive agencies. On January 10, 2013, the [Improper Payments Elimination and Recovery Improvement Act of 2012 \(IPERIA\) \(P.L. 112-248\)](#)<sup>D</sup> was signed into law, further amending IPIA and IPERA. Throughout this evolution, NASA has stayed committed to preventing and reducing improper payments through its Improper Payments Program.

In 2013, additional improper payment legislation was ratified via the [Disaster Relief Appropriations Act \(Disaster Relief Act\) \(P.L. 113-2\)](#)<sup>E</sup>. The Disaster Relief Act, as signed, provided \$50.5 billion in aid for Hurricane Sandy disaster victims and their communities and detailed additional stewardship requirements for agencies receiving Hurricane Sandy appropriations. In order to provide implementation guidance for the principles presented in the Disaster Relief Act, the Office of Management and Budget (OMB) issued [Memorandum M-13-07, Accountability for Funds Provided by the Disaster Relief Appropriations Act](#)<sup>F</sup> which provided 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 IPIA (as amended). In February 2018, the [Bipartisan Budget Act of 2018 \(P.L. 115-123\)](#)<sup>G</sup> also became law. Similar to the Disaster Relief Act, it provided \$84.4 billion in emergency supplemental appropriations to respond to and recover from recent natural disasters. To provide guidance in administering and monitoring these funds, OMB released [Memorandum M-18-14, Implementation of Internal Controls and Grant Expenditures for the Disaster-Related Appropriations](#)<sup>H</sup>. The Memorandum mandates that Agency programs that disburse more than \$10,000,000 in emergency appropriations in one fiscal year shall be considered susceptible to significant improper payments for purposes of IPIA (as amended), and such programs shall report an improper payment estimate in the FY 2019 reporting cycle.

### Improper Payment Risk Assessment

NASA executed its FY 2019 Improper Payment Risk Assessment Methodology under the requirements set forth in OMB Circular A-123 Appendix C, Requirements for Payment Integrity Improvement. On an annual basis, NASA reviews and updates the risk assessment methodology to account for implementation of recommendations made by auditors, changes to improper payment legislation and guidance, changes to NASA’s operating environment, and other circumstances. Once updated, NASA performed its FY 2019 Improper Payments Risk Assessment employing the updated risk assessment methodology. This methodology incorporates seven (7) risk conditions, each with a set of related criteria designed to account for eleven (11) OMB-designated and NASA-specific risk factors.

OMB requires that each agency assess programs or activities deemed not susceptible to significant improper payments at least once every three years. Historically, NASA has not identified significant improper payments or found its programs to be susceptible to significant improper payments via risk assessment; therefore, NASA assessed such programs once every three years. In order to meet this requirement, NASA assesses approximately one third of all programs annually, selecting each program based on the most recent year of assessment and prior year assessment results. Accordingly, in FY 2019, the Improper Payment Risk Assessment Methodology was completed in two major phases: Identify and Select NASA Programs and Assess Improper Payment Risk.

#### 1. Identify and Select NASA Programs

NASA extracted the population (\$22.4 billion) of FY 2018 disbursements from its financial management system to develop a list of NASA programs eligible to be assessed

for the FY 2019 Improper Payment Risk Assessment. The universe of payments subject to analysis included disbursements to vendors, NASA employees, and other government agencies issued by NASA between October 1, 2017 and September 30, 2018. The disbursements were then analyzed and categorized by NASA mission and program. A review of the FY 2018 budget was performed. Within the Agency's financial management systems, programs listed within the budget were compared to the select programs identified for the assessment. Based on FY 2018 budgetary resources, materiality of disbursements, and the nature of program funding, there were 92 distinct programs.

In order to implement the approach stated in the OMB Circular A-123, NASA elected to select approximately one third of its programs for assessment in FY 2019 (35 of 92 programs). OMB Memorandum M-13-07, Accountability for Funds Provided by the Disaster Relief Appropriations Act, mandates that any programs or activities that receive appropriations under the Disaster Relief shall be deemed "susceptible to significant improper payments for the purposes of IPIA"<sup>1</sup>. The Hurricane Sandy, Irma, and Harvey projects (within the Institutional Construction of Facilities program) were identified as the NASA programs or activities receiving such funds; however, under OMB Circular A-123 Appendix C<sup>2</sup>, the Hurricane projects met the requirements for relief from improper payment reporting. NASA requested, and OMB granted, a waiver from the reporting requirements stipulated by the Disaster Relief Act and NASA, the Hurricane projects (Institutional Construction of Facilities program) on an annual assessment cycle. NASA selected the remaining 34 programs based on whether the program was new under review, whether there were any significant changes in the program within the fiscal year, and or when the program was last assessed. Once selected, the programs were confirmed by NASA management. The list of programs selected for assessment in FY 2019 is included below.

### **Figure 1: Programs Assessed during the FY 2019 Improper Payment Risk Assessment**

Advanced Air Vehicles Program  
Advanced Space Technology  
Center Management and Operations  
Early Stage Innovations and Partnerships  
Earth Science Technology  
Earth Systematic Missions  
Earth Systems Science Path Finder  
Exoplanet Exploration  
Exploration Technology Development

Gateway  
Heliophysics Research  
Institutional Construction of Facilities  
International Space Station (ISS) Program  
James Webb Space Telescope (JWST)  
Launch Services  
Living with a Star  
Lunar Discovery & Exploration  
Mars Exploration  
New Frontiers  
Orion Program  
Outer Planets  
PICS & Strategic Int  
Physics of the Cosmos  
Planetary Defense  
Planetary Science Research  
RMB-SCMD Programmatic  
Small Business Innovative Research/Small Business  
Technology Transfer  
Solar Terrestrial Probe  
Space Communication and Navigation (SCaN)  
Space Launch System  
Space Shuttle Program  
Space Technology Research and Development  
Technology  
Technology Demonstration  
Technology Maturation

## **2. Assess Improper Payment Risk**

NASA has designed an Improper Payment Risk Assessment Methodology which utilizes static sets of criteria categorized by risk conditions. These risk conditions and the related criteria are intended to provide a framework for analyzing quantitative and qualitative risk factors for each of NASA's programs. The risk assessment methodology employs eleven (11) risk factors total – the seven (7) OMB risk factors outlined in Circular A-123, Appendix C and four (4) additional risk factors. The following risk conditions and risk factors compose NASA's Improper Payment Risk Assessment Methodology:

### **Risk Conditions**

- i. Internal Control over Payment Processing
- ii. Internal Monitoring and Assessments
- iii. External Monitoring and Assessments
- iv. Human Capital Risk
- v. Program Profile
- vi. Payment Profile
- vii. Dollar Materiality

<sup>1</sup> OMB Memorandum M-13-07, Accountability for Funds Provided by the Disaster Relief Appropriations Act and Disaster Relief Appropriations Act (Disaster Relief Act) (Public Law 113-2), section 904(b).

<sup>2</sup> According to IPIA and OMB's IPIA implementation guidance (OMB Circular A-123 Appendix C, Requirements for Payment Integrity Improvement), if a program has documented a minimum of two (2) consecutive years of improper payments that are below the thresholds, the Agency may request relief from annual reporting requirements for the program or activity.

## OMB Risk Factors

- i. Whether the program or activity reviewed is new to the agency;
- ii. The complexity of the program or activity reviewed, particularly with respect to determining correct payment amounts;
- iii. The volume (dollar value/amount) of payments made annually;
- iv. Whether payments or payment eligibility decisions are made outside of the agency;
- v. Recent major changes in program funding, authorities, practices, or procedures;
- vi. The level, experience, and quality of training for personnel responsible for making program eligibility determinations or certifying that payments are accurate; and
- vii. Significant deficiencies in the audit reports of the agency including, but not limited to, the agency OIG or the GAO audit report findings, or other relevant management findings that might hinder accurate payment certification.

## Additional Risk Factors

- viii. Inherent risks of improper payments due to the nature of agency programs or operations;
- ix. Results from prior improper payment work;
- x. Other Risk Susceptible Programs determined by OMB on a case by case basis that certain programs may be subject to annual PAR/AFR reporting; and
- xi. Disaster Relief Appropriations Legislation (Hurricane Sandy, Hurricane Irma, Hurricane Harvey)

In order to evaluate susceptibility of each program to improper payments, using the framework and risk factors shown above, NASA reviewed various reports and other supporting information, conducted surveys, and executed analyses related to NASA programs. Three (3) separate risk assessment questionnaires were developed and distributed to address the 11 risk factors included in the risk assessment. Specific information obtained and reviewed includes the following:

- FY 2018 and FY 2017 audit reports, findings, and recommendations (i.e. reports from the OIG, GAO, and other independent bodies)
- FY 2016 – FY 2018 OMB Circular A-123 Appendix A, Internal Control over Financial Reporting Summary Reports
- NASA Budgetary Estimates and Trends from FY 2014 – FY 2018
- FY 2018 Payment Processing Questionnaire
- FY 2018 Procurement Questionnaire
- FY 2018 Disaster Relief Questionnaire
- Applicable OMB Memoranda

- FY 2018 and FY 2017 Program Disbursements
- NASA Quality Assurance Division (QAD) Internal Control Program
- Statement on Standards for Attestation Engagements (SSAE) 18 Reports
- FY 2017, 2016, and 2015 IPIA Compliance Audit Results and Recommendations

Using the information reviewed and the risk assessment criteria, the risk conditions for each program were assigned a risk rating. NASA then calculated a weighted average risk rating for each program based on the risk scores and weights assigned to each risk condition. As a result of the FY 2019 Risk Assessment, none of the 35 programs evaluated were deemed to be susceptible to significant improper payments. Accordingly, the Agency was not required to perform improper payment sampling and estimation for FY 2019.

## Barriers

Given the results of the FY 2019 Improper Payment Risk Assessment, NASA is not required to develop a corrective action plan or identify applicable barriers for FY 2019. NASA will continue to monitor and assess its payment processes and processing environment to minimize Agency vulnerability to improper payments. Should the Agency identify improper payments, 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 OMB Circular A-123 Appendix C, NASA 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 internal control standards (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 2019 Improper Payment 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 2019, 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

## Recapture of Improper Payments Reporting

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 performs internal recapture reviews as part of its overall program to ensure effective internal control over payments.

Historically NASA performed recapture audits over fixed price contracts only. NASA no longer considers it cost – effective to conduct payment recapture audits for firm fixed priced contracts. This approach is in accordance with the amended OMB Circular A-123, Appendix C guidance, which allows agencies to make the determination to exclude payments from certain activities and programs 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. Furthermore, NASA does not consider it cost-effective to conduct payment recapture audits for cost type contracts or grants and cooperative agreements as these 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.

In FY 2014, NASA awarded the contingency based recapture audit contract to an industry leading consultant. During that five year period, the Recapture Audit scope

entailed the review of FY 2013-2017 disbursements to identify and recover overpayments, duplicate payments, erroneous payments, lost credit memos, and internal transaction errors of NASA's fixed price contracts . For the years under review, the auditors identified twelve overpayments that resulted in \$116K funds recaptured. For the past 3 years, there were no overpayments identified nor recaptured through the payment recapture audit and there are no outstanding identified overpayments from previous year's audits.

NASA conducted an internal review of overpayment activities outside of a Recapture Audit in FY19. The scope of the review included both cost-type and fixed priced contracts. Examples of such activities include Agency post-payment review/audits, single audit and self-reported overpayments. As a result, NASA recovered \$8.23m, which is 70.2% of the total overpayments identified for payments outside of the recapture audit.

NASA has taken steps through Improper Payment Reviews and internal recapture reviews to continue efforts already embedded in the control environment for reducing and recovering improper payments. In addition, all collection and disbursement functions are centralized which ensures consistent application of the control environment and reduction of improper payments. There are no statutory or regulatory barriers limiting NASA's ability to reduce improper payments.

## Do Not Pay Initiative

The Office of Management and Budget (OMB) issued Memorandum M-12-11 dated April 12, 2012, [Reducing Improper Payments through the "Do Not Pay List"](#)<sup>1</sup> requiring agencies to submit a "Do Not Pay (DNP) List" Implementation Plan by August 31, 2012.

NASA fully integrated into Treasury's DNP portal process on September 27, 2014, utilizing the following data sources: the Social Security Administration Death Master File (SSA-DMF) and the System for Award Management Exclusion Records-Restricted.

The cumulative results of these monthly reviews reported are for the period of October 1, 2018 through September 19, 2019. During this time period, there were 132,936 payments made by Treasury on behalf of NASA with a dollar value of \$13.730 billion. Treasury uses only the vendor name in SAM to identify any matches for potential improper payments. NASA researches any identified matches, validating the data using the Tax Identification Number (TIN), full name or address in addition to the vendor name.

The review by NASA resulted in no matching improper payments for FY 2019.

## Fraud Reduction Reporting

The Fraud Reduction and Data Analytics Act (FRDA) of 2015 requires Federal Agencies to establish and improve financial and administrative controls and procedures to assess and mitigate fraud risks, and to improve Federal agencies' development and use of data analytics for the purpose of identifying, preventing, and responding to fraud, including improper payments.

NASA has the stewardship responsibility for establishing and maintaining internal controls to safeguard its assets against loss from unauthorized use or disposition, ensure that its financial statements are not materially misstated, and ensure compliance with applicable laws and regulations. As an integral part of this stewardship responsibility, management has a specific duty to design and implement programs and controls to prevent, deter, and detect fraud. In order to achieve this responsibility, NASA has the following fraud safeguarding mechanisms in place:

### NASA'S FRAUD RISK MANAGEMENT FRAMEWORK

Fraud Prevention & Detection Activities	Objective
Acquisition Integrity Program (AIP)	To monitor and ensure coordination of criminal, civil, contractual and administrative remedies for investigations of fraud and/or corruption related to procurement activities. To establish and maintain coordination with the Office of Inspector General (OIG) and the Department of Justice
Improper Payments Program (IPP)	To identify programs susceptible to improper payments through annual risk assessment and testing.
Fraud risk assessments	To identify and prioritize fraud risks and determine scope of testing
Evaluation of fraud risk management control activities through the annual Control Environment Summary	To describe how the organization considers the potential for fraud in assessing risks to the achievement of objectives, and to rate the effectiveness of control activities
Enterprise Risk Assessment & management of Agency Risk Profile	To identify and report significant cross-cutting risks impacting the Agency that require escalation to senior management
Anti-fraud awareness and training	To establish the tone at the top, communicate employee responsibility/accountability, and increase awareness of fraud reporting mechanisms
Coordination and collaboration with the Office of Inspector General (OIG)	To share information on potential fraud risks, relevant controls, identified issues, results of investigations and other reviews. To learn of emerging fraud trends and improved fraud prevention and detection techniques
OIG audits, reviews and investigations	To evaluate the adequacy and effectiveness of controls (this may include controls that address fraud risk); to investigate potential incidents of fraud, waste and abuse
Financial Statement audit	To obtain reasonable assurance that the financial statements are free from material misstatements whether due to fraud or error
Data Breach Response Program	To establish policies, procedures and practices that address federal information technology mandates including privacy and security requirements, and to reduce the risk of loss of NASA's data and technology assets
Counterfeit Parts Awareness & Inspection program	To identify counterfeit parts through components and materials investigation and to mitigate the risk of misrepresentation by a supplier or vendor

NASA aims to detect and prevent improper payments via fraud reduction through the improper payment program (IPP). NASA identifies, reviews, classifies, determines root causes for, and develops Agency corrective actions for instances of fraud identified via the improper payment risk assessment. Cases of fraud are also considered when determining whether NASA's programs are susceptible to significant improper payments as required by OMB Circular A-123, Appendix C, Requirements for Payment Integrity Improvement. When suspected instance of fraud are identified, the Agency coordinates with the appropriate parties by referring those instances for investigation and adjudication to the appropriate parties such as NASA's Office of Inspector General or the Department of Justice.

In addition to NASA's IPP, the Agency has taken additional steps to ensure appropriate strategies and procedures are in place to reduce fraud. 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 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 Program. 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.

NASA's Mission Support Offices, Mission Directorates and Centers participate in annual fraud assessments related to the GAO's "Standards for Internal Control in the Federal Government" (the "Green Book"); and OMB Circular A-123 with respect to the leading practices for managing fraud risk. These assessments aid in the evaluation of all aspects of fraud, including fraud prevention, fraud detection through continuous monitoring and evaluations, fraud corrective action plans and the communication of fraud control activities across the Agency.

NASA's comprehensive OMB Circular A-123 Appendix A assessment approach includes assessment of all risks, including fraud risk, associated with each business cycle; evaluating whether internal controls mitigate those risks to acceptable levels; and conducting risk-based internal control reviews to determine whether controls are operating as intended. To identify potential risk areas for fraud, NASA analyzes known fraud cases and inherent risk of errors and irregularities due to fraud that could potentially impact business cycles.

NASA also employs an Ethics Program that requires all NASA employees to: (1) Comply with all applicable ethics laws, regulations, Executive orders, and other guidance, and avoid even the appearance of impropriety; and (2) Complete annual and other periodic training as required. The Agency widely communicates and encourages employees to report instances observed or allegations of fraud, waste, abuse and mismanagement. One reporting mechanism is the Office of Inspector General's Hotline.

NASA remains committed to combating fraud through its strong risk management and internal control structure, which allows its organizational structure to be conducive to effective fraud risk management.

## IPIA REFERENCES

<sup>A</sup> For additional details related to NASA Improper Payments <https://paymentaccuracy.gov/>

<sup>B</sup> The Improper Payments Information Act of 2002 (IPIA) (Public Law (P.L.) 107-300) <https://www.congress.gov/107/plaws/pub300/PLAW-107publ300.pdf>

<sup>C</sup> 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>

<sup>D</sup> 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>

<sup>E</sup> Disaster Relief Appropriations Act (Disaster Relief Act) (P.L. 113-2) <https://www.congress.gov/113/plaws/publ2/PLAW-113publ2.pdf>

<sup>F</sup> Memorandum M-13-07, Accountability for Funds Provided by the Disaster Relief Appropriations Act <https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/memoranda/2013/m-13-07.pdf>

<sup>G</sup> Bipartisan Budget Act of 2018 (P.L. 115-123) <https://www.congress.gov/115/bills/hr1892/BILLS-115hr1892enr.pdf>

<sup>H</sup> Memorandum M-18-14, Implementation of Internal Controls and Grant Expenditures for the Disaster-Related Appropriations <https://www.whitehouse.gov/wp-content/uploads/2018/03/M-18-14.pdf>

<sup>I</sup> Reducing Improper Payments through the "Do Not Pay List" [https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/memoranda/2012/m-12-11\\_1.pdf](https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/memoranda/2012/m-12-11_1.pdf)

## UNDISBURSED BALANCES IN EXPIRED GRANT ACCOUNTS

Section 529 of the Consolidated Appropriations Act, 2019 (P.L. 116-6), requires certain departments, agencies, and instrumentalities of the United States Government receiving appropriations under the Act to track 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)
2016	954	\$6.8
2017	917	\$7.1
2018	1,093	\$9

## REDUCE THE FOOTPRINT

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" (RtF) 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 2019 to 2023, NASA plans to dispose over 6.1 percent of its owned other-than-office-and-warehouse buildings (over 1.9 million square feet), while acquiring about 1.7 percent (534,000 square feet), resulting in about a 4.4 percent net consolidation (1.4 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.

As of September 30, 2018, NASA's Reduce the Footprint portfolio footage was 15.227 million square feet. NASA incurred \$105 million in operations and maintenance costs for owned and direct lease buildings.

Operations and Maintenance (O&M) costs for RtF buildings continue to increase despite a decrease in the number of assets. Abandoned and small assets have been among the most frequently disposed. While the disposed assets do incur some costs, they are among those provided the least resources since they are available for disposal. The majority of costs are driven by wage and material costs which are more closely associated with facility replacement cost rather than utilization.

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 2018	Change (FY 2015 Baseline - FY 2018)
Square Footage (SF in Millions)	15.716	15.227	(0.489)

O&M Costs - Owned and Direct Lease Buildings	FY 2015 Reported Cost	FY 2018	Change (FY 2015 - FY 2018)
Operation and Maintenance Cost (\$ in Millions)	\$78	\$105	\$27

## CIVIL MONETARY PENALTY ADJUSTMENT FOR INFLATION

### For the Fiscal Year Ended September 30, 2019

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	2019	\$11,463	Federal Register Vol.84 No.65 (4 April 2019) Rules and Regulations <a href="http://www.federalregister.gov">www.federalregister.gov</a>
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	2019	\$20,134	Federal Register Vol.84 No.65 (4 April 2019) Rules and Regulations <a href="http://www.federalregister.gov">www.federalregister.gov</a>
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	2019	\$201,340	Federal Register Vol.84 No.65 (4 April 2019) Rules and Regulations <a href="http://www.federalregister.gov">www.federalregister.gov</a>
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	2019	\$20,134	Federal Register Vol.84 No.65 (4 April 2019) Rules and Regulations <a href="http://www.federalregister.gov">www.federalregister.gov</a>
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	2019	\$201,340	Federal Register Vol.84 No.65 (4 April 2019) Rules and Regulations <a href="http://www.federalregister.gov">www.federalregister.gov</a>

**SUMMARY OF FINANCIAL STATEMENT AUDIT AND MANAGEMENT ASSURANCES**

The following tables summarize the Agency's FY 2019 Financial Statement Audit and Management Assurances.

**Table 1** summarizes the status of prior year - FY 2018 material weaknesses identified by the Financial Statement Auditor.

**Table 2** summarizes the status of prior year material weaknesses, if any 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**

<b>Effectiveness of Internal Control over Financial Reporting (FMFIA 2)</b>						
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
<b>Effectiveness of Internal Control over Operations (FMFIA 2)</b>						
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
<b>Conformance with Financial Management System Requirements (FMFIA 4)</b>						
Statement of Assurance	Systems conform Substantially comply					
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
<b>Compliance with Federal Financial Management Improvement Act (FFMIA)</b>						
	Agency			Auditor		
1. System Requirements	Substantially comply			Substantially comply		
2. Accounting Standards	Substantially comply			Substantially comply		
3. USSGL at Transaction Level	Substantially comply			Substantially comply		

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# APPENDIX

## GLOSSARY OF ACRONYMS & ACKNOWLEDGMENTS

Rescue team members are using a Boeing CST-100 Starliner training capsule to rehearse a search and rescue training exercise in the unlikely event of an emergency resulting in a splashdown. NASA and the Department of Defense (DoD) Human Space Flight Support Office Rescue Division conducted the open-ocean exercise. **Photo Credit: NASA**



## GLOSSARY OF ACRONYMS

AA	Associate Administrator
AA-2	Ascent Abort-2
AAIRS	Audit and Assurance Information Reporting System
ACME	Advanced Combustion via Microgravity Experiments
AFO	Audit Follow-up Official
AFR	Agency Financial Report
AFRC	Armstrong Flight Research Center
AICPA	American Institute of Certified Public Accountants
AIP	Acquisition Integrity Program
ALR	Audit Liaison Representative
AOC	Administrative Order on Consent
APG	Agency Priority Goal
APH	Advanced Plant Habitat
API	Annual Performance Indicator
APR	Annual Performance Report
ARC	Ames Research Center
ARMD	Aeronautics Research Mission Directorate
ARMWG	Agency Risk Management Working Group
ASC	Accounting Standards Codification
ATAL	Asian Tropopause Aerosol Layer
ATV	Automated Transfer Vehicle
BAA	Broad Agency Announcement
BATAL	Balloon Measurement Campaign of the Asian Tropopause Aerosol Layer
BSA	Business Services Assessment
Caltech	California Institute of Technology
CAP	Corrective Action Plan
CAP	Cross-Agency Priority Goals
CASIS	Center for the Advancement of Science in Space
CF	Core Financial
CFO Act	Chief Financial Officers Act
C-I-A	Confidentiality, Integrity, and Availability
CIO	Chief Information Officer

CLA	CliftonLarsonAllen LLP
CMP	Continuous Monitoring Program
COTS	Commercial Off-the-Shelf
CRS2	Commercial Resupply Services Phase 2
CRV	Current Replacement Value
CSLI	CubeSat Launch Initiative
CSRS	Civil Service Retirement System
D.C.	District of Columbia
DATA Act	Digital Accountability and Transparency Act of 2014
DCIA	Debt Collection Improvement Act
DiD	Defense in Depth
DM	Deferred Maintenance
DM&R	Deferred Maintenance and Repairs
DNP	Do Not Pay
DTSC	Department of Toxic Substance Control
EC	Executive Council
EDT	Eastern Daylight Time
EEO	Equal Employment Opportunity
EGS	Exploration Ground Systems
EIS	Environmental Impact Statement
EM	Exploration Mission
EPSCoR	Established Program to Stimulate Competitive Research
ERM	Enterprise Risk Management
ERMWG	Enterprise Risk Management Working Group
ERP	Enterprise Resource Planning
EUI	Energy Use Intensity
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 Employee Health Benefits

## Appendix / Glossary of Acronyms

FERS	Federal Employees Retirement System
FFMIA	Federal Financial Management Improvement Act
FFRDC	Federally Funded Research and Development Center
FIR	Fluids Integration Rack
FISMA	Federal Information Security Modernization Act
FITARA	Federal Information Technology Acquisition Act
FMFIA	Federal Managers' Financial Integrity Act
FPTBU	Funds to be Put to Better Use
FRDA	Fraud Reduction and Data Analytics Act
FY	Fiscal Year
GAAP	Generally Accepted Accounting Principles
GAO	Government Accountability Office
GCAM	Grant and Cooperative Agreement Manual
GFED	Global Fire Emissions Database
GISS	Goddard Institute for Space Studies
GOES	Geostationary Operational Environmental Satellite
G-PP&E	General Property, Plant and Equipment
GPRAMA	Government Performance and Results Act Modernization Act of 2010
GPS	Global Positioning System
GRACE-FO	Gravity Recovery and Climate Experiment Follow-On
GRC	Glenn Research Center
GSFC	Goddard Space Flight Center
HALO	Habitation and Logistics Outpost
HEOMD	Human Exploration and Operations Mission Directorate
HQ	Headquarters
HRBP	Human Resources Business Partner
HTV	H-II Transfer Vehicle
HVA	High Value Asset
HVAC	Heating, Ventilating and Air Conditioning
IAS	Intelligent Automation Services
IBNR	Incurred But Not Reported
ICESat	Ice, Cloud and land Elevation Satellite
INKSNA	Iran, North Korea, and Syria Nonproliferation Act
INPE	Instituto Nacional de Pesquisas Espaciais

IPERA	Improper Payments Elimination and Recovery Act of 2010
IPERIA	Improper Payments Elimination and Recovery Improvement Act of 2012
IPIA	Improper Payments Information Act
IPP	Improper Payment Program
IRB	Independent Review Boards
ISRO	Indian Space Research Organization
ISS	International Space Station
IT	Information Technology
JCL	Joint Cost and Schedule Confidence Level
JPL	Jet Propulsion Laboratory
JPSS	Joint Polar Satellite System
JSC	Johnson Space Center
JWST	James Webb Space Telescope
KSC	Kennedy Space Center
LaRC	Langley Research Center
LCCA	Life-cycle Cost Analyses
LEO	Low Earth Orbit
LMS	Large Mission Study
L'SPACE	Lucy Student Pipeline Accelerator and Competency Enabler
LUT	Lookup Table
AIP	Acquisition Integrity Program
MAF	Michoud Assembly Facility
M&R	Maintenance and Repairs
MD&A	Management Discussion and Analysis
MDA	Missile Defense Agency
MODIS	Moderate Resolution Imaging Spectroradiometer
MSC	Mission Support Council
MSD	Mission Support Directorate
MAP	Mission Support Future Architecture Program
MSI	Minority Serving Institution
MSRR-1	Materials Science Research Rack
MSWG	Management System Working Group
MUREP	Minority University Research & Education Program
NASA	National Aeronautics and Space Administration

## Appendix / Glossary of Acronyms

MSFC	Marshall Space Flight Center
NEPA	National Environmental Policy Act
NextSTEP	Next Space Technologies for Exploration Partnerships
NFR	Notice of Findings and Recommendations
NFS	NASA FAR Supplement
NHPA	National Historic Preservation Act
NISAR	NASA-Indian Space Research Organisation Synthetic Aperture Radar
NIST	National Institute of Standards and Technology
NMO	NASA Management Office
NOAA	National Oceanic and Atmospheric Administration
NPP	National Polar-Orbiting Partnership
NPR	NASA Procedural Requirements
NRC	National Research Council
NSSC	NASA Shared Services Center
O&M	Operation and Maintenance
OCE	Office of the Chief Engineer
OCFO	Office of the Chief Financial Officer
OCHCO	Office of the Chief Human Capital Officer
OCHMO	Office of the Chief Health & Medical Officer
OCIO	Office of the Chief Information Officer
OHCM	Office of Human Capital Management
OIG	Office of Inspector General
OMB	Office of Management and Budget
OP	Office of Procurement
OPM	Office of Personnel Management
OSMA	Office of Safety & Mission Assurance
P.L.	Public Law
PAR	Performance and Accountability Report
PEIR	Programmatic Environmental Impact Report
PG	Performance Goal
PIV	Personal Identify Verification
PMC	Program Management Council
PO	Purchase Order
PPE	Power and Propulsion Element

PPS	Procurement for Public Sector
PSD	Planetary Science Division's
PSE	Program Support Equipment
QAD	Quality Assurance Division
R&D	Research and Development
RAP	Robotics Alliance Project
RPA	Robotic Process Automation
RSI	Required Supplementary Information
RSSI	Required Supplementary Stewardship Information
S&E	science and engineering
SAISO	Senior Agency Information Security Officer
SAP	Systems Applications and Products
SAT	Senior Assessment Team
SBIR	Small Business Innovation Research
SBR	Statement of Budgetary Resources
SFFAS	Statement of Federal Financial Accounting Standards
SLS	Space Launch System
SMC	Senior Management Council
SMD	Science Mission Directorate
SNC	Statement of Net Cost
SoA	Statement of Assurance
SOC	Security Operations Center
SOFIA	Stratospheric Observatory for Infrared Astronomy
SP	Special Publication
Space Grant	National Space Grant and College Fellowship Program
SpaceX	Space Exploration Technologies Corporation
SSA-DMF	Social Security Administration Death Master File
SSAE	Statement on Standards for Attestation Engagements
SSC	Stennis Space Center
SSFL	Santa Susana Field Laboratory
STEM	Science, Technology, Engineering and Mathematics
STMD	Space Technology Mission Directorate
TCAT	Technical Capabilities Assessment Team
TIN	Tax Identification Number



## Appendix / Glossary of Acronyms

Treasury	U.S. Department of the Treasury
U.S.	United States
UNICORN	Unified Comprehensive Operational Risk Network
USSGL	United States Standard General Ledger
VAB	Vehicle Assembly Building
VIIRS	Visible Infrared Imaging Suite
VIPer	Volume of Integrated Performance
Webb	James Webb Space Telescope
WFIRST	Wide Field Infrared Survey Telescope
xEMU	Exploration Extravehicular Mobility Unit



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## THANK YOU

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The Agency Financial Report (AFR) was produced with the energies, time, and talents of the National Aeronautics and Space Administration in Washington, D.C. We offer our sincerest thanks and acknowledgments. In particular, we recognize the following individuals and organizations.

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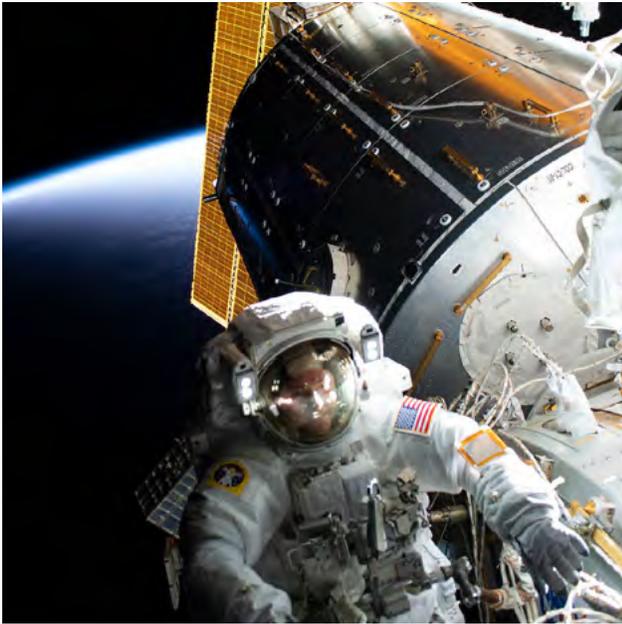
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We would also like to acknowledge KPMG and Deloitte & Touche LLP for their objective review of the Agency's Financial Report and CliftonLarsonAllen for the professional manner in which they conducted the audit of the FY 2019 financial statements. We would like to send a special thank you to the Office of Human Capital Management (OHCM) and Office of Communication.

We offer special thanks to our graphic designer, Rahn Johnson.



## ASTRONAUT NICK HAGUE TETHERED TO THE INTERNATIONAL SPACE STATION (ISS)

NASA astronaut Nick Hague is pictured tethered to the forward end of the International Space Station during a spacewalk to install the orbiting lab's second commercial crew vehicle docking port, the International Docking Adapter-3 (IDA-3).

**Photo Credit: NASA**

## ORION TEST BRINGS MOON, MARS MISSIONS CLOSER

A fully functional launch abort system (LAS) with a test version of the Orion crew spacecraft attached soars upward on NASA's Ascent Abort-2 (AA-2) flight test atop a Northrop Grumman provided booster on July 2, 2019, after launching at 7 a.m. EDT, from Launch Pad 46 at Cape Canaveral Air Force Station in Florida.

**Photo Credit: NASA/Tony Gray and Kevin O'Connell**



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