National Aeronautics and Space Administration

FY 2021 AGENCY

# FINANCIAL REPORT

# COVER IMAGE CAPTION AND CREDITS

## COVER IMAGE

An illustration of NASA's Perseverance rover landing safely on Mars. Hundreds of critical events must execute perfectly and exactly on time for the rover to land safely on Feb. 18, 2021.

At about 6,900 feet (2,100 meters) above the surface, the rover separates from the backshell, and fires up the descent stage engines. As the descent stage levels out and slows to its final descent speed of about 1.7 mph (2.7 kph), it initiates the "skycrane" maneuver. About 12 seconds before touchdown, roughly 66 feet (20 meters) above the surface, the descent stage lowers the rover on a set of cables about 21 feet (6.4 meters) long. The rover unstows its mobility system, locking its legs and wheels into landing position.

PHOTO CREDIT — NASA/JPL

## PERSEVERANCE ROVER TAKES TO MARS

This illustration shows the events that occur in the final minutes of the nearly seven-month journey that NASA's Perseverance rover takes to Mars. Hundreds of critical events must execute perfectly and exactly on time for the rover to land on Mars safely on Feb. 18, 2021.

PHOTO CREDIT — NASA/JPL-Caltech

# TABLE OF CONTENTS

INSPIRE | ENGAGE | EDUCATE | EMPLOY

# NASA IN STEM

Science, Technology, Engineering, and Mathematics

PHOTO CREDIT — NASA

## What is Next Gen STEM?

NASA's Office of STEM Engagement executed a series of efforts to develop STEM products and opportunities that provide a platform for students to contribute to NASA's endeavors in exploration and discovery. These mission-driven activities include over 20 evidence-based products and opportunities to engage students in authentic STEM experiences. NASA is working to provide mission driven opportunities that enhance STEM literacy and help build a vibrant and diverse next generation STEM workforce. See NASA's STEM engagement activities at https://www.nasa.gov/stem.

## NASA Awards More Than $7 Million to Minority-Serving Institutions Over Three Years

Creating a future for humanity in the stars and continuing to improve life on Earth are tasks NASA can only achieve by involving all of humanity. To challenge the barriers to entry for students from diverse backgrounds in engineering, NASA's Minority University Research and Education Project, or MUREP, called upon Minority Serving Institutions to develop proposals for how they could use NASA funding to strengthen their support for underrepresented communities.

Today, NASA has chosen six universities to win the MUREP Inclusion Across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science, or INCLUDES, award. Each award provides up to $1.2 million for a three-year period to implement the institution's proposal.

The selected institutions are:

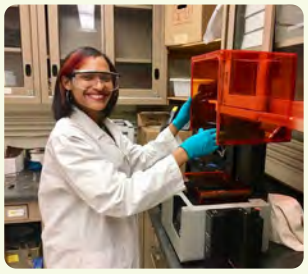
Alabama State University
Florida A&M University
J.F. Drake State Technical College
Navajo Technical College
Texas A&M Kingsville
University of Massachusetts, Boston

PHOTO CREDIT — NASA Goddard/Chris Gunn


## NASA STEM Engagement Highlights

Interns use their creativity and innovation to work on projects impacting NASA's mission, such as returning to the Moon. Applicants for this internship must be U.S. citizens. As a NASA intern, you will be part of an amazing team that is dedicated to space exploration.

PHOTO CREDIT — NASA



## NASA Awards $18 Million for Research at Minority Serving Institutions

A MUREP student explores careers in science and engineering at NASA.

PHOTO CREDIT — NASA

# MESSAGE FROM THE ADMINISTRATOR

I am pleased to present the Fiscal Year 2021 Agency Financial Report (AFR) for the National Aeronautics and Space Administration (NASA). NASA has achieved amazing accomplishments over the past year. These include the launch of American astronauts from American soil on American rockets, the landing of the Perseverance rover on the surface of Mars, successful flight of the Ingenuity helicopter on that far off world, and the continued steady progress of our Artemis program to return American men and women to the Moon and beyond. This report summarizes many of these achievements toward a more equitable, sustainable, and inspired Nation in alignment with our Vision and Mission. Consistent with the lofty goals encompassed by our Vision and Mission, our activities are aligned to four strategic themes – **DISCOVER**, **EXPLORE**, **DEVELOP**, and **ENABLE** – which are articulated in our 2018 Strategic Plan. This AFR provides an accounting of our mission and programmatic performance against these strategic goals. Transparency about our performance and stewardship of taxpayer resources is at the center of the confidence we are proud to maintain with the American public.

Operating within our coronavirus (COVID-19) framework for almost 21 months, I could not be prouder of our team and how we have adapted to these unforeseen challenges. From the thousands of NASA employees working from their kitchen tables, dens, and bedrooms, to the mission-critical employees finding new and safe ways to work and collaborate onsite, our teams have done a fantastic job of keeping each other safe while also keeping the mission moving forward. Our determination and tenacity during this time has not gone unnoticed, as NASA was recently ranked number one among large Federal agencies for our response to the COVID-19 pandemic by the Partnership for Public Service.

I want to particularly highlight a few hallmark achievements of the past year. On February 18th, the Mars 2020 Perseverance rover landed on the Red Planet to begin exploration and address high-priority science goals and on September 10th collected the first two samples of Martian rock ever taken. The Perseverance rover mission will help enable human exploration of the planet in coming years as it demonstrates a new and more precise entry approach. Our plan for further human exploration of our solar system, including missions to Mars, starts with the Moon. NASA is committed to returning American astronauts, including the first woman and the first person of color, to the Moon through the Artemis program.

While we look outward to the Moon, Mars, and beyond, we understand the importance of our own planet. As climate change continues to contribute to more intense and destructive disasters, we know that NASA has a critical role in meeting the moment demanded of all of us in response to this urgent threat. NASA contributes significantly to what we know about Earth's changing climate. Demonstrating our significant focus in this area, we announced the formation of the Earth System Observatory this year, a new set of Earth-focused missions to provide key information to guide efforts related to climate change, disaster mitigation, fighting forest fires, and improving real-time agricultural processes.

Finally, and not least important, NASA continues to play an important role in supporting STEM education and outreach in underrepresented communities to create the next generation of scientists and explorers, supporting hundreds of thousands of good high-paying jobs and practical technological innovation across the United States, and catalyzing the creation of a healthy and vibrant commercial space industry.

To provide transparency into our business strategy, a full accounting of our financial statements in accordance with Generally Accepted Accounting Principles is presented within the accompanying financial reports. NASA is committed to delivering credible, quality data and important information regarding the Agency's fiscal operations. We follow standard financial reporting practices, ensuring appropriate controls with efficient and effective management of appropriated and reimbursable Agency funds. Under the leadership of the Office of the Chief Financial Officer, for 11 straight years, NASA has received an unmodified "clean" opinion on its financial statements, with no reported material weaknesses, signifying our internal controls are operating effectively to provide assurance of complete and reliable financial data. The financial and performance data presented in this report are complete and reliable.

I am inspired and humbled by the examples of the great men and women of NASA. We will continue to push the boundaries of space exploration, scientific discovery, climate understanding and action, and technological breakthrough in the next year and beyond. We will do all of this and more because that is what NASA does, and no one does it better.

Bill Nelson

## NASA's Major Themes and 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.

# HERstory: Past, Present, and Future

**Women have made extraordinary contributions to NASA's rich history serving in many roles from Deputy Administrators, to engineers and to astronauts. Take a stroll through time and read about the wonderful contributions women have made – in the past, present, and future.**

## Dr. Irene D. Long PAST

Dr. Long was the first African-American female to serve in the Senior Executive Service (SES) at Kennedy Space Center (KSC). As chief medical officer at the Florida spaceport, she was the first female and the first minority to hold that position. Her NASA career spanned 31 years. She helped create the Spaceflight and Life Sciences Training Program at Kennedy, in partnership with Florida Agricultural and Mechanical University (FAMU), a program that encouraged more women and minority college students to explore careers in science. Dr. Long retired from NASA in 2010 and died in 2020. **PHOTO CREDIT — NASA**

## Dr. Kalpana Chawla PAST

Selected by NASA in December 1994, Dr. Chawla was the prime robotic arm operator on STS-87 in 1997, the fourth U.S. Microgravity Payload flight. STS-87 focused on how the weightless environment of space affects various physical processes. Dr. Chawla died on STS-107 in 2003. Prior to STS-107, Dr. Chawla logged more than 376 hours in space. **PHOTO CREDIT — NASA**

## Dr. Swati Mohan PRESENT

Swati Mohan emigrated from India to the United States when she was 1 year old, and was raised in Northern Virginia /Washington DC metro area. She completed her B.S. from Cornell University in Mechanical & Aerospace Engineering, and her M.S. and Ph.D from Massachusetts Institute of Technology (MIT) in Aeronautics/Astronautics. She is currently the Mars 2020 Guidance, Navigation, and Controls Operations Lead, at NASA's Jet Propulsion Laboratory in Pasadena, CA. **PHOTO CREDIT — NASA**

## Diana Trujillo PRESENT

Diana Trujillo, an aerospace engineer, is currently Technical Group Supervisor for Sequence Planning and Execution and a Tactical Mission Lead for the Mars Perseverance rover. Born and raised in Colombia, Trujillo immigrated to the U.S. at the age of 17 to pursue her dream of working for NASA. While enrolled in English-as-a-second-language courses, she also worked full time to support her studies in community college and later the University of Florida and University of Maryland. **PHOTO CREDIT — NASA**

## Women in STEM FUTURE

A "Houston We Have a Podcast" is the official podcast of the NASA Johnson Space Center from Houston, Texas, home for NASA's astronauts and Mission Control Center. Listen to the brightest minds of America's space agency – astronauts, engineers, scientists and program leaders – discuss exciting topics in engineering, science and technology, sharing their personal stories and expertise on every aspect of human spaceflight. Learn more about how the work being done will help send humans forward to the Moon and on to Mars in the Artemis program. **PHOTO CREDIT — NASA**

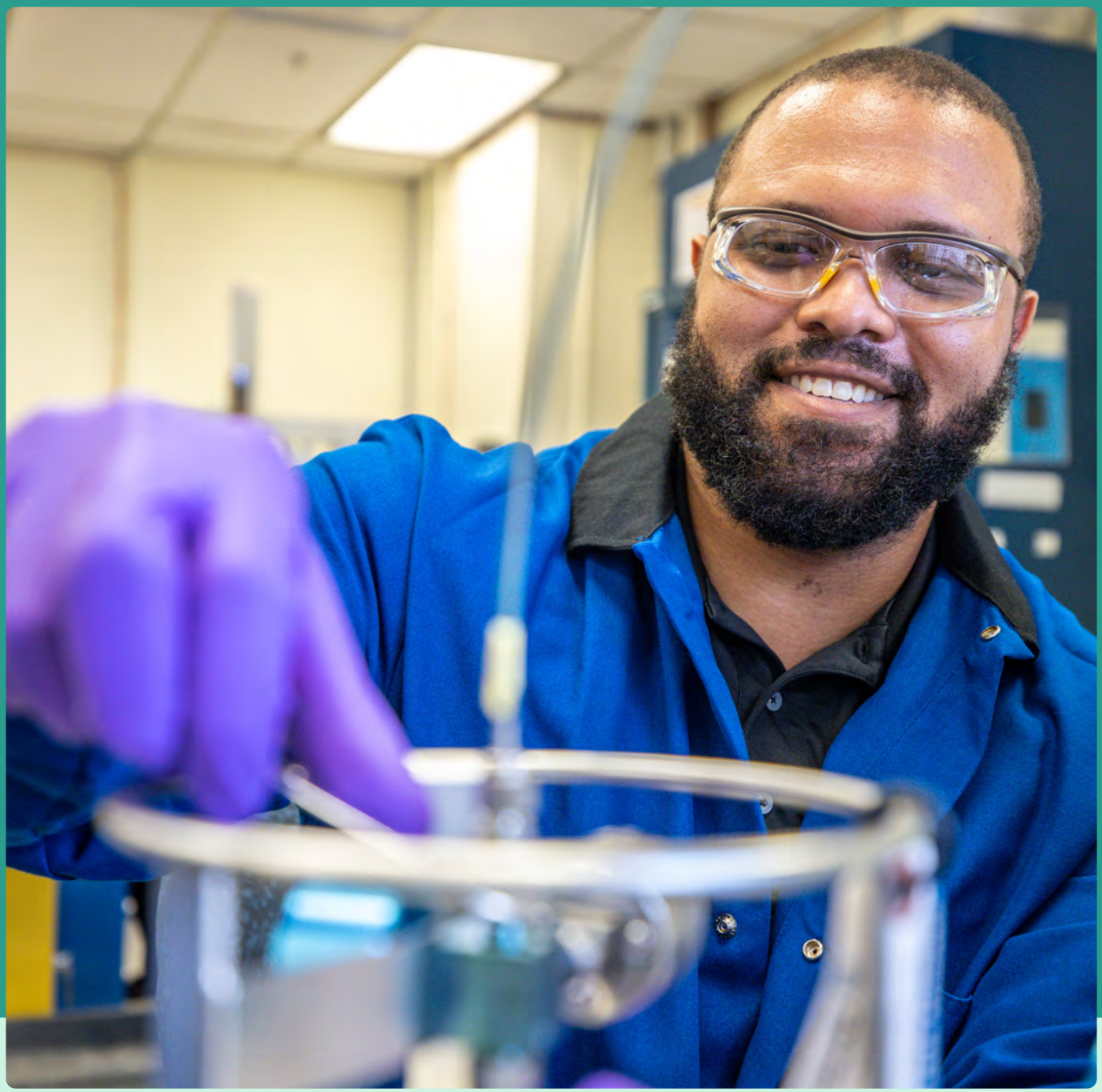
### FIRST WOMAN GRAPHIC NOVELS AND INTERACTIVE EXPERIENCES

First Woman tells the tale of Callie Rodriguez, the first woman to explore the Moon. While Callie is a fictional character, the first female astronaut and person of color will soon set foot on the Moon – a historic milestone and part of upcoming NASA missions. Interact with the graphic novel content by scanning the QR code.

SCAN ME

SECTION 1

# MANAGEMENT'S DISCUSSION AND ANALYSIS



Chemist Trey Barnes prepares a gas sample for injection into a gas chromatography-mass spectrometry system preconcentrator for analyzing trace level gas contaminants inside NASA Engineering's Analytical Laboratories at Kennedy Space Center in Florida on July 7, 2021.

PHOTO CREDIT — NASA/Frank Michaux

# WELCOME TO NASA

**The AFR presents the Agency's audited FY 2021 and FY 2020 financial statements and disclosures, the related independent auditors' audit opinion, required supplemental information, and other information. The FY 2021 AFR can be found on NASA's website at Agency Financial Reports | NASA.**

NASA inspires the world through space exploration and new scientific discoveries. Since NASA's inception in 1958 to the present day, our spacecraft have visited every planet in the solar system and begun the journey into interstellar space. NASA uses the vantage points of ground, air, and space to track and study the effects of climate change. We are continuing the human exploration of space through the Artemis program. NASA aeronautics has made contributions to every U.S. commercial aircraft and U.S. air traffic control tower that help improve efficiency and safety, and now we are striving to make air transportation more environmentally sustainable.

**DID YOU KNOW?**

The growing list of "firsts" for Perseverance, NASA's newest six-wheeled robot on the Martian surface, includes converting some of the Red Planet's thin, carbon dioxide-rich atmosphere into oxygen. A toaster-size, experimental instrument aboard Perseverance called the Mars Oxygen In-Situ Resource Utilization Experiment (MOXIE) accomplished the task. The test took place April 20, the 60th Martian day, or sol, since the mission landed Feb. 18.

PHOTO CREDIT — NASA/JPL-Caltech

NASA demonstrates stewardship of its resources and accountability for results through compliance with the *Chief Financial Officers Act of 1990* (CFO Act)[1] and the *Government Performance and Results Act Modernization Act of 2010* (GPRAMA)[2]. 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 *NASA 2018 Strategic Plan*[3]. Highlights of key program activities contributing to each strategic goal are provided in the Mission Performance section (starting on page 12). A high-level summary of the linkage between program results and the cost of operations is available in the Statement of Net Cost (SNC), found in the Financial section (starting on page 41). The SNC presents comparative net cost of operations during FY 2020 and FY 2021 by strategic goal and for the Agency as a whole. In addition, the Financial Highlights, in the Financial Performance section explain any significant changes in NASA's financial condition from FY 2020 to FY 2021.

Financial systems that meet requirements of the *Federal Financial Management Improvement Act of 1996* (FFMIA)[4] 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 Circular A-123, *Management's Responsibility for Enterprise Risk Management and Internal Control*[5], 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.

[1] Chief Financial Officers Act of 1990 (CFO Act) https://govinfo.library.unt.edu/npr/library/misc/cfo.html
[2] Government Performance and Results Act Modernization Act of 2010 (GPRAMA) https://www.congress.gov/111/plaws/publ352/PLAW-111publ352.pdf
[3] NASA 2018 Strategic Plan https://www.nasa.gov/sites/default/files/atoms/files/6-nasa_2018_strategic_plan.pdf
[4] Federal Financial Management Improvement Act of 1996 (FFMIA) https://www.congress.gov/bill/104th-congress/house-bill/4319
[5] OMB Circular 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

# ACHIEVING OUR VISION AND MISSION


NASA Administrator Bill Nelson gives keynote remarks during the 36th Space Symposium, Tuesday, Aug. 24, 2021, in Colorado Springs, CO.

PHOTO CREDIT — NASA/JPL-Caltech

## Vision

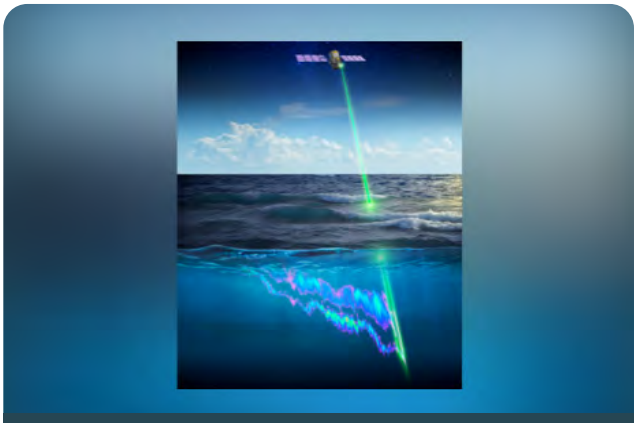
To discover and expand knowledge for the benefit of humanity.

## 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.

NASA's achievements of tomorrow are being built on a solid foundation of performance management and fiscal operations. We use credible, quality data to drive Agency decision-making and planning. Through the rigorous application of controls and standards, we ensure that our programs and projects have the resources they need to continue this forward momentum. NASA is transparent in these efforts, complying fully with requirements on accountability and performance management. We are committed to self-evaluation and continuous improvement, positioning NASA for long-term success.

This commitment is at the core of the NASA 2018 Strategic Plan and drives our Vision and Mission. The Strategic Plan creates a framework for our short- and long-term goals, provides a clear and unified direction for our activities, and sets the foundation on which we can build the success of our programs and projects.



DID YOU KNOW?

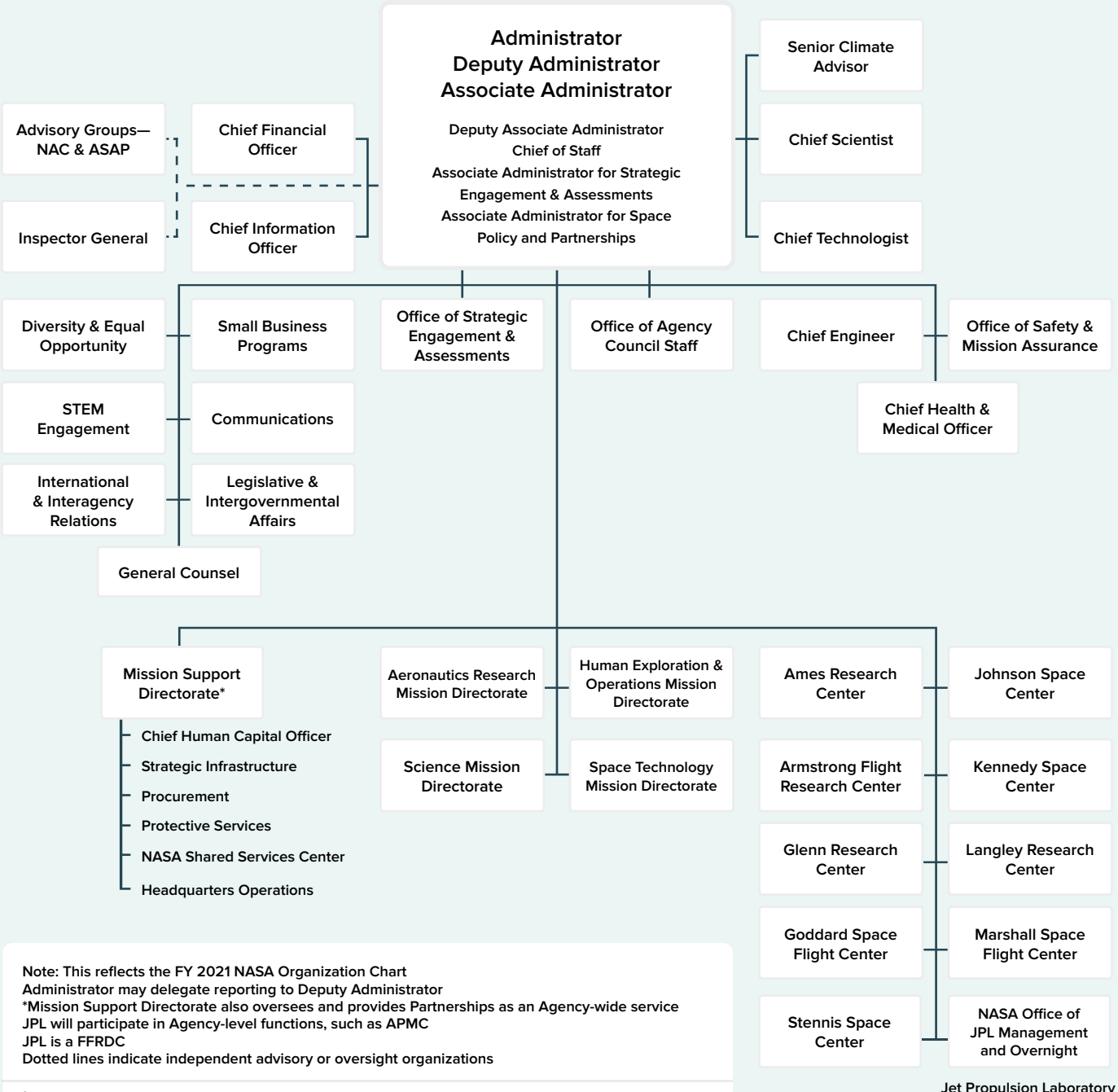
NASA satellite data combined with field measurements help scientists construct a clearer picture of the travel routes of sharks and other marine animals. In 2019 with the Cloud-Aerosol Lidar and Infrared Pathfinder Satellite (CALIPSO), a joint venture between NASA and the French space agency, the Centre National D'Etudes Spatiales (CNES), observed a massive animal migration that takes place on our planet. In this case, marine animals such as fish, krill and squid rise from the ocean depths to the surface to feast on microscopic plants called phytoplankton as well as smaller zooplankton and other animals on a daily basis.

PHOTO CREDIT — NASA/Timothy Marvel

# 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 Policy Directive 1000.3E, *NASA Organization*[6]. The Administrator and senior officials lead the Agency by providing top-level strategies and direction. The Mission Directorate and Mission Support Offices at Headquarters 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.

NASA Advisory Council (NAC)
Aerospace Safety Advisory Panel (ASAP)
Agency Program Management Council (APMC)
Jet Propulsion Laboratory (JPL)
Federally Funded Research and Development Center (FFRDC)

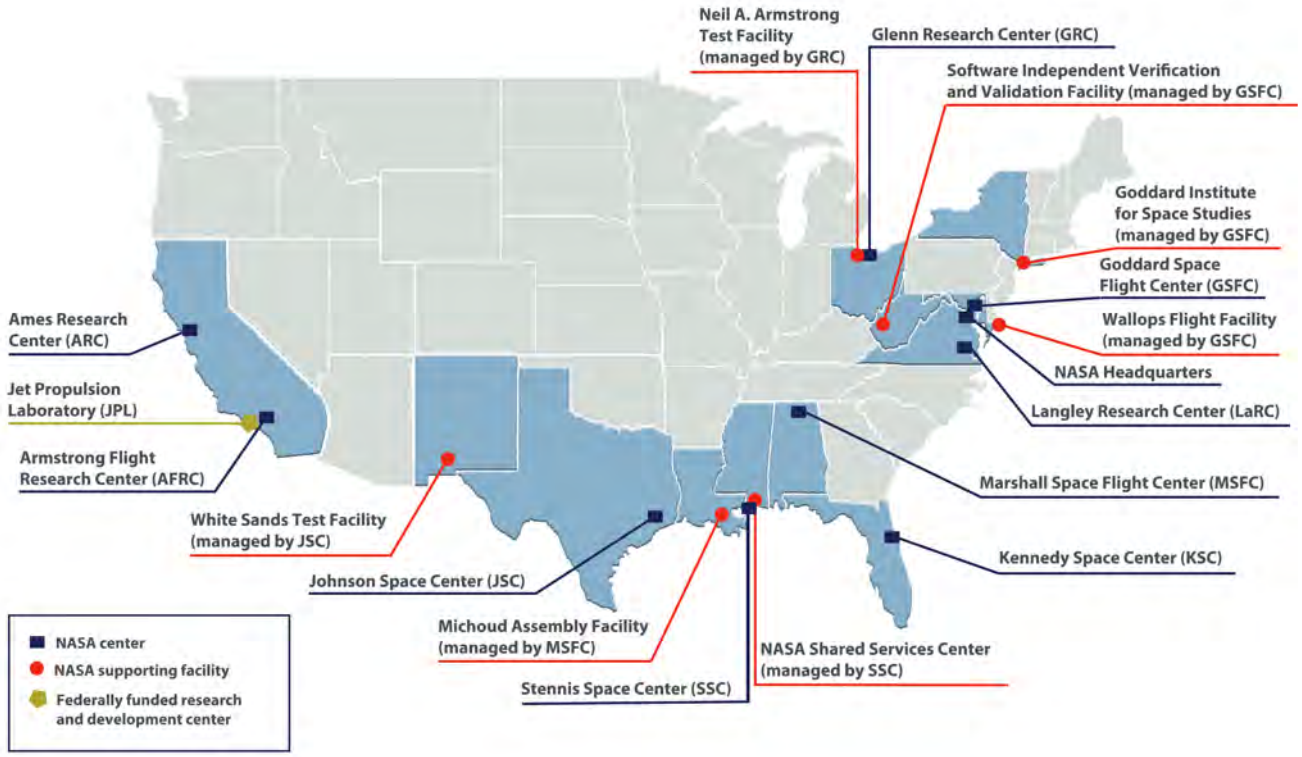



Note: This reflects the FY 2021 NASA Organization Chart
Administrator may delegate reporting to Deputy Administrator
*Mission Support Directorate also oversees and provides Partnerships as an Agency-wide service
JPL will participate in Agency-level functions, such as APMC
JPL is a FFRDC
Dotted lines indicate independent advisory or oversight organizations

[6] NASA Policy Directive 1000.3E, NASA Organization
https://nodis3.gsfc.nasa.gov/displayDir.cfm?t=NPD&c=1000&s=3E

# 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 10 Centers and a variety of unique facilities.




## LOCATIONS IN THE SPOTLIGHT

### GODDARD SPACE FLIGHT CENTER

NASA's Goddard Space Flight Center (GSFC) is home to the Nation's largest organization of scientists, engineers, and technologists who build spacecraft, instruments, and new technology for studying Earth, the Sun, our solar system, and the universe. GSFC's team, led by principal investigator James Garvin, was one of two new missions—both focused on Venus—selected for NASA's Discovery Program. DAVINCI+ will measure the composition of Venus' thick atmosphere to better understand why it is a runaway hothouse compared to Earth's. Mission launch is currently targeted for FY 2030.

### WALLOPS FLIGHT FACILITY

Wallops Flight Facility (WFF), managed by GSFC, provides a variety of launch range services, from high-altitude balloons to suborbital and orbital rockets. Northrop Grumman launches commercial resupply services missions to the International Space Station (ISS) from the Mid-Atlantic Regional Spaceport at WFF. On June 25, 2021, NASA launched 40 university student experiments aboard a sounding rocket from WFF. The launch, part of the RockOn! and RockSat-C programs, was designed for students to learn and apply skills in building experiments for suborbital space flight. RockOn! is supported by NASA's Office of STEM Engagement.

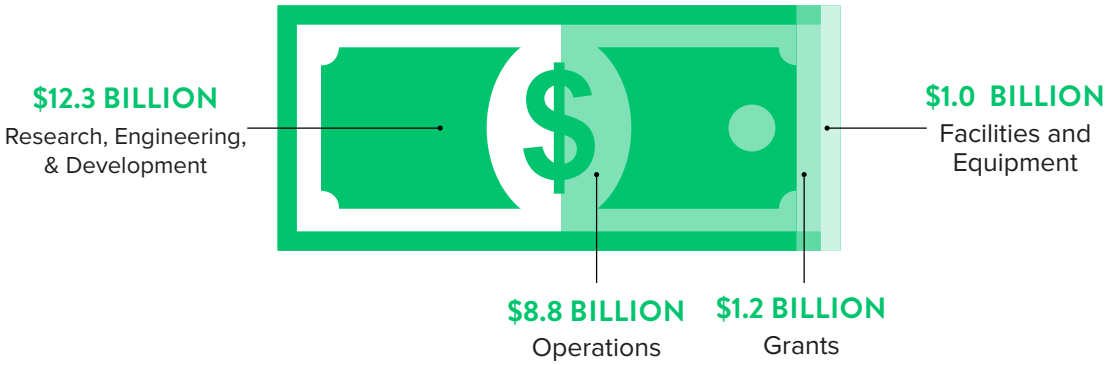
### GODDARD INSTITUTE FOR SPACE STUDIES

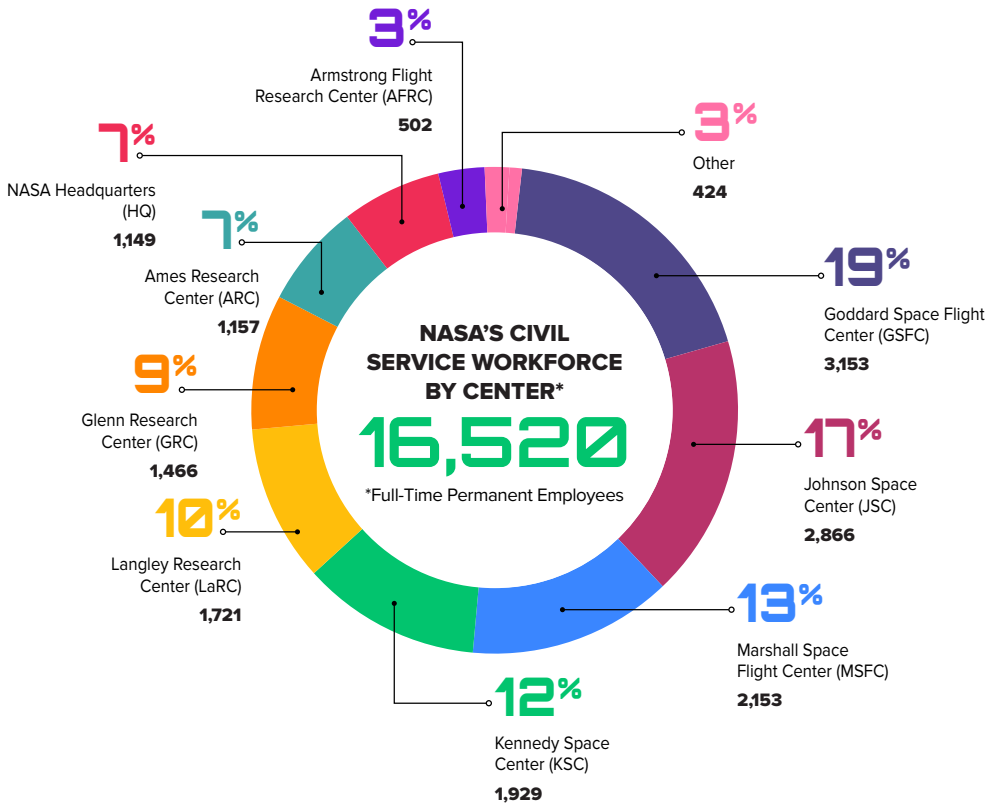
The Goddard Institute for Space Studies (GISS) is a laboratory in the Earth Sciences Division of GSFC. GISS's key objective is prediction of atmospheric and climate changes in the 21st century. In FY 2021, experts from GISS, Columbia University's Center for Climate Systems Research and Center on Global Energy Policy, Agricultural Model Intercomparison and Improvement Project (AgMIP), New York University, and the United Nations Food and Agricultural Organization developed new analyses on greenhouse gas emissions from the food system. This improved quantification of food system emissions can help to provide scenarios used by global climate models to project future changes in Earth's climate.

# NASA BY THE NUMBERS

BUDGET IN FY 2021

## $23.3 BILLION




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

**Voted Best Place to Work in the Federal Government for the 9th Consecutive Year**

Mary W. Jackson NASA Headquarters building in Washington, D.C.

PHOTO CREDIT — NASA

# MISSION PERFORMANCE


A Mars 2020 message is seen on the video board of the Nasdaq MarketSite after NASA's Perseverance rover landed on the surface of Mars, Thursday, Feb. 18, 2021 in New York City. A key objective for Perseverance's mission on Mars is astrobiology, including the search for signs of ancient microbial life. The rover will characterize the planet's geology and past climate, pave the way for human exploration of the Red Planet, and be the first mission to collect and cache Martian rock and regolith.

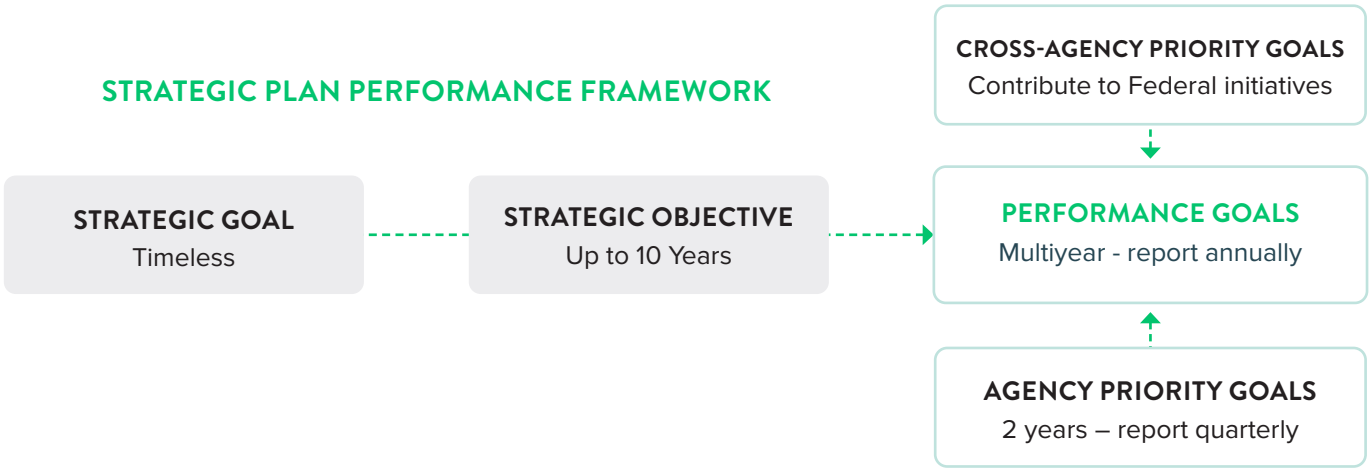
PHOTO CREDIT — NASA/Emma Howells

# STRATEGIC PLAN FRAMEWORK

The NASA *2018 Strategic Plan* created a framework (see the graphic below) topped by strategic goals that describe how we will pursue our Mission. Strategic objectives describe what we plan to do to achieve each strategic goal. Each strategic objective encompasses one or more portfolios of related programs that work towards the objective's outcomes. Multiyear performance goals measure progress towards achieving the strategic objectives. These performance goals have annual performance targets that are consistent with NASA's budget.

NASA elevates a subset of performance goals—agency priority goals—for additional attention and external reporting. Agency priority goals often reflect Administration priorities, as well those of an agency. Due to the presidential transition, the Office of Management and Budget discontinued external reporting for the FY 2020-2021 agency priority goals. Because NASA continued performance toward the milestones described in our agency priority goals, we transitioned our agency priority goals to performance goals for FY 2021. Those performance results are included in the summary of preliminary FY 2021 ratings provided on page 18. Agency priority goal information for FY 2020 is available on the Performance.gov archive.

Cross-agency priority goals reflect efforts toward addressing a subset of the President's Management Agenda. These multi-Government agency goals are not part of NASA's framework, but they inform strategic objective and performance goal activities, such as human capital management, cybersecurity, and customer experience with NASA's social media platforms. The *Foundations for Evidence-Based Policymaking Act of 2018* (Evidence Act)[7] complements GPRAMA through evaluation and evidence-building activities to answer priority questions in NASA's Learning Agenda. The Annual Evaluation Plan, NASA's plan for answering its priority questions, inform annual performance goal planning.




**NASA's Performance Framework Breakdown**

| 4 | 13 | 48 |
|---|---|---|
| STRATEGIC GOALS | STRATEGIC OBJECTIVES | PERFORMANCE GOALS |

[7] **Foundations for Evidence-Based Policymaking Act of 2018 (Evidence Act)** https://www.congress.gov/115/plaws/publ435/PLAW-115publ435.pdf

# STRATEGIC GOALS AND OBJECTIVES

As detailed in the *NASA 2018 Strategic Plan*, NASA's historic and enduring purpose is aligned to four major strategic themes—**DISCOVER**, **EXPLORE**, **DEVELOP**, and **ENABLE**—that characterize our four strategic goals. These four strategic goals, supported by 13 strategic objectives, outline the Agency's Mission.

**1. DISCOVER**

**Expand human knowledge through new scientific discoveries.**

### 1.1 Understand the Sun, Earth, Solar System, and Universe.

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.

### 1.2 Understand Responses of Physical and Biological Systems to Spaceflight.

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.

**2. 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.

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.

### 2.2 Conduct Exploration in Deep Space, Including to the Surface of the Moon.

Extend human presence into cislunar space and the lunar surface, with capabilities that allow for sustained operations in deep space and the lunar surface.

**EVER WONDER HOW YOU WOULD SOUND ON MARS?**

Grab your headset, turn up the volume and listen for the subtle differences between the sounds on Earth versus how they would sound on the Red Planet. Then, try the Mars Playlist to hear actual recordings from the Red Planet, as captured by the two microphones onboard the Mars Perseverance rover.

PLAY NOW


**Address national challenges and catalyze economic growth.**

### 3.1 Develop and Transfer Revolutionary Technologies to Enable Exploration Capabilities for NASA and the Nation.

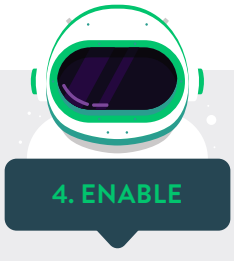
Advance revolutionary technologies for NASA and the Nation, involving commercial space products, specifically for utilization of near-Earth space; efficient transportation through space; access to planetary surfaces; enabling human space exploration; next generation science missions; and growth and utilization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

### 3.2 Transform Aviation Through Revolutionary Technology Research, Development, and Transfer.

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.

### 3.3 Inspire and Engage the Public in Aeronautics, Space, and Science.

Inspire, engage, educate, and employ the next generation of explorers through NASA-unique STEM learning opportunities.




**Optimize capabilities and operations.**

### 4.1 Engage in Partnership Strategies.

Support cooperative, reimbursable, and funded initiatives through domestic and international partnerships.

### 4.2 Enable Space Access and Services.

Support the communication, launch service, rocket propulsion testing, and strategic capabilities needs of NASA's programs.

### 4.3 Assure Safety and Mission Success.

Assure effective management of NASA programs and operations to complete the mission safely and successfully.

### 4.4 Manage Human Capital.

Cultivate a diverse and innovative workforce with the right balance of skills and experience to provide an inclusive 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.

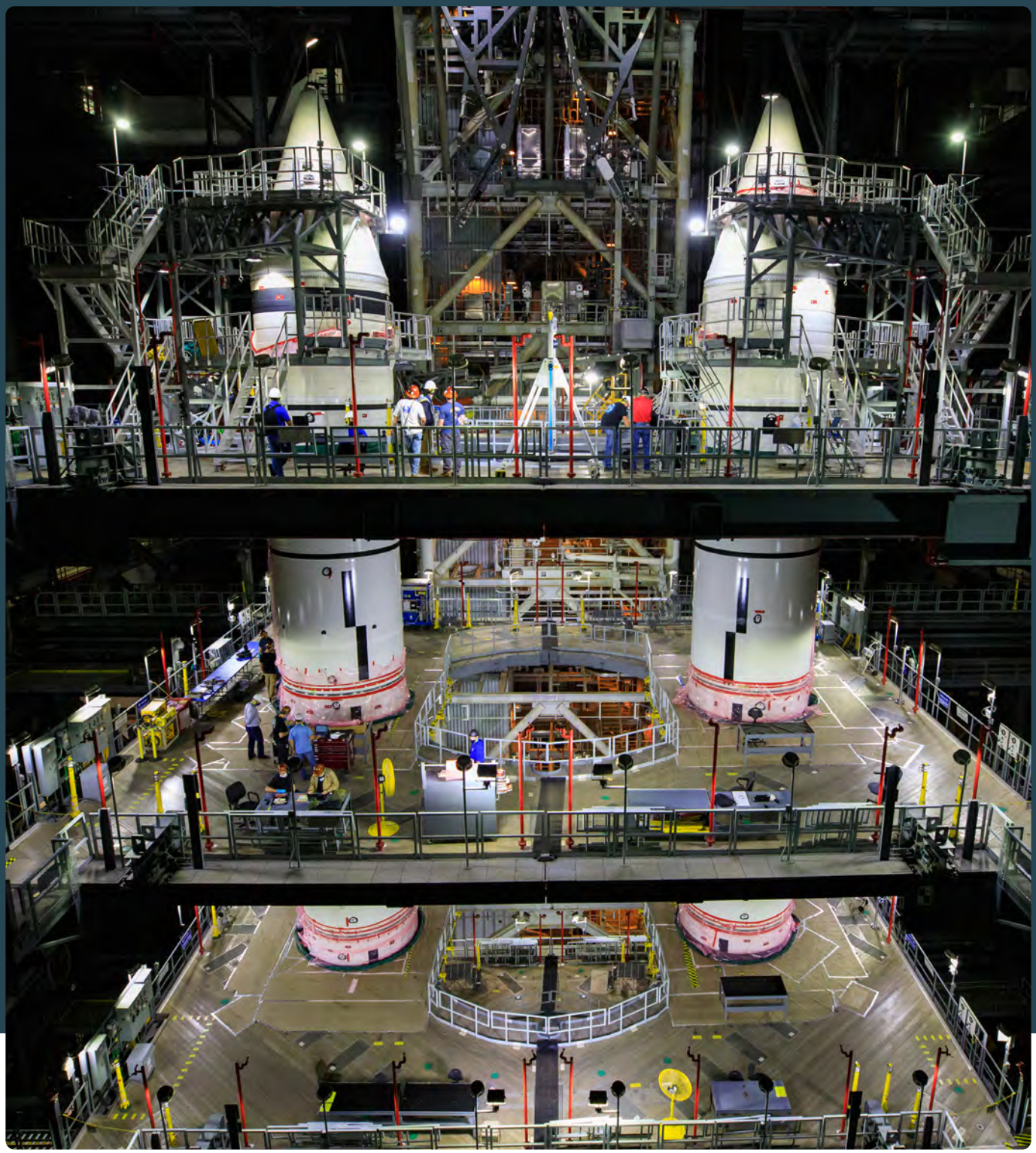
### 4.5 Ensure Enterprise Protection.

Increase the resiliency of NASA's enterprise systems by assessing risks and implementing comprehensive, economical, and actionable solutions.

### 4.6 Sustain Infrastructure Capabilities and Operations.

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.

# STRATEGIC GOALS AND HIGHLIGHTS



Stacking is complete for the twin Space Launch System (SLS) solid rocket boosters for NASA's Artemis I mission.

PHOTO CREDIT — NASA/Isaac Watson

# ASSESSMENT APPROACH

**Every strategic objective is supported by at least one performance goal. NASA's performance goals consist of an outcome-based statement and an annual performance target. To the right is an example of a performance goal supporting Strategic Objective 4.2: Enable space access and services.**

**MEASUREMENT STATEMENT:** Provide cargo transportation through commercial partners to support the ISS.
**MEASUREMENT APPROACH:** Number of commercial cargo missions launched/delivered to ISS
**TARGET FOR FY 2021:** 4 commercial cargo missions
**NUMBER OF MISSIONS COMPLETED:** 4
**FY 2021 RATING:** Green

For NASA's 48 performance goals, we indicate the preliminary progress, based on the FY 2021 targets, by assigning a color rating of Green (complete or on target to complete), Yellow (slightly below target), or Red (significantly below target). Internal success criteria determine the levels of performance for a Yellow or Red rating. A White rating indicates that NASA is unable to assess the performance goal for the fiscal year due to missing data and a Grey rating indicates that the performance goal is unrated at this time, but a final rating should be provided in the *FY 2023 Volume of Integrated Performance* (VIPer)[8].

**GREEN**

**COMPLETE OR ON TARGET TO COMPLETE**

NASA has completed or is on target as planned to complete the performance goal.

**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 time frame. The program is substantially below the target and/or significantly behind schedule.

**WHITE**

**NOT ASSESSED**

Data not available to assess this performance goal for FY 2021.

**GREY**

**CURRENTLY UNRATED**

A final rating will be provided in the FY 2023 VIPer.

During the third and fourth quarters of the fiscal year, program officials assessed progress towards achieving the performance goals listed in the FY 2021 Annual Performance Plan. They determined whether targets or milestones were met as anticipated and assigned the appropriate color rating. NASA's Performance Improvement Officer and executive leadership reviewed the results to ensure that they are complete, accurate, and relevant. NASA's Internal Controls Assessment Team reviewed the GPRAMA assessment and reporting approach and confirmed that there were no deficiencies.

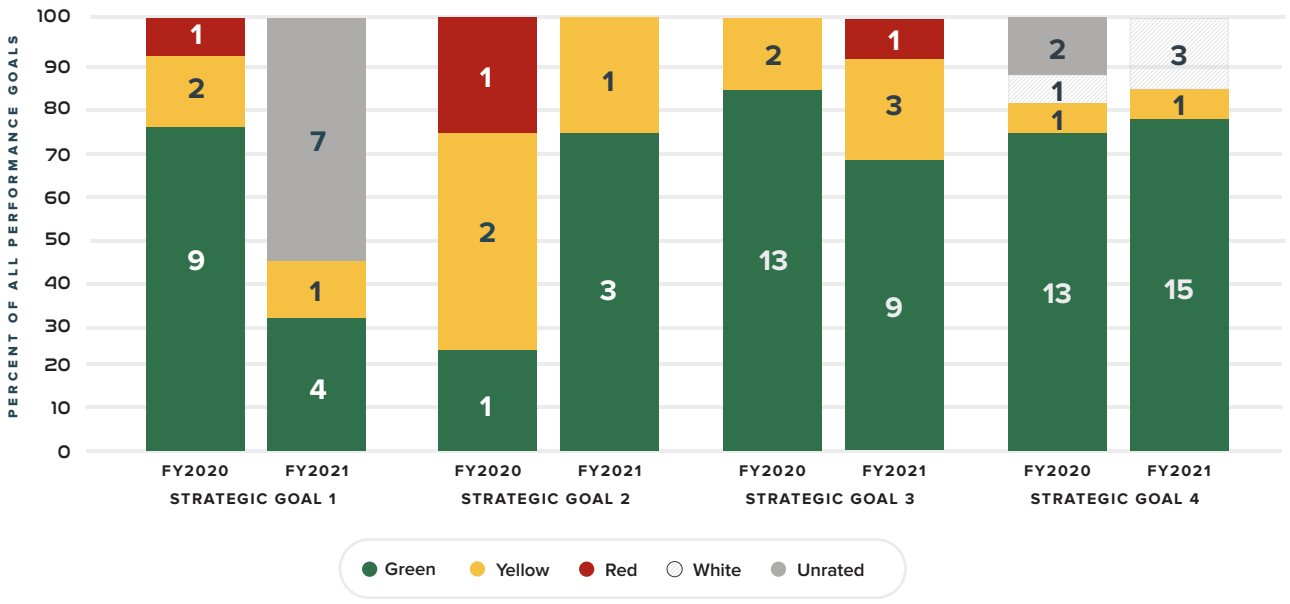
[8] **NASA's VIPer document is comprised of the Annual Performance Report of fiscal year performance results and the Annual Performance Plan, which lists the performance goals and provides annual targets consistent with the budget request.**

# FY 2021 PERFORMANCE ASSESSMENT

During FY 2021, program officials assessed progress towards achieving NASA's 48 performance goal FY 2021 targets released in the FY 2022 VIPer[9], determined whether these annual targets were met, and assigned one of the color ratings described above. The AFR provides a summary of the preliminary color ratings for FY 2021. The final color ratings, as well as the final performance results based on the targets, will be provided in the FY 2023 VIPer, which has an anticipated publication date of February 7, 2022.

The following graph shows the summary of preliminary FY 2021 ratings for NASA's 48 performance goals grouped by strategic goal compared to the FY 2020 ratings for the 48 performance goals published in the FY 2022 VIPer. For each strategic goal, the graph shows both the percentage and number of performance goals rated Green, Yellow, Red, or White, or that are currently Unrated or were Unrated in the FY 2022 VIPer.

## Summary of FY 2020 Performance Goal Ratings* Compared to Preliminary FY 2021 Performance Goal Ratings, Grouped by Strategic Goal




*FY 2020 performance goal ratings published in the FY 2022 VIPer

While 7 performance goals still remain unrated for FY 2021, overall the fiscal year has fewer performance goals rated Yellow (slightly below target) or Red (significantly below target). Notably, most programs and projects experienced fewer performance impacts due to the COVID-19. The Federal Employee Viewpoint Survey, which was a metric source for three performance goals, was not opened to employees during FY 2020. As a result, NASA was unable to assess (rated White) 3 performance goals supporting Strategic Goal 4.

[9] *FY 2022* VIPer
https://www.nasa.gov/sites/default/files/atoms/files/nasa_fy22_volume_of_integrated_performance.pdf

# Strategic Goal I. Discover

## Expand Human Knowledge Through New Scientific Discoveries.

### Overview

Since NASA's inception, scientific discovery about our Earth, the Sun, the solar system, and the universe beyond has been an enduring purpose of the Agency as part of its three major strategic thrusts: discover, explore, and develop. We conduct scientific exploration enabled by observatories that view Earth from space, observe and visit other bodies in the solar system, and gaze out into the galaxy and beyond. Our scientific exploration will also inform human exploration of the Moon, Mars, and the solar system, providing valuable scientific data for such human missions.

Conducting research in space, including aboard the ISS, provides scientists with the unique opportunity to observe natural phenomenon in ways not possible on Earth. By studying biological and physical systems under extreme conditions, such as altered gravity and radiation, scientists can better understand how biological and physical systems work. This knowledge can contribute to important scientific discoveries and technology advancements that not only enable space exploration, but also benefit life on Earth.

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.

### Highlights

Strategic Goal 1 is supported by 12 performance goals in the areas of Earth system science, heliophysics, planetary science, and astrophysics, as well as responses of biological and physical systems to spaceflight. Below are performance highlights and a sample preliminary performance goal ratings for FY 2021.

Annual progress toward achieving NASA's science-focused performance goals is determined by our Science Committees under the NASA Advisory Council and/or our Science Mission Directorate (SMD) senior leadership. Although seven performance goals remain Unrated, we are on track to achieve (rate Green) all performance goals for Strategic Goal 1 but one, which is slightly behind schedule (rated Yellow). For example, research using data from NASA's Mars Atmosphere and Volatile Evolution (MAVEN) mission shows that the Martian moon Phobos orbits through a stream of charged particles, known as ions, that flow off the Red Planet's atmosphere. Some of these ions have been escaping Mars' atmosphere for billions of years. The uppermost layer of Phobos' surface may have trapped some of these ions, recording information about the evolution of Martian atmosphere.

We achieved our target to complete 12 critical milestones for major Science Mission Directorate projects, receiving a Green rating for the performance goal. The milestones included development launching Sentinel-6 Michael Freilich, an ocean observation satellite, on November 21, 2020, landing the Mars 2020 Perseverance Rover in Jezero Crater on February 18, 2021, and completing development milestones for Europa Clipper, the Nancy Grace Roman Telescope, and other projects.

NASA completed FY 2021 behind schedule for our target to complete shipment of the James Webb Space Telescope (Webb)—the biggest, most complex space telescope ever built—to the European Space Agency's launch site in Kourou, French Guiana. We completed milestones leading up to shipment, such as folding the large and complex sunshield, so the performance goal received a Yellow rating.

DID YOU KNOW?

**These images were captured during Webb's final tests when the 6.5 meter (21 feet 4 inch) mirror was commanded to fully expand and lock itself into place, just like it would in space. The conclusion of this test represents the team's final checkpoint in a long series of tests designed to ensure Webb's 18 hexagonal mirrors are prepared for a long journey in space, and a life of profound discovery.**

**PHOTO CREDIT — Joby Aviation**

# Strategic Goal II. Explore

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

### 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 to create a better future for generations to come.

NASA is enabling the development of a space-based low Earth orbit economy by establishing the infrastructure necessary for a transition from operations aboard the ISS to one or more future commercial platforms, while continuing to leverage ISS for research and technology development.

NASA's Artemis program has a goal to return American astronauts—the first woman and the first person of color—to the Moon. NASA will use innovative technologies to explore larger areas of the Moon and for longer durations than ever before. Artemis is a collaborative effort with commercial and international partners to establish a sustainable lunar exploration capability for long-term exploration of the Moon, followed by human missions to Mars.

### Highlights

Strategic Goal 2 is supported by four performance goals. Below are performance highlights and sample preliminary performance goal ratings for FY 2021.

During FY 2021, NASA achieved (rated Green) the annual Artemis program target leading, incrementally, to the performance goal to land the first woman and first person of color on the Moon[10]. On March 18, 2021, the SLS program successfully completed the Green Run Hot Fire test at Stennis Space Center. The year-long, eight-part series of tests gradually brought the SLS core stage to life for the first time, culminating with the hot fire of the four RS-25 engines. During the second quarter of FY 2021, engineers installed the SLS solid rocket boosters on the Mobile Launcher inside the Vehicle Assembly Building at KSC in preparation for Artemis I. On April 27, the fully tested SLS core stage was delivered by barge to KSC for integration. The objective of Artemis I is to send an uncrewed Orion module around the Moon and return it to Earth for a safe splashdown and recovery.

NASA exceeded (rated Green) the FY 2021 performance goal target to initiate five research and technology demonstrations aboard the ISS by launching and initiating seven demonstrations. These included Radio-frequency identification (RFID) Enabled Autonomous Logistics Management (REALM)-2, SERFE, Saffire V, Universal Waste Management System (UWMS), Airborne Particulate Monitor (APM), Collapsible Contingency Urinal (CCU) and Biosentinel. WPA Cat-reactor was installed but since replaced by legacy h/w due to a leak. The technologies have been designed to support human space exploration beyond low Earth orbit. Find out more about research aboard the ISS at Space Station Research & Technology.

[10] **Performance Goal 2.2.1, published in the FY 2022 VIPer in June 2021, reads: "Advance America's goal to land the first woman and the next man on the Moon by demonstrating the necessary capabilities that advance lunar exploration." Since then, NASA has revised the goal to land the first woman and the first person of color on the Moon. The technical efforts supporting this goal were unchanged.**

# Strategic Goal III. Develop

## Address National Challenges and Catalyze Economic Growth.

### Overview

NASA is dedicated to developing transformative, cross-cutting technologies that enable our missions. We develop new technologies to enable human and robotic exploration of the Moon, Mars, and beyond and enhance research and development to contribute to U.S. leadership in space technology. We foster a community of America's best and brightest working on the Nation's toughest challenges and closing technology gaps in multiple mission architectures. Furthermore, we make our space technology available to commercial companies to generate real world benefits.

NASA explores technologies and capabilities that reduce aircraft noise and fuel use, get you from gate-to-gate safely and on time, and transform aviation into an economic engine at all altitudes. Aeronautics researchers, engineers, and pilots use world-class NASA facilities to keep U.S. aviation the global leader in safety, efficiency, and innovation.

NASA's education efforts attract, engage, and educate students and support educators and educational institutions across the United States. We provide opportunities for students, especially those underrepresented in STEM fields, to engage with our aeronautics, space, and science people, content, and facilities in support of a diverse future STEM workforce. We also enhance the reach and effectiveness or our programs and projects through our social media platforms, including Instagram and Twitter.

### Highlights

Strategic Goal 3 is supported by 13 performance goals. Below are performance highlights and sample preliminary performance goal ratings for FY 2021.

NASA was slightly below the FY 2021 performance goal target to complete at least 60 percent of planned key performance parameter events for our technology maturation projects, resulting in a Yellow rating. Completed events represent technology advancements that may lead to entirely new mission approaches. For example, the Safe and Precise Landing Integrated Capabilities Evolution (SPLICE) project, which was selected in October 2020 as part of the technology maturation Tipping Point contract, is slated for demonstration aboard Blue Origin's 17th Blue Shepard mission. Read more about our technology maturation at STMD [Space Technology Mission Directorate]: Game Changing Development.

NASA's Low Boom Flight Demonstration project has designed and is now building a piloted, large-scale supersonic experimental plane, or X-plane, with technology that reduces the perceived loudness of a sonic boom to that of a gentle thump. We ended FY 2021 behind schedule (rated Yellow) for our performance goal target to ship the demonstrator aircraft from Lockheed Martin's facility in Palmdale, California, to Fort Worth, Texas. NASA is working with the contractor to address COVID-related schedule impacts.

NASA is demonstrating tools, technologies, and flight operations methods to support industry and the Federal Aviation Administration in the development of a new class of aviation transport called Urban Air Mobility (UAM). We achieved our FY 2021 performance goal target to complete conceptual design and sizing trade studies of noise versus performance for vertical take-off and landing vehicles for the UAM market, resulting in a Green rating for the performance goal. Read more about NASA's work on UAM at https://www.nasa.gov/aam.

DID YOU KNOW?

**NASA's Revolutionary Vertical Lift Technology Project's Mobile Acoustics Facility is parked in the background of Joby's prototype aircraft near Big Sur, California. As the aircraft flew planned test scenarios, NASA's Advanced Air Mobility National Campaign team collected information about how the vehicle moved, how the vehicle sounded, and how the vehicle communicated with controllers during recent testing from Aug. 30-Sept. 10.**

**PHOTO CREDIT — Joby Aviation**

# Strategic Goal IV. Enable

## Optimize Capabilities and Operations.

### Overview

While mission requirements evolve with our priorities and external conditions, our mission services and capabilities are focused on the permanent and critical essentials that enable all NASA activity. They include a range of foundational services, such as a diverse, highly skilled workforce, procurement, cybersecurity, and right sized and efficient facilities. This strategic goal also includes services and capabilities critical to space exploration, including launch services, commercial space transportation, and space communications and navigation.

NASA strives to accomplish our mission with the utmost care, recognizing that we are stewards of taxpayer dollars, critical human capital, and one-of-a-kind facilities. NASA maintains a large and diverse set of technical capabilities and assets to support our missions, other Federal agencies' work, and the private sector to test, validate, and optimize innovations. 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.

### Highlights

Strategic Goal 4 is supported by 14 performance goals. Below are performance highlights and a sample of preliminary performance goal ratings for FY 2021.

NASA achieved all FY 2021 performance goal targets for providing space access and services, such as space communications, commercial crew transportation and resupply, and rocket propulsion testing. Our commercial partners SpaceX and Northrop Grumman completed the four planned commercial resupply services missions. NASA's SpaceX Crew-1 mission—the first commercial crew, long-duration mission aboard ISS—launched November 15, 2020. Crew 2 launched on April 23, 2021.

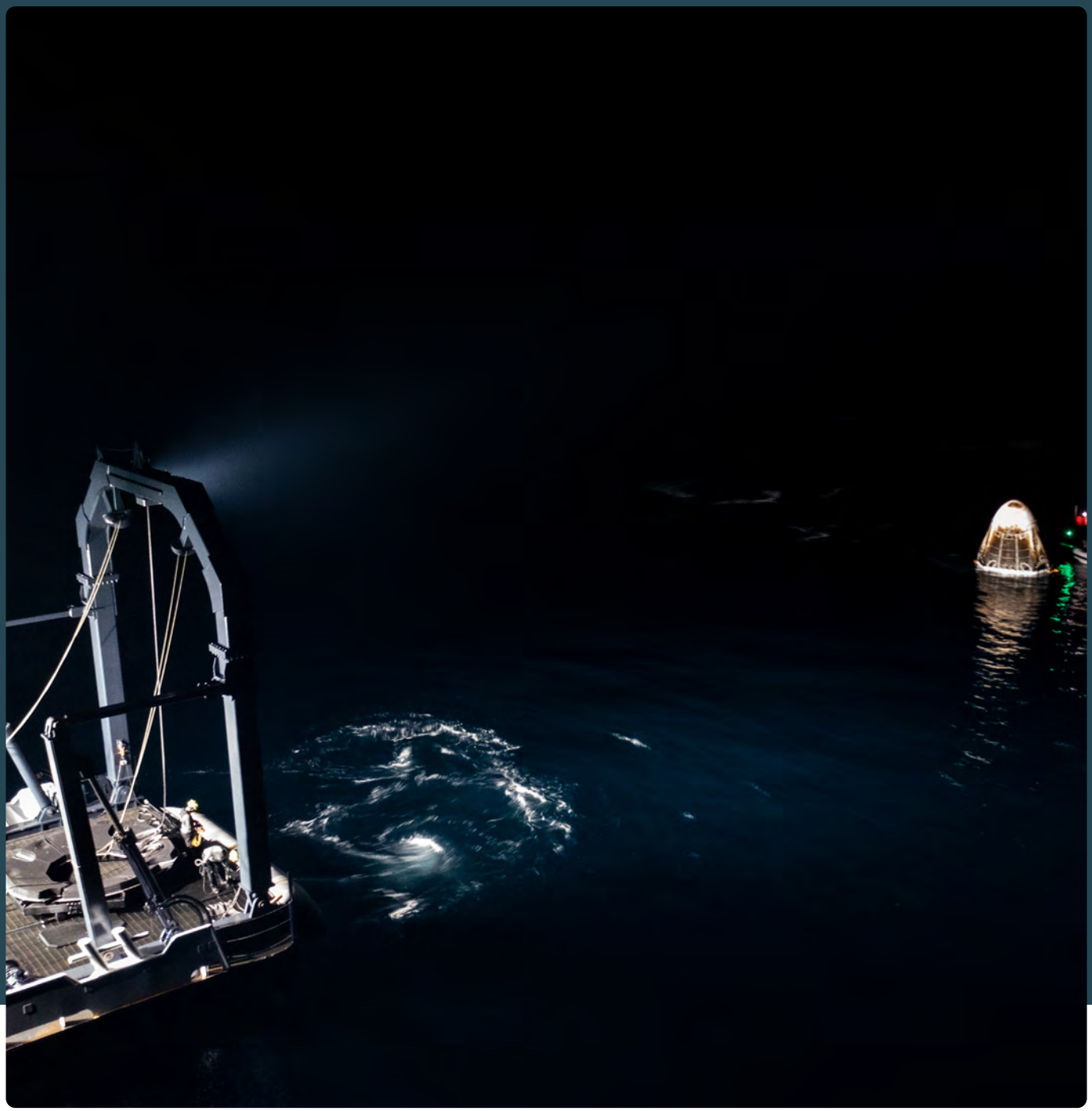
NASA uses the Federal Employee Viewpoint Survey (FEVS), administered by the Office of Personnel Management, as a useful gauge of our employees' work experiences at the Agency, including their perceptions of NASA as an equal opportunity and innovative workplace. FEVS results highlight where our human capital and diversity, equity, inclusion, and accessibility initiatives have been successful and identify where work is still needed. NASA withdrew (rated White) three performance goals focused on FEVS results for FY 2021 because the survey was not administered during the fiscal year. However, in June 2021, NASA was ranked Best Place to Work in the Federal Government among large agencies for the ninth year in a row based on the results of the 2020 FEVS. We also ranked number 1 among large agencies in response to COVID-19-related questions on the FEVS survey.

DID YOU KNOW?

**NASA astronauts Shannon Walker, left, Victor Glover, Mike Hopkins, and Japan Aerospace Exploration Agency (JAXA) astronaut Soichi Noguchi, right are seen inside the SpaceX Crew Dragon Resilience spacecraft onboard the SpaceX GO Navigator recovery ship shortly after landing in the Gulf of Mexico off the coast of Panama City, Florida, at 2:56 a.m. EDT May 2, 2021.**

**Photo Credit: NASA/Bill Ingalls**

# FINANCIAL PERFORMANCE



The SpaceX Crew Dragon Resilience splashes down in the Gulf of Mexico off the coast of Panama City, in Florida, at 2:56 a.m. EDT on May 2, 2021. Astronauts Michael Hopkins, Victor Glover, and Shannon Walker of NASA, and Soichi Noguchi of JAXA (Japan Aerospace Exploration Agency) completed Crew-1, the first crew rotation mission to the International Space Station in partnership with NASA as part of the agency's Commercial Crew Program. At left is SpaceX's Go Navigator recovery ship. Crew Dragon will be secured and then hoisted onto the main deck of the recovery ship with the astronauts inside.

PHOTO CREDIT — NASA/Jamie Peer

# FINANCIAL HIGHLIGHTS

## Overview of Financial Position

NASA's Balance Sheet provides a comparable snapshot of the Agency's financial position as of September 30, 2021 and September 30, 2020. It displays amounts in three primary categories.

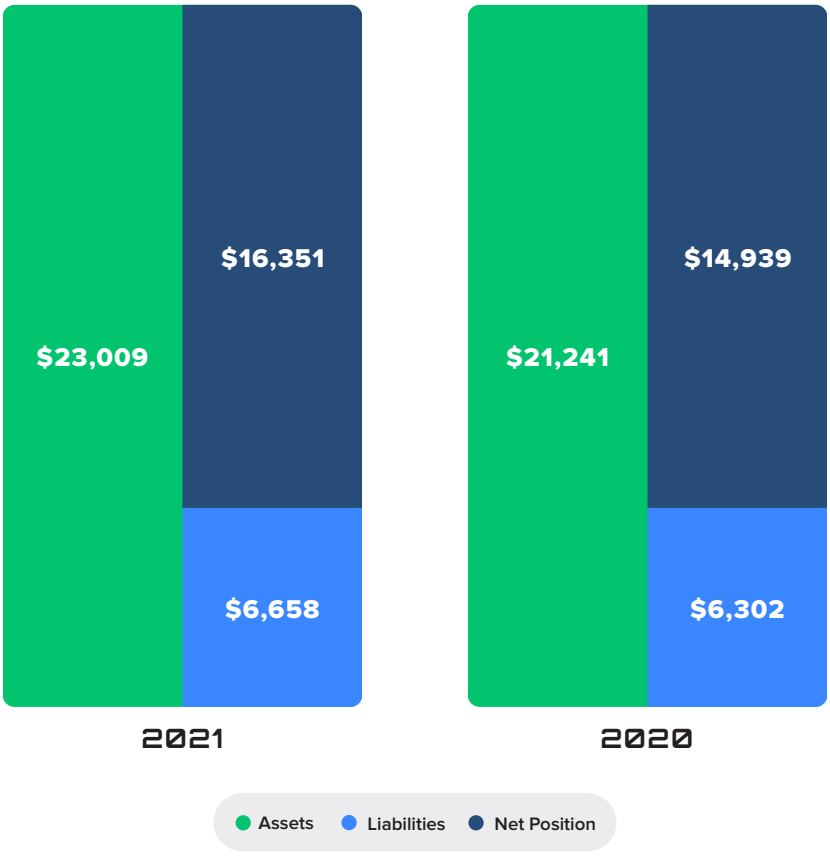
**+ ASSETS**
the current and future economic benefits owned or available for use by NASA.

**— LIABILITIES**
the debts owned by NASA but not yet paid.

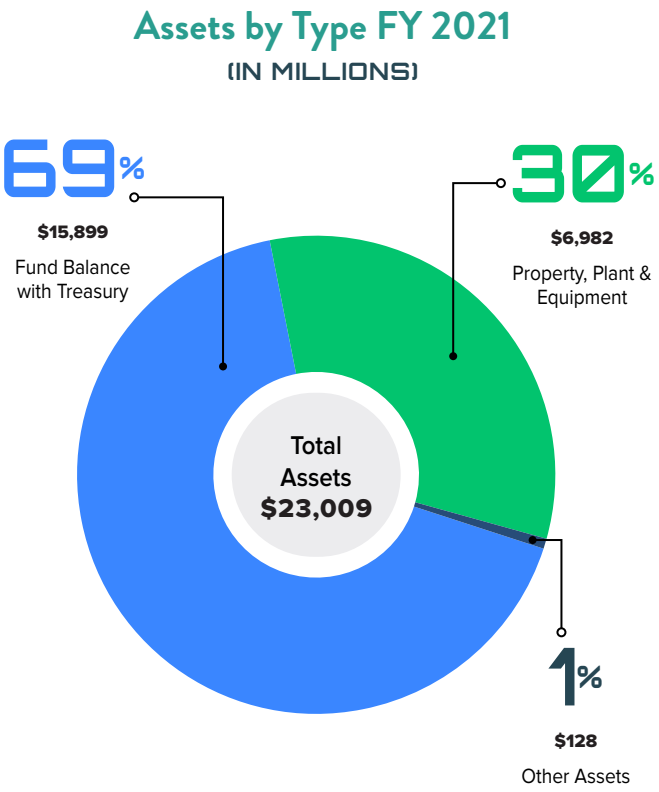
**NET POSITION**
the activity between revenue and other financing sources, and costs incurred since inception.

### Balance Sheet Components FY 2021 and FY 2020

(IN MILLIONS)



**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, 2021, was $23 billion or eight percent higher than FY 2020.


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 $16 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 $7 billion as of September 30, 2021, 30 percent of total assets. The balance was 13 percent higher in FY 2021 compared to FY 2020. The increase is primarily due to the fabrication of equipment items that will support Habitation and Logistics Outpost (HALO), Gateway S Band, Power and Propulsion Element (PPE) Spacecraft, Aerospace Communication Facility, Research Support Building, and the Marshall Steam Distribution Revitalization Project, the maintenance of ISS, as well as the production work on the Mobile Launcher-2.

The Other category represents the amount of Investments, Accounts Receivable, Advances and Prepayments, and Other Assets as of September 30, 2021. There was a decrease of $4 million, or three percent as compared to FY 2020.

**TOTAL LIABILITIES,** as of September 30, 2021, were $7 billion, six percent higher than FY 2020. Environmental and Disposal Liabilities, Accounts Payable, and Other Liabilities represent the majority of NASA's liabilities. The increase in FY 2021 is primarily due to increased commitments with the Deep Space Network, Mars Rover 2020, and various missions including the Psyche mission, Exoplanet Exploration Supporting Research & Technology (SR&T) mission, Europa Clipper mission, Mars Mission Operations and Mars Technology, RMB-Science Programmatic mission.

Environmental and Disposal Liabilities of $2 billion represent the estimated cost to clean up both known and projected environmental hazards. There was a slight decrease of $46 million, or two percent in FY 2021 as compared to FY 2020.

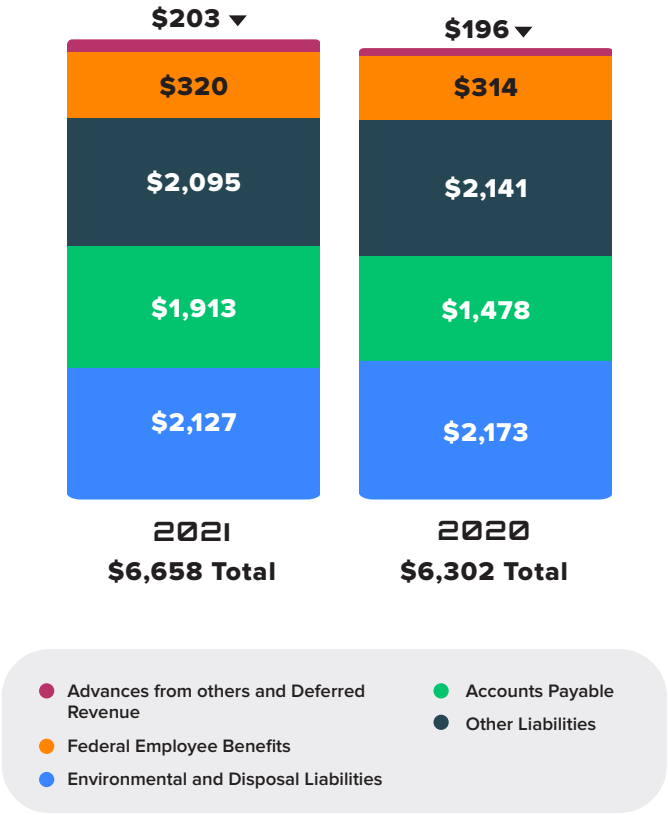
Accounts Payable, which represents amounts owed to other entities, was $1.9 billion, an increase of $435 million, or 29 percent, compared to FY 2020.

Other Liabilities, which represents various amounts including Accrued Funded Payroll and Contingent Liabilities, were $2 billion, a decrease of $46 million, or two percent, compared to FY 2020. The decrease is primarily due to a legal settlement over construction delays of Kennedy Space Center's Headquarters building.

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

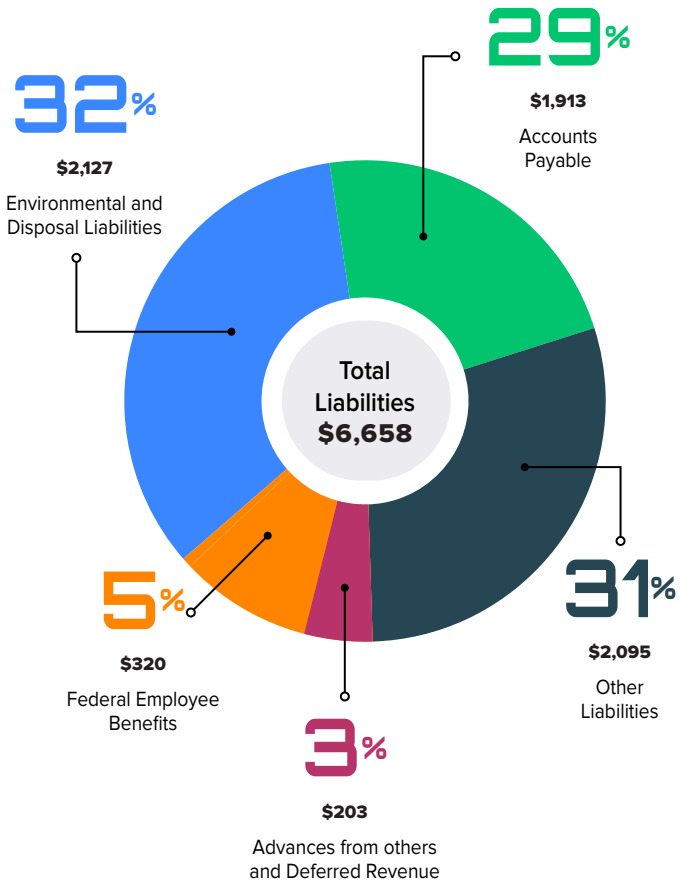
## Liabilities by Type Comparison For FY 2021 and FY 2020

(IN MILLIONS)




## Liabilities by Type FY 2021

(IN MILLIONS)




**TOTAL NET POSITION** comprised of Unexpended Appropriations and Cumulative Results of Operations ("net worth"), increased by $1.4 billion, 10 percent higher than FY 2020. Unexpended Appropriations, at $12 billion, increased by five percent from FY 2020. Cumulative Results of Operations, at $5 billion, increased by $820 million or 22 percent from FY 2020. The change to Net Position is primarily due to the change in NASA Held Personal Property cost settlement to Asset Under Construction.

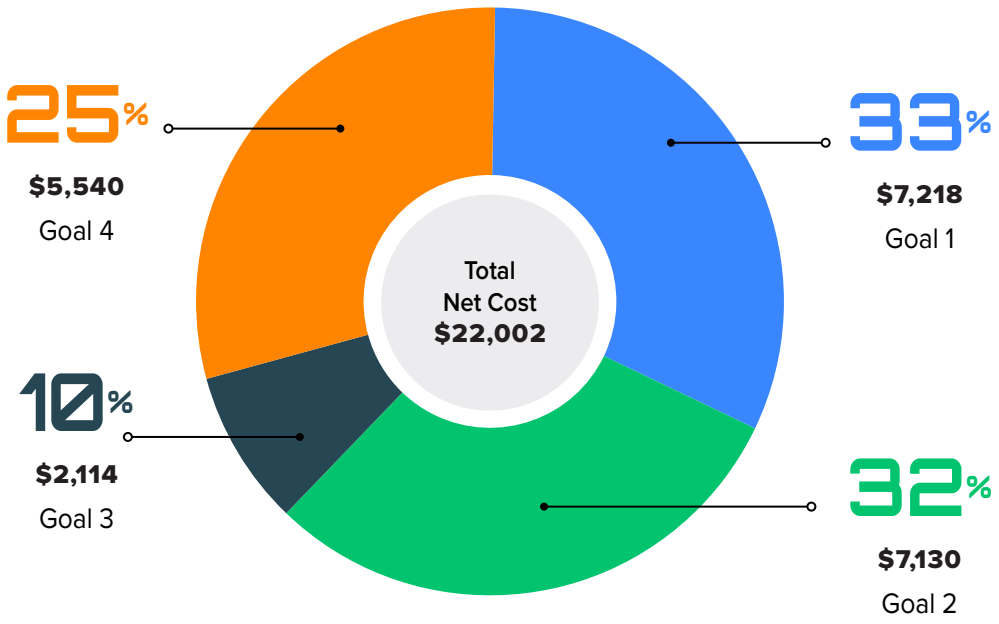
# Results of Operations

## 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 12). 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, 2021, NASA's gross costs were $24 billion, a decrease of $357 million from FY 2020. Earned Revenue from other governmental organizations or private entities was $2 billion, a $228 million decrease from FY 2020, leaving NASA with a FY 2021 net cost of $22 billion, a decrease of $129 million from FY 2020.

### Net Cost of Operations by Strategic Goal for FY 2021

(IN MILLIONS)




- 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.

DID YOU KNOW?

The Space Canary sensor developed by Lunar Outpost Inc. can detect the ultra-fine lunar dust particles inside a habitat, alerting astronauts should an elevated level of contamination occur. Adapted for use on Earth, the same technology, now renamed the Canary-S, can monitor forest fire emissions, evaluate urban air quality, and more.

PHOTO CREDIT — Lunar Outpost

# Results of Operations (Continued)

## Gross Cost of Operations

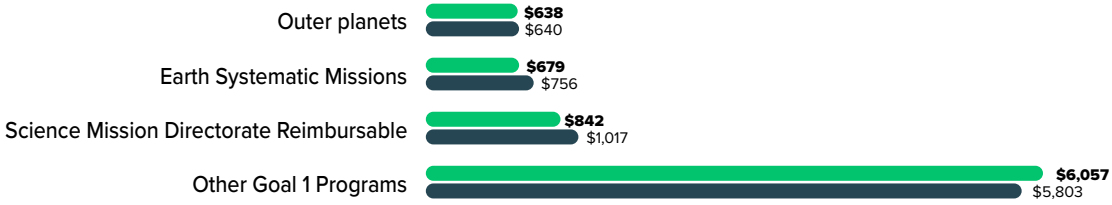
NASA's day-to-day operations are performed at NASA and contractor facilities around the globe and in space. Gross costs of operations is presented in the following table, detailing select NASA programs that support each strategic goal. Gross costs of operations include expenses incurred for NASA's research and development (R&D) investments that are expected to maintain or increase national economic productive capacity or yield other future benefits. Top programs by strategic goal in relation to gross costs have remained consistent year to year.

### Comparative Gross Cost of Operations by Strategic Goal FY 2021 and FY 2020

**(IN MILLIONS)**

**FY 2021 TOTAL: $23,550** | FY 2020 TOTAL: $23,907

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

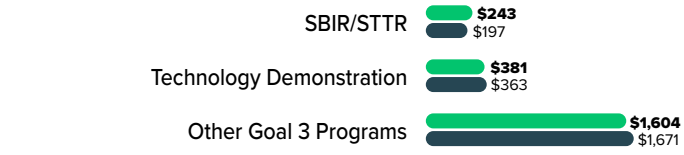



**FY 2021 TOTAL: $8,216** | FY 2020 TOTAL: $8,216

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

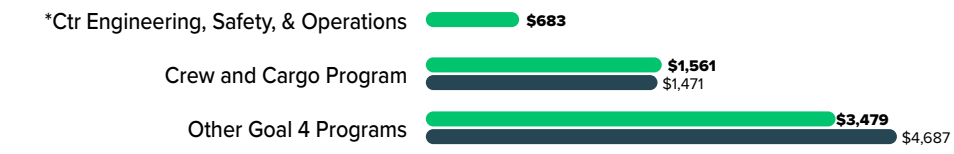

**FY 2021 TOTAL: $7,383** | FY 2020 TOTAL: $7,302

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




**FY 2021 TOTAL: $2,228** | FY 2020 TOTAL: $2,231

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




**FY 2021 TOTAL: $5,723** | FY 2020 TOTAL: $6,158

* Created FY2020 Q4

2021 2020

# 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 2021, the total funds available for use by the Agency were $28 billion — an increase of $186 million, or one percent, compared to FY 2020.

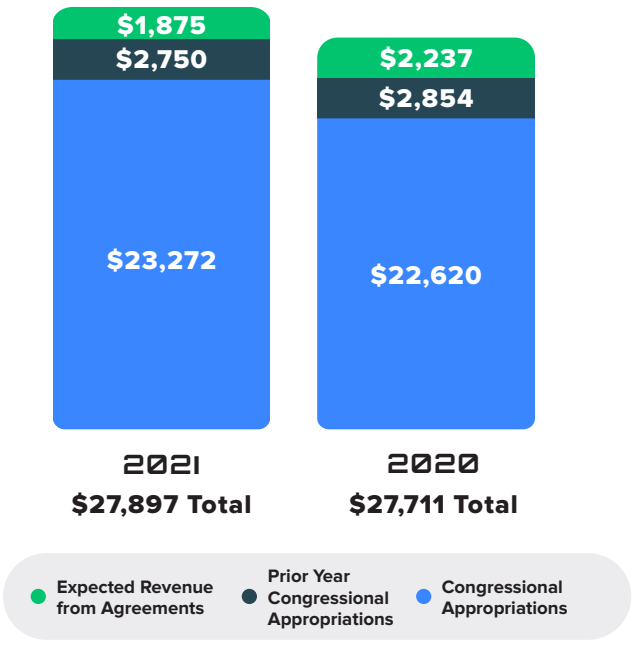
The $23.3 billion in appropriations from Congress for FY 2021 accounted for 83 percent of the total funds available for use by the Agency. Congress designates the funding available to the Agency for a specific NASA mission. Appropriations that remained available from prior years totaled $2.8 billion, 10 percent of NASA's available resources in FY 2021.

NASA's FY 2021 funding also included $2 billion of spending authority from offsetting collections, primarily comprised of revenue earned and collected from agreements, this totaled seven percent of NASA's available resources in FY 2021. Revenue is earned under NASA's authority to provide goods, services, or use of facilities to other entities on a reimbursable basis.

In FY 2021, NASA obligated $25 billion of the $28 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 $3 billion may be obligated until the funds' periods of availability expire.

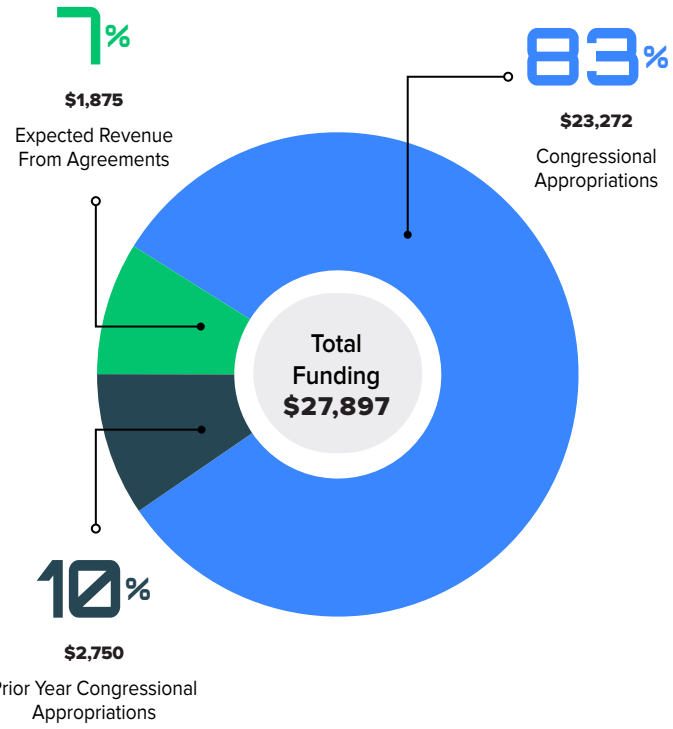
## Sources of Funding Comparison For FY 2021 and FY 2020

(IN MILLIONS)




## Sources of Funding FY 2021

(IN MILLIONS)



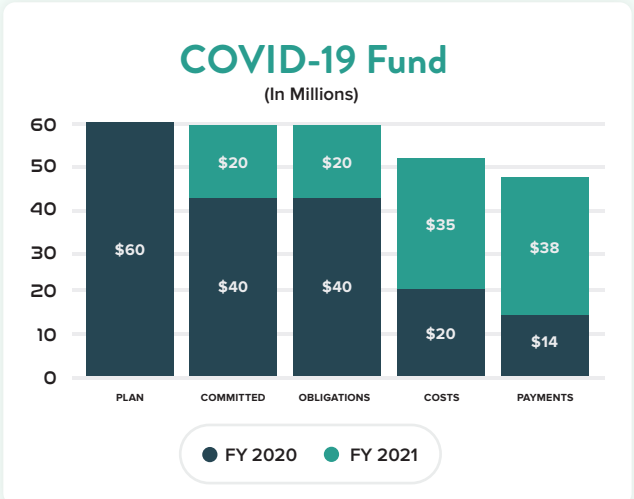
# FINANCIAL AND PERFORMANCE IMPACT OF COVID-19


DID YOU KNOW?

NASA has once again joined forces with the community in the continuing effort to fight COVID-19. The agency provided specialized ground support on Jan. 11 for Samaritan's Purse, enabling the aid organization to land their DC-8 cargo jet at NASA's Armstrong Flight Research Center Building 703 in Palmdale, California. The Samaritan's Purse DC-8 arrived early Monday with supplies to aid in Los Angeles County's Emergency Field Hospital that will expand capacity to care for COVID-19 patients at Antelope Valley Hospital. The aircraft is specially configured to carry up to 84,000 pounds of cargo and 32 passengers in support of international relief efforts.

PHOTO CREDIT — NASA / Lauren Hughes

The Coronavirus Aid, Relief, and Economic Security Act, or CARES Act, was passed by Congress and signed by President Donald Trump on March 27, 2020. This bill allotted $2.2 trillion to provide fast and direct economic aid to the American people negatively impacted by the COVID-19 pandemic. Of those funds, $60 million was provided to NASA within its Safety, Security, and Mission Services appropriation to prevent, prepare for, and respond to the coronavirus domestically or internationally. These funds primarily were used for contractor impact claims, information technology services, cleaning supplies, and personal protective equipment. These funds include the costs of increased cleaning efforts at each NASA facility to protect the health and safety of our workforce and ensuring the well-being of every employee. In FY 2021, we have fully obligated our funding to cover additive costs related with COVID-19.



# LIMITATIONS OF THE FINANCIAL STATEMENTS


This uniform in the center of this image belonged to one of the unsung heroes of the Space Shuttle Program – Travis Thompson, former Closeout Crew Lead.

The closeout crew was responsible for assisting the astronauts to strap into the shuttle's crew module and take care of any other last-minute needs that arose. Ultimately, they close and seal the crew access hatch and leave the astronauts behind before they launch into space.

On July 9, 2021, Thompson, who served for nearly 100 missions, and Deputy Administrator and former shuttle commander Pamela Melroy met to view his uniform at its exhibit in the National Air and Space Museum, Steven F. Udvar-Hazy Center in Chantilly, VA. Melroy presented him with a plaque for the occasion and surprised him by showing him she had kept the gift he gave to her many years ago. It was an emotional moment that celebrated not just the heroes who venture out into space but also the heroes who make sure they get there safely and come back home to us.

Learn more about the closeout crew.

PHOTO CREDIT — NASA/Taylor Mickal

The principal financial statements are prepared to report the financial position, financial condition, and results of operations, pursuant to the requirements of 31 U.S.C. § 3515(b). The statements are prepared from records of Federal entities in accordance with Federal Generally Accepted Accounting Principles (GAAP) and the formats prescribed by OMB. Reports used to monitor and control budgetary resources are prepared from the same records. Users of the statements are advised that the statements are for a component of the U.S. Government.

# SYSTEMS, CONTROLS, AND LEGAL COMPLIANCE

The Empire State Building is illuminated in red to celebrate this Thursday's scheduled landing on Mars of NASA's Perseverance rover, Tuesday, Feb. 16, 2021 in New York City. A key objective for Perseverance's mission on Mars is astrobiology, including the search for signs of ancient microbial life. The rover will characterize the planet's geology and past climate, pave the way for human exploration of the Red Planet, and be the first mission to collect and cache Martian rock and regolith.

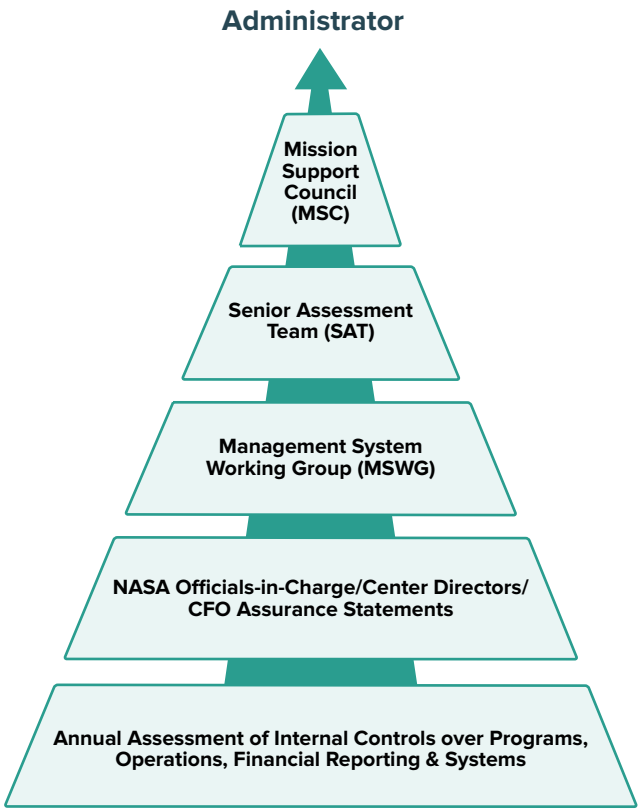
PHOTO CREDIT — NASA/Emma Howells

# INTERNAL CONTROL FRAMEWORK

## NASA Federal Managers' Financial Integrity Act Annual Statement of Assurance Process

The Federal Managers' Financial Integrity Act (FMFIA)[1] 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.

An effective system of 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 organization in meeting established objectives. NASA complies with OMB Circular A-123, 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 A-123[2] also requires agencies to establish internal controls over operations, reporting and compliance.




NASA FMFIA Annual Statement of Assurance Process

Figure 1

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 intended objectives. In addition, the NASA Office of the Chief Financial Officer (OCFO) deploys an extensive annual assessment methodology and internal control testing techniques that evaluate internal controls over financial reporting. NASA considers Enterprise Risk Management (ERM) Program activities, reviews the Agency Risk Profile and considers fraud risk in its execution of the Administrator's Statement of Assurance Process (SoA) in evaluating and providing assurance on internal controls.

The FMFIA assurance statement is based on self-certifications submitted by NASA Officials-in-Charge that ultimately support the Administrator's SoA as well as a review of various internal and external sources of information. The self-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[3]). The self-certifications and subsequent reviews are informed by various

[1] The Federal Managers' Financial Integrity Act (FMFIA) https://obamawhitehouse.archives.gov/omb/financial_fmfia1982
[2] 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
[3] Green Book - https://www.gao.gov/assets/670/665712.pdf

# NASA Federal Managers' Financial Integrity Act Annual Statement of Assurance Process (Continued)

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 that recommends the type of assurance that results from their execution of the SoA Program.

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 components.

In FY 2021, as the COVID-19 pandemic continued to impact how the Agency operates, leadership maintained a strong working culture, ensuring that processes and internal controls could withstand long-term telework and new health protocols. NASA leadership reiterated that the health and safety of the NASA community is a top priority and critical to the success of the mission as evidenced by its core values of Safety, Integrity, Teamwork, Excellence and Inclusion.

NASA leadership continuously evaluates Agency operations based on lessons learned from the pandemic and makes changes, as appropriate, to better protect the health and safety of the workforce and missions while meeting mission objectives. Internal control processes at NASA are robust and continue to operate in an effective and efficient manner.

DID YOU KNOW?

**Perseverance's Navigation Camera Captures Sample Borehole**

This composite of two images shows the hole drilled by NASA's Perseverance rover during its second sample-collection attempt. The images, which were obtained by one of the rover's navigation cameras on Sept. 1, 2021 (the 190th sol, or Martian day, of the mission), were taken in the "Crater Floor Fractured Rough" geologic unit in Mars' Jezero Crater. The team nicknamed the rock "Rochette" for reference and the spot on the rock where the sample was cored "Montdenier."

PHOTO CREDIT — NASA/JPL-Caltech

# ENTERPRISE RISK MANAGEMENT

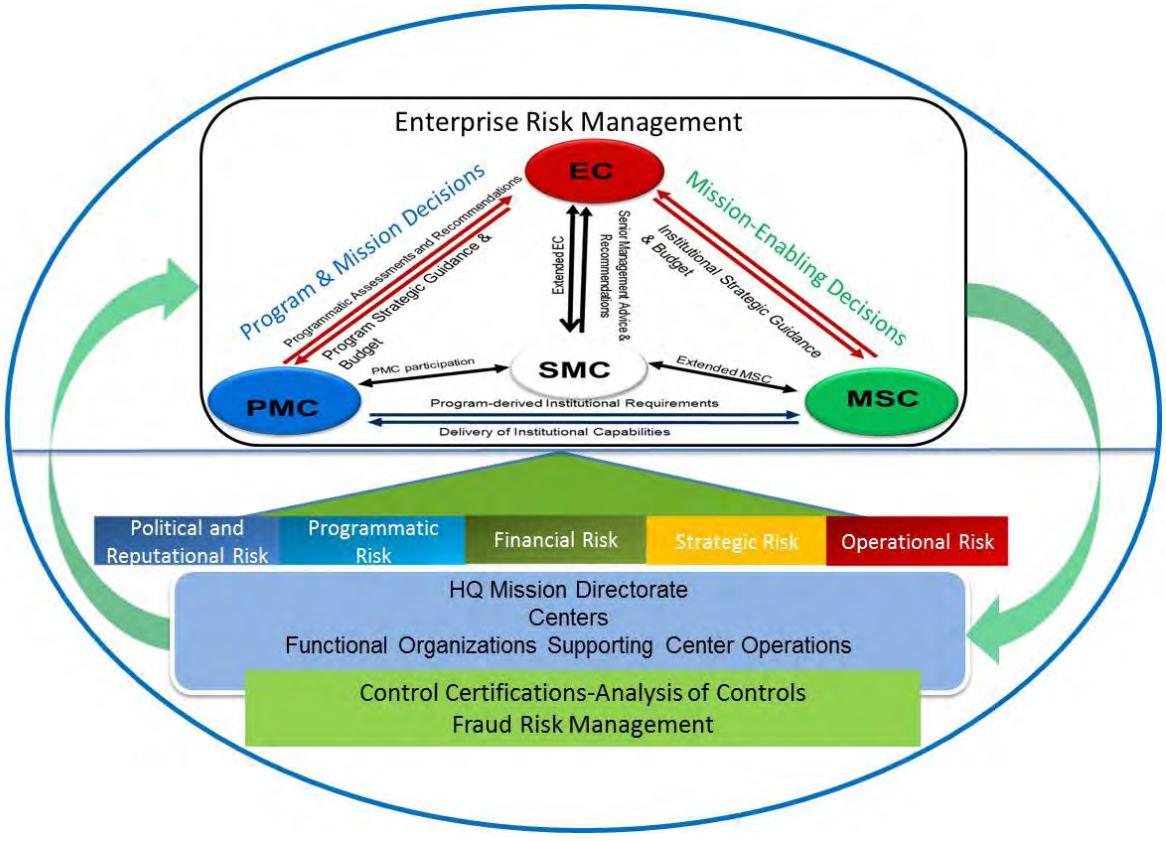
OMB Circular No. A-123, *Management's Responsibility for Enterprise Risk Management and Internal Control*, requires Federal agencies to implement Enterprise Risk Management (ERM) to ensure Federal managers are effectively managing risks that could affect the achievement of Agency strategic objectives.

Risk management continues to be embedded in NASA's culture, and the principles and practices are inherent in everyday 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 (see Figure 2). The UNICORN's foundation is the Agency's risk management activities and decisional councils.

## UNIFIED COMPREHENSIVE OPERATIONAL RISK NETWORK

## NASA's UNICORN

**Figure 2**



In FY 2021, NASA's maturation of its ERM Program continued. The NASA Enterprise Risk Management Working Group (ERMWG) continues to identify enterprise-level risks and opportunities and collaborates with organizations to address identified enterprise risks. The ERMWG, which is comprised of representatives from several stakeholder organizations, proposes enterprise-level risks to the Chair for consideration and integration into the Agency Risk Profile. The Chair of the ERMWG presents the Agency Risk Profile, highlighting the Agency's most significant risks, each month at Baseline Performance Reviews (BPR) for concurrence by the BPR Chair, the Associate Administrator.

As illustrated in Figure 3, NASA leverages a variety of sources 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 MSWG to facilitate the integration of risks across the Agency for appropriate consideration as enterprise risks. 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 which focuses on integrating risks at the enterprise level.

## ERM Sources

**Figure 3**


As a result of the pandemic, NASA continues to face new challenges in carrying out essential functions necessary to achieve its core mission. Long standing risk management processes and activities are inherently woven throughout NASA's culture, so beneficially, the Agency is well-positioned to respond to unknown threats or national emergencies that may disrupt operations for an extended period. NASA leadership has developed agency-wide guidance that considers guidelines provided by the White House, Office of Personnel Management (OPM), and OMB. As the pandemic remains, uncertainty still exists as to the future of normal operations. The ERMWG takes these challenges into consideration when identifying and prioritizing enterprise risks. The ERMWG continues to analyze the impact of the pandemic on the risks being reported on the Agency Risk Profile. The QAD works closely with senior leaders to understand the impact of COVID-19 on their ability to meet organizational objectives and to identify additional emerging risks and opportunities.

NASA will continue to strengthen its risk management and reporting process through comprehensive collaboration with the various risk bodies and stakeholders throughout the Agency, to effectively identify key risks and opportunities particularly as they have arisen as a result of the COVID-19 response, develop effective risk responses, and implement timely mitigation actions.

# MANAGEMENT ASSURANCES

## Administrator's Statement of Assurance - November 15, 2021

National Aeronautics and Space Administration (NASA) management is responsible for establishing and maintaining an effective system of internal control to support reliable financial reporting, and effective and efficient programmatic operations. Accordingly, NASA conducted its Fiscal Year (FY) 2021 annual assessment of the effectiveness of management's internal controls for compliance with applicable laws, regulations, and policies; the Federal Managers' Financial Integrity Act (FMFIA); Federal Financial Management Improvement Act (FFMIA); the Office of Management and Budget's (OMB) Circular A-123, *Management's Responsibility for Enterprise Risk Management and Internal Control*; the U.S. Government Accountability Office's *Standards for Internal Controls in the Federal Government*, and NASA policies. 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, regulations, and policies was operating effectively as of September 30, 2021, and no material weaknesses were found in the design or implementation of internal controls.

In accordance with OMB requirements to integrate Enterprise Risk Management (ERM) and internal control in Federal agencies, NASA's ERM Program conducts enterprise risk activities and fraud risk activities, evaluates internal control, and provides an overall assurance on the internal control environment. As a result, managers and employees throughout the Agency are actively engaged in assessing risks, identifying and updating key control objectives, implementing controls and other mitigation strategies, conducting reviews, and taking corrective actions as appropriate.

In addition, NASA complies with FMFIA and OMB requirements to evaluate and assure the reliability of its internal controls over its financial management systems, complies with Federal financial management system requirements, and assures reliability of its Digital Accountability and Transparency Act of 2014 (DATA Act) submissions.

FFMIA requires agencies to have financial management systems that substantially comply with Federal financial management system requirements, Federal Accounting Standards, and the U.S. Government Standard General Ledger at the transaction level. NASA conducted its evaluation of financial management systems for compliance with FFMIA in accordance with Appendix D of OMB Circular A-123. NASA financial management systems substantially comply with FFMIA as of September 30, 2021.

NASA's Certification of Reasonable Assurance is based upon management's knowledge gained from daily operations, monitoring activities, assessment of risk and internal control, and other internal controls that govern the effectiveness and efficiency of operations. NASA makes an unmodified statement of assurance that its internal controls for FY 2021 were operating effectively. NASA remains committed to ensuring that a sound system of internal control exists over operations, reporting, and financial management systems.

Sincerely,

Bill Nelson
Administrator

# FINANCIAL SYSTEMS STRATEGIES

NASA's financial management system strategy is to establish an overarching roadmap that aligns with the Agency's mission for innovation and strategic goals to optimize capabilities and operations which promote the technologies of tomorrow. Current financial management systems initiatives seek to enable integrated solutions which utilize modern business processes, meet evolving stakeholder needs and comply with internal and external Federal policies, standards and OMB requirements.

The Systems, Applications & Product ERP Central Component (SAP ECC) is the dedicated enterprise resource planning (ERP) solution serving as NASA's integrated financial accounting system of record since 2003. The eBudget Suite of applications designed to develop, manage, and maintain the NASA Federal Budget by phases, has supported budget formulation and Congressional justifications since 2007. These financial management tools are supported by commercial off-the-shelf (COTS) software, NASA developed applications, and interfaces with systems managed by other Federal agencies.

In collaboration with Agency Information Technology (IT) Governance structure, a financial application management board was established to prioritize significant IT investments, establish functional roadmaps, and continually review inventory of applications for modernization opportunities across the financial management portfolio evaluating whether enterprise solutions meet current business needs.

This approach is in adherence with the FY 2018 President's Management Agenda: Modernizing Government for the 21st Century, which lays out a long-term vision for modernizing the Federal Government in key areas that will improve the ability of agencies to deliver mission outcomes, provide excellent service, and effectively steward taxpayer dollars on behalf of the American people. A key component of the Administration's Information Technology Framework effort includes addressing aging IT infrastructure and modernizing citizen facing services.

NASA utilized 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. This effort improved accounts payable business processes, provided a single Agency-wide electronic solution, and significantly reduced manual invoice data entry. NASA successfully met the FY 2018 target to implement expanding eInvoicing.

NASA is currently working to implement G-Invoicing, Treasury's long-term solution for Federal Program Agencies (FPAs) to manage intragovernmental (IGT) Buy/Sell transactions by the mandated implementation deadline.


**A SpaceX Falcon 9 rocket, with the company's uncrewed Dragon spacecraft atop, is raised to a vertical position at NASA Kennedy Space Center's Launch Complex 39A on Aug. 25, 2021, in preparation for the 23rd commercial resupply services launch to the International Space Station.**

**PHOTO CREDIT — SpaceX**

# FORWARD LOOKING

A Northrop Grumman Antares rocket carrying a Cygnus resupply spacecraft is seen as it is rolled out of the Horizontal Integration Facility on its way to the Mid-Atlantic Regional Spaceport's Pad-0A, Tuesday, Feb. 16, 2021, at NASA's Wallops Flight Facility in Virginia. Northrop Grumman's 15th contracted cargo resupply mission with NASA to the International Space Station will deliver about 8,000 pounds of science and research, crew supplies and vehicle hardware to the orbital laboratory and its crew. The CRS-15 Cygnus spacecraft is named after NASA mathematician, Katherine Johnson, a Black woman who time and again broke through barriers of gender and race. The launch is scheduled for 12:36 p.m. EST, Feb. 20, 2021.

PHOTO CREDIT — NASA/Patrick Black

# FY 2022 AND BEYOND

Members of NASA's Perseverance Mars rover team watch in mission control as the first images arrive moments after the spacecraft successfully touched down on Mars, Thursday, Feb. 18, 2021, at NASA's Jet Propulsion Laboratory in Pasadena, California. A key objective for Perseverance's mission on Mars is astrobiology, including the search for signs of ancient microbial life. The rover will characterize the planet's geology and past climate, pave the way for human exploration of the Red Planet, and be the first mission to collect and cache Martian rock and regolith.

PHOTO CREDIT — SpaceX

**In February 2022,** NASA will release a new quadrennial strategic plan that updates the strategic direction, goals, and priorities in the *2018 Strategic Plan*. The *2022 Strategic Plan* is aligned with presidential priorities and provides a unified, long-term, and achievable direction for all of our activities.

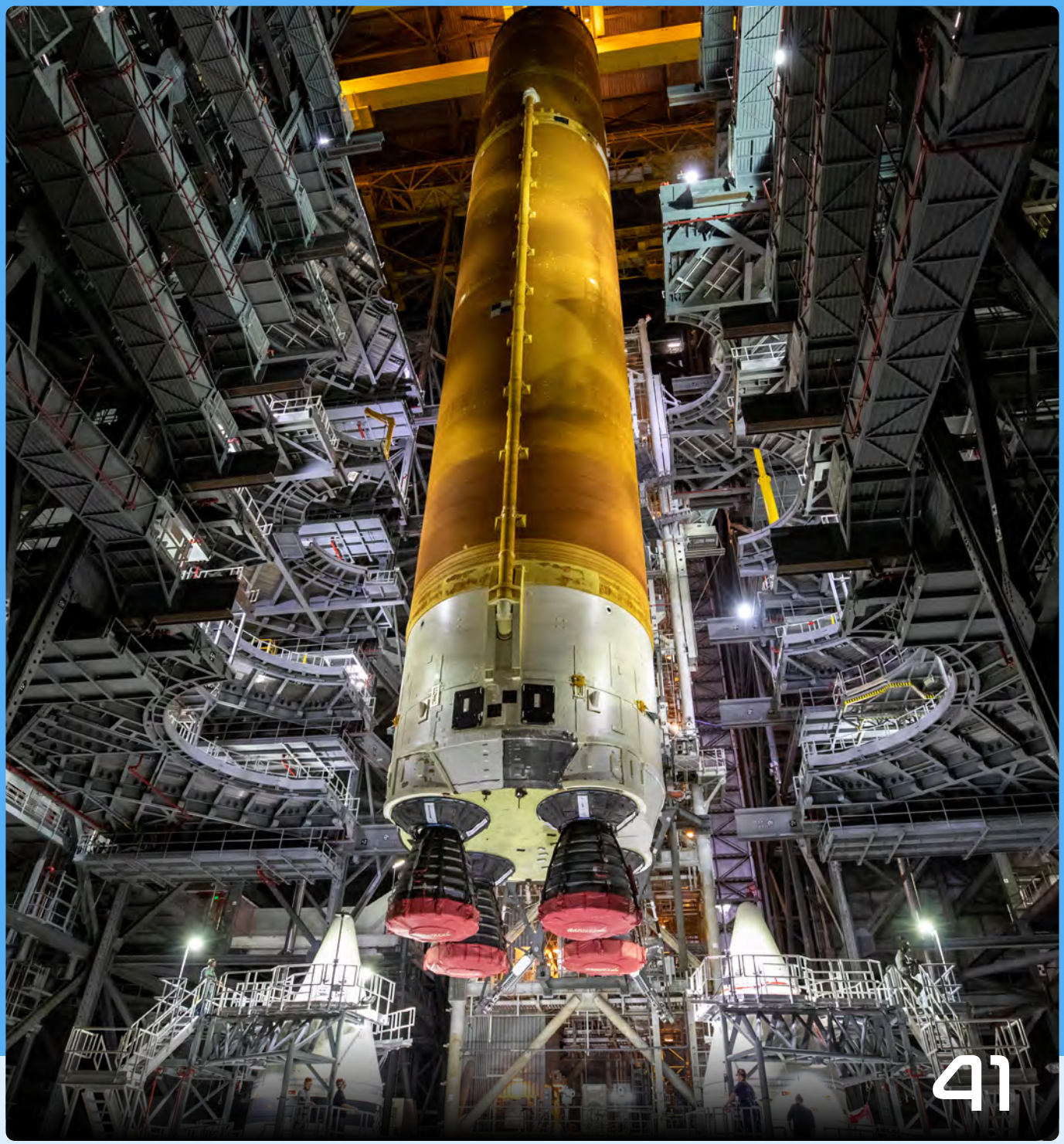
At the top of NASA's strategic plan framework will continue to be four strategic goals focused on scientific discovery, human space exploration, innovation, and capabilities and operations to advance mission success. We have added new strategic objectives, and reframed continuing ones, to support Administration and Agency priorities, and we have created stronger budget-performance alignment by assigning mission directorates to specific strategic goals. NASA cross-walked the FY 2022 performance goals to the new strategic plan framework. Beginning with the FY 2022 AFR, the updated alignment will be reflected in where ratings are grouped in the summary of preliminary performance ratings. It also will change the Comparative Gross Cost of Operations by Strategic Goal and the Consolidated Statement of Net Cost.

At the end of September 2021, Administrator Nelson announced that the Human Exploration and Operations Mission Directorate (HEOMD), which was responsible for NASA's ambitious human space exploration effort and largest budget lines, would be separated into two mission directorates. As of FY 2022, the Space Operations Mission Directorate will focus on launch, space operations (including the International Space Station), the commercialization of low Earth orbit, and eventually, sustaining operations on and around the Moon. The Exploration Systems Development Mission Directorate will define and manage systems development for programs critical for our Artemis program. These refocused mission directorates will be well positioned to implement the strategies in the 2022 Strategic Plan and address the ongoing challenges described in the Office of Inspector General's Letter on NASA's Top Management and Performance Challenges (see page 81).

This organizational change should not alter the Required Supplementary Information Combining Statement of Budgetary Resources, which already uses separate budget lines for the Space Operations mission and the Exploration mission.

SECTION 2

# FINANCIAL SECTION




Teams with NASA's Exploration Ground Systems and contractor Jacobs prepare to lower the Space Launch System (SLS) core stage – the largest part of the rocket – onto the mobile launcher, in between the twin solid rocket boosters, inside High Bay 3 of the Vehicle Assembly Building at NASA's Kennedy Space Center in Florida on June 12, 2021.

PHOTO CREDIT — NASA/Cory Huston

# MESSAGE FROM THE CHIEF FINANCIAL OFFICER

I am pleased to join Administrator Nelson in presenting the Fiscal Year (FY) 2021 NASA Agency Financial Report (AFR). The Office of the Chief Financial Officer (OCFO) carries the immense responsibility of supporting NASA's mission and workforce needs through effective stewardship of taxpayer resources, while providing transparent and accurate reporting on NASA's operating performance, resource management, and accomplishment of strategic goals. I am proud of the incredible dedication, skill, and perseverance shown by the OCFO team over the past year to meet the highest standards for budgetary performance, risk management, internal control, and innovative financial reporting all against the backdrop of the COVID-19 pandemic. The dedication of this workforce is recognized in a tangible way with the achievement of NASA's eleventh consecutive unmodified "clean" audit opinion with no material internal control weaknesses from our independent auditor. This certifies that NASA's financial statements conform in all material respects with the requirements of U.S. Generally Accepted Accounting Principles (GAAP), and our system of internal controls is operating effectively. This ensures that the preparation and fair presentation of financial statements are free from material misstatements and compliant with laws, regulations, contracts, and grant agreements applicable to NASA. I want to send a special thank you to the entire OCFO team and our supporting stakeholders for their contributions to the success of this report.

NASA is undertaking a number of highly important and complex missions, with goals designed to create educational opportunities, combat climate change, catalyze technological innovation and new realms of commerce, and venture out farther into the cosmos than ever before. These goals are pursued with determination and dedication across the Centers, divisions, and directorates by the world's most talented workforce.

## Audit and Compliance Activities

In FY 2021, NASA's independent auditors identified no material weaknesses in their financial audit. NASA's "clean" unmodified audit opinion shows our FY 2021 financial statements are presented fairly and conform with GAAP. Additionally, the auditors disclosed no instances of deficiency complying with the applicable provisions of the Federal Financial Management Improvement Act (FFMIA) in NASA's financial management systems.

Our independent auditors identified one significant deficiency in the FY 2021 audit. It was determined that enhancements were needed in the notes to the statements to comply with the disclosure requirements of Federal Accounting Standards Advisory Board's (FASAB) Statement of Federal Financial Accounting Standards (SFFAS) 49, *Public-Private Partnerships: Disclosure Requirements*, and OMB Circular A-136, *Financial Reporting Requirements*. NASA will work to timely resolve this deficiency as recommended by our independent auditors. The OCFO team will collaborate with the NASA Centers, as required, to refine and standardize our Public-Private Partnerships analysis and disclosure process.

## OCFO Key Accomplishments

The OCFO team has achieved much over the past year, despite the impacts of the COVID-19 pandemic. We are especially proud that NASA was again recognized by the Association of Government Accountants (AGA) for excellence in financial reporting with the prestigious Certificate of Excellence in Accountability Reporting (CEAR) for our FY 2020 AFR, reflecting the painstaking efforts, resourcefulness and collaboration of the OCFO team and our Agency stakeholders to produce clear, compelling, and accurate Agency financial reporting.

Complementing our focus on the core OCFO mission, we are also devoted to strengthening the knowledge, skills, and abilities of our workforce across the enterprise. We successfully deployed a comprehensive CFO University course curriculum, in a completely virtual environment, for the second year in a row, providing NASA-focused financial management, program planning and control, and management and leadership training to our OCFO community. This ensures that the crucial connections, sharing of knowledge, and camaraderie which have always been our strengths are maintained and sustained during these unprecedented times.

This year has shown just how resilient NASA can be in achieving its ambitious goals through the incredible efforts of our world-class teams. I have every confidence in our continued success as we move forward together.

Sincerely,

Margaret V Schaus

MARGARET VO SCHAUS

# 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, 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 periods. 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 periods.

## 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.

## Consolidated Statements of Changes in Net Position

report the beginning balances of net position, current financing sources and use of resources, unexpended resources for the reporting periods, and ending net position for the current reporting periods.

## Combined Statements of Budgetary Resources

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

# FINANCIAL STATEMENTS, NOTES, AND SUPPLEMENTAL INFORMATION


Expedition 65 Russian cosmonaut Pyotr Dubrov, top, NASA astronaut Mark Vande Hei, middle, and Russian cosmonaut Oleg Novitskiy wave farewell prior to boarding the Soyuz MS-18 spacecraft for launch, Friday, April 9, 2021 at the Baikonur Cosmodrome in Kazakhstan. Launch of the Soyuz rocket will send the trio on a mission to the International Space Station.

PHOTO CREDIT — NASA/Bill Ingalls

# National Aeronautics and Space Administration
# Consolidated Balance Sheets
# As of September 30, 2021 and 2020

(In Millions)

| | 2021 | 2020 |
|---|---|---|
| **Assets:** | | |
| Intragovernmental: | | |
| Fund Balance with Treasury (Note 2) | $ 15,899 | $ 14,914 |
| Investments (Note 3) | 16 | 16 |
| Accounts Receivable, Net (Note 4) | 90 | 110 |
| Total Intragovernmental | 16,005 | 15,040 |
| With the Public: | | |
| Accounts Receivable, Net (Note 4) | 1 | – |
| General Property, Plant and Equipment, Net (Note 5) | 6,982 | 6,195 |
| Advances and Prepayments | 16 | – |
| Other Assets (Note 7) | 5 | 6 |
| Total with the Public | 7,004 | 6,201 |
| **Total Assets** | **$ 23,009** | **$ 21,241** |
| **Stewardship PP&E (Note 6)** | | |
| **Liabilities (Note 8):** | | |
| Intragovernmental: | | |
| Accounts Payable | $ 166 | $ 187 |
| Advances from Others and Deferred Revenues | 55 | 61 |
| Other Liabilities (Note 10) | 50 | 45 |
| Total Intragovernmental | 271 | 293 |
| With the Public: | | |
| Accounts Payable | 1,747 | 1,291 |
| Federal Employee Benefits Payable (Note 8) | 320 | 314 |
| Environmental and Disposal Liabilities (Note 9) | 2,127 | 2,173 |
| Advances from Others and Deferred Revenues | 148 | 135 |
| Other Liabilities (Note 10) | 2,045 | 2,096 |
| Total with the Public | 6,387 | 6,009 |
| **Total Liabilities** | **$ 6,658** | **$ 6,302** |
| **Commitments and Contingencies (Note 11)** | | |
| **Net Position:** | | |
| Unexpended Appropriations | $ 11,822 | $ 11,230 |
| Cumulative Results of Operations | 4,529 | 3,709 |
| **Total Net Position** | **$ 16,351** | **$ 14,939** |
| **Total Liabilities and Net Position** | **$ 23,009** | **$ 21,241** |

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, 2021 and 2020

(In Millions)

| | 2021 | 2020 |
|---|---|---|
| **Strategic Goal 1 – Expand human knowledge through new scientific discoveries:** | | |
| Gross Costs | $ 8,216 | $ 8,216 |
| Less: Earned Revenue | 998 | 1,229 |
| Net Cost | 7,218 | 6,987 |
| **Strategic Goal 2 – Extend human presence deeper into space and to the Moon for sustainable long-term exploration and utilization:** | | |
| Gross Costs | $ 7,383 | $ 7,302 |
| Less: Earned Revenue | 253 | 260 |
| Net Cost | 7,130 | 7,042 |
| **Strategic Goal 3 – Address national challenges and catalyze economic growth:** | | |
| Gross Costs | $ 2,228 | $ 2,231 |
| Less: Earned Revenue | 114 | 116 |
| Net Cost | 2,114 | 2,115 |
| **Strategic Goal 4 - Optimize capabilities and operations:** | | |
| Gross Costs | $ 5,723 | $ 6,158 |
| Less: Earned Revenue | 183 | 171 |
| Net Cost | 5,540 | 5,987 |
| **Net Cost of Operations** | | |
| Total Gross Costs | $ 23,550 | $ 23,907 |
| Less: Total Earned Revenue | 1,548 | 1,776 |
| **Net Cost** | **$ 22,002** | **$ 22,131** |

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, 2021 and 2020

(In Millions)

| | 2021 | 2020 |
|---|---|---|
| **Unexpended Appropriations:** | | |
| Beginning Balance | $ 11,230 | $ 10,542 |
| Appropriations Received | 23,271 | 22,689 |
| Other Adjustments | (26) | (90) |
| Appropriations Used | (22,653) | (21,911) |
| Net Change in Unexpended Appropriations | 592 | 688 |
| **Total Unexpended Appropriations** | **$ 11,822** | **$ 11,230** |
| **Cumulative Results of Operations:** | | |
| Beginning Balance | $ 3,709 | $ 3,708 |
| Appropriations Used | 22,653 | 21,911 |
| Non-Exchange Revenue | – | – |
| Donations and Forfeitures of Property | 14 | 72 |
| Imputed Financing | 155 | 149 |
| Other | – | – |
| Net Cost of Operations | (22,002) | (22,131) |
| Net Change in Cumulative Operations | 820 | 1 |
| **Cumulative Results of Operations: Ending** | **$ 4,529** | **$ 3,709** |
| **Net Position** | **$ 16,351** | **$ 14,939** |

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, 2021 and 2020

(In Millions)

| | 2021 | 2020 |
|---|---|---|
| **Budgetary Resources:** | | |
| Unobligated balance from prior year budget authority, net | $ 2,750 | $ 2,854 |
| Appropriations | 23,272 | 22,620 |
| Spending authority from offsetting collections | 1,875 | 2,237 |
| **Total Budgetary Resources** | **$ 27,897** | **$ 27,711** |
| | | |
| **Status of Budgetary Resources:** | | |
| New obligations and upward adjustments (total) | $ 25,239 | $ 25,271 |
| Unobligated balance, end of year: | | |
| Apportioned, unexpired accounts | 2,490 | 2,286 |
| Exempt from apportionment | 1 | – |
| Unapportioned, unexpired accounts | 44 | 40 |
| Unexpired unobligated balance, end of year | 2,535 | 2,326 |
| Expired unobligated balance, end of year | 123 | 114 |
| Unobligated balance, end of year (total) | 2,658 | 2,440 |
| **Total Status of Budgetary Resources** | **$ 27,897** | **$ 27,711** |
| | | |
| **Outlays, net:** | | |
| Outlays, net (total) | $ 22,253 | $ 21,545 |
| Distributed offsetting receipts (-) | (4) | (22) |
| **Agency Outlays, net** | **$ 22,249** | **$ 21,523** |

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 9):

- 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 Standards (SFFAS) No. 47, *Reporting Entity*, 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 (August 2021). 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.

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

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.

In FY 2020, NASA implemented the requirements of paragraphs 2, 9, and 10 of SFFAS No. 57, *Omnibus Amendments*. The requirements set forth in paragraphs 3-8, 11 and 12 of the standard are effective in FY 2024 and early adoption is not permitted.

### Budgets and Budgetary Accounting

NASA complies with Federal budgetary accounting guidelines of OMB Circular No. A-11, *Preparation, Submission and Execution of the Budget*, Revised (August 2021). Congress funds NASA's operations through nine main appropriations: Science; Aeronautics; Exploration; Space Operations; Science, Technology, Engineering and Mathematics Engagement; 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 (R&D), Other Initiatives and Similar Costs

NASA makes substantial 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, for 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, liabilities, and disclosures of contingent liabilities as of the date of the financial statements. Also, 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 that are provided to other Federal agencies or for the public. The disbursements are for goods and services in support of NASA's operations and for other liabilities. The Fund Balance with Treasury (FBWT) is an asset account that shows the available budget spending authority of Federal agencies.

### 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.

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

**(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/or a bond when feasible. P.L. 100-404 requires that a quarterly payment of $250,000 be sent to the Challenger Center from interest earned on the Challenger Trust Fund investments. In order to meet the requirement of providing funds to the Challenger Center, NASA typically 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 reinvested. NASA has not been able to secure favorable returns on investment through securities issued by Treasury's Bureau of the Fiscal Service in recent years that were available for previous long-term bond investments. In anticipation of insufficient interest earnings that will not meet NASA's requirement to make quarterly disbursements, the Committees on Appropriations included a provision in the FY 2021 Consolidated Appropriations Act (P.L. 116-260) enabling NASA to utilize up to $1M from the Safety, Security, and Mission Services (SSMS) appropriation for disbursement to the Challenger Center.

### 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. An allowance for uncollectible accounts is recorded for Accounts Receivable due from the public and Federal sector in order to reduce Accounts Receivable to its net realizable value in accordance with SFFAS No. 1, *Accounting for Selected Assets and Liabilities*.

### General Property, Plant and Equipment (G-PP&E)

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. 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.

### 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.

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

## 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 cancelled appropriations. Liabilities not covered by budgetary resources require future congressional action whereas liabilities covered by budgetary resources reflect prior congressional action. Liabilities that do not require the use of budgetary resources are covered by monetary assets that are not budgetary resources to the entity.

## 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, 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 16.0 percent of gross pay. For employees hired January 1, 2013, and after, NASA contributes 14.2 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 Employees 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.

## Public Private Partnerships

SFFAS No. 49, Public-Private Partnerships: Disclosure Requirements, defines public-private partnerships as "risk-sharing arrangements or transactions with expected lives greater than five years between public and private sector entities" and was effective beginning in FY 2019. NASA performed an extensive assessment of agreements with the public and reviewed the terms of the agreements against risk sharing and other criteria for financial statement disclosure as provided in the standard. NASA determined that as of September 30, 2021 there are no public-private partnerships that meet the criteria for disclosure.

## Reclassification of FY 2021 Information

Certain reclassifications have been made to FY 2021 financial statements, notes, and supplemental information to better align with the Agency's policies and procedures effective in FY 2021, in accordance with the Treasury Financial Manual and OMB Circular A-136.

## Subsequent Events

Subsequent events have been evaluated per guidance in OMB Circular A-136 for FY 2021. The auditors' report date is the date the financial statements are available to be issued and management determined that there are no other items to disclose related to NASA's FY 2021 financial statements.

## 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 appropriated 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 balance 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 non-appropriated funds.

| (In Millions) | 2021 | 2020 |
|---|---|---|
| **Status of Fund Balances with Treasury:** | | |
| Unobligated Balances | | |
| Available | $ 2,491 | $ 2,286 |
| Unavailable | 167 | 154 |
| Obligated Balance not yet Disbursed | 13,215 | 12,441 |
| Non-Budgetary FBWT | 26 | 33 |
| **Total** | **$ 15,899** | **$ 14,914** |

## 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 zero in FY 2021 and less than one-half million dollars in FY 2020. 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.

| 2021 | | | | | | | |
|---|---|---|---|---|---|---|---|
| (In Millions) | Cost | Amortization Method | Amortized (Premium) Discount | Interest Receivable | Investments, Net | Other Adjustments | Market Value Disclosure |
| Intragovernmental Securities: | | Straight-Line Effective interest | | | | | |
| Non-Marketable: Par value | $ 16 | 0.055 - 0.065% | $ — | $ — | $ 16 | $ — | $ 16 |
| **Total** | **$ 16** | | **$ —** | **$ —** | **$ 16** | **$ —** | **$ 16** |

| 2020 | | | | | | | |
|---|---|---|---|---|---|---|---|
| (In Millions) | Cost | Amortization Method | Amortized (Premium) Discount | Interest Receivable | Investments, Net | Other Adjustments | Market Value Disclosure |
| Intragovernmental Securities: | | Straight-Line Effective interest | | | | | |
| Non-Marketable: Par value | $ 16 | 0.105 - 1.487% | $ — | $ — | $ 16 | $ — | $ 16 |
| **Total** | **$ 16** | | **$ —** | **$ —** | **$ 16** | **$ —** | **$ 16** |

## 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 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 and Federal sector 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 2021 and FY 2020 is less than one–half million dollars.

| 2021 | | | |
|---|---|---|---|
| (In Millions) | Accounts Receivable | Allowance for Uncollectible Accounts | Net Amount Due |
| Intragovernmental | $ 90 | $ — | $ 90 |
| Public | 1 | — | 1 |
| **Total** | **$ 91** | **$ —** | **$ 91** |

| 2020 | | | |
|---|---|---|---|
| (In Millions) | Accounts Receivable | Allowance for Uncollectible Accounts | Net Amount Due |
| Intragovernmental | $ 110 | $ — | $ 110 |
| Public | — | — | — |
| **Total** | **$ 110** | **$ —** | **$ 110** |

## 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, 2021 and 2020 is presented in the table below.

| 2021 | | | | | |
|---|---|---|---|---|---|
| (In Millions) | Depreciation Method | Estimated Useful Life | Cost | Accumulated Depreciation | Book Value |
| **General PP&E** | | | | | |
| Structures, Facilities and Leasehold Improvements | Straight-line | 15–40 Years | $ 12,017 | $ (8,812) | $ 3,205 |
| Equipment | Straight-line | 5–20 Years | 16,504 | (15,161) | 1,343 |
| Work in Progress - Personal Property | N/A | N/A | 1,695 | — | 1,695 |
| Construction In Progress - Real Property | N/A | N/A | 608 | — | 608 |
| Internal Use Software | Straight-line | 5 years | 253 | (246) | 7 |
| Land | N/A | N/A | 124 | — | 124 |
| **Total** | | | **$ 31,201** | **$ (24,219)** | **$ 6,982** |

| 2020 | | | | | |
|---|---|---|---|---|---|
| (In Millions) | Depreciation Method | Estimated Useful Life | Cost | Accumulated Depreciation | Book Value |
| **General PP&E** | | | | | |
| Structures, Facilities and Leasehold Improvements | Straight-line | 15–40 Years | $ 11,642 | $ (8,539) | $ 3,103 |
| Equipment | Straight-line | 5–20 Years | 16,560 | (15,109) | 1,451 |
| Work in Progress - Personal Property | N/A | N/A | 741 | — | 741 |
| Construction In Progress - Real Property | N/A | N/A | 766 | — | 766 |
| Internal Use Software | Straight-line | 5 Years | 253 | (243) | 10 |
| Land | N/A | N/A | 124 | — | 124 |
| **Total** | | | **$ 30,086** | **$ (23,891)** | **$ 6,195** |

The following table presents the changes in total General PP&E and accumulated depreciation from October 1, 2020 to September 30, 2021 and October 1, 2019 to September 30, 2020.

| Net PP&E | | |
|---|---|---|
| (In Millions) | 2021 | 2020 |
| **Balance Beginning of Year** | **$ 6,195** | **$ 6,008** |
| Capitalized acquisitions | 1,418 | 769 |
| Disposition | (101) | (106) |
| Depreciation expense | (544) | (547) |
| Donations | 14 | 71 |
| **Balance End of Year** | **$ 6,982** | **$ 6,195** |

## 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);
- Significant architectural characteristics.

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.

Throughout the history of NASA's operations, the Agency has become an owner of historic buildings, structures, historical artifacts, art, and other cultural resources. The protection and conservation of these heritage assets is an essential part of the agency's mission. NASA acquires such assets as a result of donation, or acquires the assets as a result of historically significant items being retired from active service and preserved by the agency for historic purposes. When capitalized assets are identified as heritage assets and no longer predominately serve NASA's primary operations, their values are removed from the PP&E accounts. Any maintenance costs incurred for the upkeep of the heritage assets are 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 their 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, 2021 and 2020, the total number of NASA's multi-use heritage assets were 523 and 520 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. Such assets 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: NASA-held and 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 collection 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 year ended September 30, 2021 and 2020 for NASA's heritage assets are displayed in the table right:

| Heritage Assets (In Physical Units) | 2020 | Additions | Withdrawals | 2021 |
|---|---|---|---|---|
| **Collection-type** | | | | |
| Air and Space Displays and Artifacts | 2 | — | — | 2 |
| Art | 1 | — | — | 1 |
| **Non-Collection type** | | | | |
| NASA Locations | 9 | — | — | 9 |
| **Total Heritage Assets** | **12** | **—** | **—** | **12** |

## Note 7: Other Assets

NASA's Other Assets consists of G-PP&E that NASA determined are no longer needed and are awaiting disposal, retirement, or removal from service. The G-PP&E Other Assets are recorded at estimated net realizable value. Other Assets at the end of the period totaled $5 million as of September 30, 2021 and $6 million as of September 30, 2020.

| (In Millions) | 2021 | 2020 |
|---|---|---|
| **Non-Intragovernmental Assets** | | |
| G-PP&E - Removed from Service and Pending Disposal | $ 5 | $ 5 |
| Other Advances | _ | 1 |
| **Total Other Assets** | **$ 5** | **$ 6** |

## Note 8: Liabilities Not Covered by Budgetary Resources

Liabilities not covered by budgetary resources require future congressional action whereas liabilities covered by budgetary resources reflect prior congressional action. Regardless of when the congressional action occurs, when the liabilities are liquidated, Treasury will finance the liquidation in the same way that it finances all other disbursements, using some combination of receipts, other inflows, and borrowing from the public (if there is a budget deficit).

The present value of the FECA actuarial liability estimate at year-end was calculated by the Department of Labor using a discount rate of 2.23 percent in FY 2021 and 2.41 percent in FY 2020. 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) | 2021 | 2020 |
|---|---|---|
| **Intragovernmental:** | | |
| Accounts Payable | $ 166 | $ 83 |
| Advances from Others and Deferred Revenue | 55 | 61 |
| Other | 50 | 149 |
| **Total Intragovernmental** | **$ 271** | **$ 293** |
| **Accounts Payable** | 1,747 | 1,291 |
| **Federal Employee Benefits Payable** | 320 | 314 |
| **Environmental and Disposal Liabilities** | 2,127 | 2,173 |
| Less: Environmental and Disposal Liabilities - Funded | (118) | (138) |
| **Advances from Others and Deferred Revenues** | 148 | 135 |
| **Other** | 2,045 | 2,096 |
| Total Liabilities Not Covered by Budgetary Resources | 2,463 | 2,462 |
| Total Liabilities Covered by Budgetary Resources | 4,173 | 3,809 |
| Total Liabilities Not Requiring Budgetary Resources | 22 | 31 |
| **Total Liabilities** | **$ 6,658** | **$ 6,302** |

# 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 regulations 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 environmental response, clean-up, and monitoring liabilities 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.

Environment and disposal liabilities as of September 30, 2021 and 2020 were as follows:

| (In Millions) | 2021 | 2020 |
|---|---|---|
| **Environmental Liabilities** | | |
| Restoration Projects | $ 1,893 | $ 1,912 |
| Asbestos | 182 | 179 |
| End of Life Disposal of Property, Plant & Equipment | 52 | 82 |
| **Total Environmental and Disposal Liabilities** | **$ 2,127** | **$ 2,173** |

## Restoration Projects

NASA recorded a total estimated liability for known restoration projects of $1.893 billion in FY 2021. This was a decrease of $19 million from $1.912 billion recorded in FY 2020. The decrease 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 $12 million for FY 2021 and $13 million for FY 2020. The estimate is primarily due to the addition of a large-scale demolition project at Santa Susana Field Laboratory 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.

# 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 both structures and facilities measured in square feet and for those not measured in square feet. These cost factors were then extrapolated across applicable NASA structures and facilities. The asbestos cleanup cost liability of $182 million in FY 2021 represents an increase of $3 million compared to the $179 million recorded in FY 2020.

## 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 $52 million in FY 2021. This was a decrease of $30 million over the $82 million recorded in FY 2020. The decrease was due to a disposal of one of the mobile launch platforms, change in estimate regarding the remaining two mobile launch platforms, and a reduction in the number of permitted facilities. 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 (e.g., 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 reentry. 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, and Advances from Others primarily consists of payments received from non-Federal entities in advance of NASA's performance of services under reimbursable agreements.

Other Accrued Liabilities primarily consist of the accrual of contractor costs for goods and services performed. The period of performance for contractor contracts typically spans the duration of NASA programs, which could be for a number of years prior to final delivery of the product. In such cases, NASA records a cost accrual throughout the fiscal year as the work is performed. Other Accrued Liabilities also include the accrual of IBNR grant program costs incurred in support of NASA's research and development and other related activities.

| | 2021 | | | 2020 | | |
|---|---|---|---|---|---|---|
| (In Millions) | Current | Non-current | Total | Current | Non-current | Total |
| **Intragovernmental:** | | | | | | |
| Employer Contributions and Payroll Taxes Payable | 44 | — | 44 | 38 | — | 38 |
| Other Post-Employment Benefits Due and Payable | 5 | 1 | 6 | 6 | 1 | 7 |
| **Total Intragovernmental** | **$ 49** | **$ 1** | **$ 50** | **$ 44** | **$ 1** | **$ 45** |
| **With the Public:** | | | | | | |
| Other Liabilities With Related Budgetary Obligations | 1,823 | — | 1,823 | 1,892 | — | 1,892 |
| Accrued Funded Payroll and Leave | 128 | — | 128 | 117 | — | 117 |
| Liability for Non-Fiduciary Deposit Funds and Undeposited Collections | 22 | — | 22 | 31 | — | 31 |
| Contingent Liabilities | 16 | — | 16 | — | — | — |
| Other Liabilities Without Related Budgetary Obligations | 56 | — | 56 | 56 | — | 56 |
| **Total With the Public** | **$ 2,045** | **—** | **$ 2,045** | **$ 2,096** | **—** | **$ 2,096** |
| **Total Other Liabilities and Other Accrued Liabilities** | **$ 2,094** | **$ 1** | **$ 2,095** | **$ 2,140** | **$ 1** | **$ 2,141** |

## 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 or disclosed for these cases.

| | 2021 | | | 2020 | | |
|---|---|---|---|---|---|---|
| (In Millions) | Accrued Liabilities | ESTIMATED RANGE OF LOSS | | Accrued Liabilities | ESTIMATED RANGE OF LOSS | |
| | | Lower End | Upper End | | Lower End | Upper End |
| **Legal Contingencies** | | | | | | |
| Probable | $ 16 | $ — | $ — | $ — | $ — | $ — |
| Reasonably Possible | | $ — | $ 16 | | $ — | $ 8 |

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

The FY 2023 Budget of the United States Government (President's Budget), which presents the actual amounts for the year ended September 30, 2021, has not been published as of the issue date of these financial statements. The FY 2023 Budget of the United States Government will be published on a later date at https://www.whitehouse.gov/omb/budget.

NASA reconciled the amounts of the FY 2020 column on the SBR to the actual amounts for FY 2020 in the FY 2022 President's Budget for budgetary resources, new obligations, upward adjustments (total), distributed offsetting receipts, and net outlays as presented below.

| (In Millions) | Budgetary Resources | New Obligations & Upward Adjustments (Total) | Distributed Offsetting Receipts | Net Outlays |
|---|---|---|---|---|
| **Combined Statement of Budgetary Resources** | $ 27,711 | $ 25,271 | $ (22) | $ 21,545 |
| Included on SBR, not in President's Budget | | | | |
| Expired Accounts | (143) | (29) | — | — |
| Distributed Offsetting Receipts | — | — | 22 | — |
| **Budget of the United States Government** | **$ 27,568** | **$ 25,242** | **$ —** | **$ 21,545** |

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 $11.3 billion as of September 30, 2021.

| (In Millions) | 2021 |
|---|---|
| **Federal** | |
| Unpaid | $ 730 |
| Paid | 200 |
| Total | 930 |
| **Nonfederal** | |
| Unpaid | 10,326 |
| Paid | 10 |
| Total | 10,336 |
| **Total Undelivered Orders** | **11,266** |

## Note 14: Reconciliation of Net Cost 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 and net outlays.

| | 2021 | | |
|---|---|---|---|
| **(In Millions)** | **Intragovernmental** | **With the Public** | **Total** |
| **Net Cost** | **$ 138** | **$ 21,864** | **$ 22,002** |
| **Components of Net Cost Not Part of the Budgetary Outlays** | | | |
| Property, plant, and equipment depreciation expense | — | (544) | (544) |
| Property, plant, and equipment disposals and revaluations | — | (101) | (101) |
| Applied overhead/cost capitalization offset | — | 1,418 | 1,418 |
| Donations | — | 14 | 14 |
| **Increase/(Decrease) in Assets:** | | | |
| Accounts receivable, net | (19) | — | (19) |
| Other assets | 15 | 15 | 30 |
| **(Increase)/Decrease in Liabilities:** | | | |
| Accounts payable | 17 | (456) | (439) |
| Environmental and disposal liabilities | — | 46 | 46 |
| Federal employee benefits payable | — | (6) | (6) |
| Other Liabilities | (11) | 32 | 21 |
| **Financing Sources:** | | | |
| Imputed Cost | (156) | — | (156) |
| **Total Components of Net Cost Not Part of the Budgetary Outlays** | (154) | 418 | 264 |
| **Misc Items** | | | |
| Distributed offsetting receipts (SBR 4200) | (4) | — | (4) |
| Custodial/Non-exchange revenue | — | (18) | (18) |
| Non-Entity Activity | 4 | — | 4 |
| Appropriated Receipts for Trust/Special Funds | 1 | — | 1 |
| **Total Other Reconciling Items** | **1** | **(18)** | **(17)** |
| **Total Net Outlays (Calculated Total)** | **$ (15)** | **$ 22,264** | **$ 22,249** |
| **Budgetary Agency Outlays, net (SBR 4210)** | | | **$ 22,249** |

| 2020 | | | |
|---|---|---|---|
| (In Millions) | Intragovernmental | With the Public | Total |
| **Net Cost** | **$ (267)** | **$ 22,398** | **$ 22,131** |
| **Components of Net Cost Not Part of the Budgetary Outlays** | | | |
| Property, plant, and equipment depreciation | — | (547) | (547) |
| Property, plant, and equipment disposal & reevaluation | — | (105) | (105) |
| Other | — | 764 | 764 |
| **Increase/(decrease) in assets not affecting Budgetary Outlays** | | | |
| Accounts receivable | (29) | (1) | (30) |
| Other assets | 40 | (1) | 39 |
| **(Increase)/decrease in liabilities not affecting Budgetary Outlays** | | | |
| Accounts payable | (48) | (19) | (67) |
| Salaries and benefits | (19) | (11) | (30) |
| Environmental and disposal liabilities | — | (204) | (204) |
| Other liabilities (Unfunded leave, unfunded FECA, actuarial FECA) | (12) | (245) | (257) |
| **Other financing sources** | | | |
| Federal employee retirement benefit costs paid by OPM and imputed to agency | (149) | — | (149) |
| **Total Components of Net Cost Not Part of the Budgetary Outlays** | **(217)** | **(369)** | **(586)** |
| **Components of the Budgetary Outlays That Are Not Part of Net Cost** | | | |
| Other | (1) | (21) | (22) |
| **Total Components of the Budgetary Outlays That Are Not Part of Net Cost** | **(1)** | **(21)** | **(22)** |
| **Net Outlays (Calculated Total)** | **$ (485)** | **$ 22,008** | **$ 21,523** |
| **Related Amounts on the Statement of Budgetary Resources** | | | |
| **Outlays, net (SBR 4190)** | | | $ 21,545 |
| **Distributed offsetting receipts (SBR 4200)** | | | (22) |
| **Agency Outlays, Net (SBR 4210)** | | | **$ 21,523** |

## 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 2021 was $3 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 JPL Annual Reports (nasa.gov).

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 Financial Statement Line Items for Financial Report 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 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. A copy of the 2020 FR can be found here: https://www.fiscal.treasury.gov/reports-statements/ and a copy of the 2021 FR will be posted to this site as soon as it is released.

The term "intragovernmental" is used in this note to refer to amounts that result from other components of the Federal Government.

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. The Agency does not have funds from dedicated collections.

| FY 2021 NASA Statement of Net Cost | | Line Items Used to Prepare FY 2021 Government-wide Statement of Net Cost | |
|---|---|---|---|
| **Financial Statement Line** | **Amounts (In Millions)** | **Amounts (In Millions)** | **Reclassified Financial Statement Line** |
| **Gross Costs** | 23,550 | | **Gross Cost** |
| | | 22,122 | Non-Federal Gross Cost |
| | | **22,122** | **Total Non-Federal Gross Cost** |
| | | | **Federal Gross Cost** |
| | | 567 | Benefit Program Costs |
| | | 156 | Imputed Costs |
| | | 541 | Buy/Sell Costs |
| | | 164 | Other Expenses (without reciprocals) |
| | | **1,428** | **Total Federal Gross Costs** |
| ***Total Gross Costs*** | 23,550 | 23,550 | Department Total Gross Cost |
| **Earned Revenue** | 1,548 | | **Earned Revenue** |
| | | 258 | Non-Federal Earned Revenue |
| | | | **Federal Earned Revenue** |
| | | 1,290 | Buy/Sell Revenue (Exchange) |
| | | **1,290** | **Total Federal Earned Revenue** |
| ***Total Earned Revenue*** | 1,548 | 1,548 | Department Total Earned Revenue |
| **Net Cost** | **22,002** | **22,002** | **Net Cost of Operations** |

## Note 16: Reclassification of Financial Statement Line Items for Financial Report Compilation Process (Continued)

| FY 2021 NASA Statement of Changes in Net Position | | Line Items Used to Prepare FY 2021 Government-wide Statement of Changes in Net Position | |
|---|---|---|---|
| **Financial Statement Line** | **Amounts (In Millions)** | **Amounts (In Millions)** | **Reclassified Financial Statement Line** |
| **Unexpended Appropriations** | | | |
| Beginning Balance | 11,230 | 11,230 | Net Position, Beginning of Period |
| Appropriations Received | 23,271 | 23,245 | Appropriations Received as Adjusted |
| Other Adjustments | (26) | | |
| Appropriations Used | (22,653) | (22,653) | Appropriations Used |
| Net Change in Unexpended Appropriations | 592 | 592 | |
| **Total Unexpended Appropriations** | **11,822** | **11,822** | |
| **Cumulative Results of Operations** | | | |
| Beginning Balance | 3,709 | 3,709 | Net Position, Beginning of Period |
| Appropriations Used | 22,653 | 22,653 | Appropriations Expended |
| Non-Exchange Revenue | – | 17 | Other Taxes and Receipts |
| Donations and Forfeitures of Property | 14 | | |
| Imputed Financing | 155 | 156 | Imputed Financing Sources |
| Other | – | (4) | Non-Entity Collections Transferred to the General Fund of the U.S. Government |
| Net Cost of Operations | (22,002) | (22,002) | Net Cost of Operations |
| Net Change | 820 | 820 | |
| **Cumulative Results of Operations** | **4,529** | **4,529** | |
| **Net Position** | **16,351** | **16,351** | **Net Position, End of Period** |

## Note 17: COVID-19 Activity

NASA received $60 million in FY 2020, provided for its Safety, Security, and Mission Services appropriation to prevent, prepare for, and respond to the coronavirus domestically or internationally. There was no funding received in FY 2021.

Please see page 30 for more information.

# Required Supplementary Information

## Combining Statement of Budgetary Resources
## For the Fiscal Year Ended September 30, 2021

| (In Millions) | Space Operations Mission | Science Mission | Exploration Mission | Aeronautics Mission | Safety, Security and Mission Services | STEM Engagement Mission |
|---|---|---|---|---|---|---|
| **Budgetary Resources:** | | | | | | |
| Unobligated Balance from Prior Year Budget Authority, Net | $ 289 | $ 703 | $ 252 | $ 38 | $ 998 | $ 13 |
| Appropriations | 3,987 | 7,297 | 6,512 | 829 | 2,936 | 127 |
| Spending Authority from Offsetting Collections | — | — | — | — | 1,328 | — |
| **Total Budgetary Resources** | **$ 4,276** | **$ 8,000** | **$ 6,764** | **$ 867** | **$ 5,262** | **$ 140** |
| **Status of Budgetary Resources:** | | | | | | |
| New Obligations and Upward Adjustments (Total) | $ 3,926 | $ 7,105 | $ 6,591 | $ 845 | $ 4,497 | $ 129 |
| Unobligated Balance, End of Year: | | | | | | |
| Apportioned, Unexpired Accounts | 272 | 875 | 143 | 20 | 762 | 7 |
| Exempt from Apportionment | — | — | — | — | — | — |
| Unapportioned, Unexpired Accounts | 18 | — | 18 | — | — | — |
| Unexpired Unobligated Balance, End of Year | 290 | 875 | 161 | 20 | 762 | 7 |
| Expired Unobligated Balance, End of Year | 60 | 19 | 12 | 2 | 4 | 3 |
| Unobligated Balance, End of Year (Total) | 350 | 894 | 173 | 22 | 766 | 10 |
| **Total Status of Budgetary Resources** | **$ 4,276** | **$ 7,999** | **$ 6,764** | **$ 867** | **$ 5,263** | **$ 139** |
| **Outlays, Net:** | | | | | | |
| Outlays, Net (Total) | $ 3,902 | $ 6,767 | $ 6,229 | $ 763 | $ 3,024 | $ 118 |
| Distributed Offsetting Receipts (-) | — | — | — | — | — | — |
| **Agency Outlays, Net** | **$ 3,902** | **$ 6,767** | **$ 6,229** | **$ 763** | **$ 3,024** | **$ 118** |

(Continued)

| (In Millions) | Office of Inspector General | Space Technology Mission | Construction and Environmental Compliance and Restoration | Other | Total |
|---|---|---|---|---|---|
| **Budgetary Resources:** | | | | | |
| Unobligated Balance from Prior Year Budget Authority, Net | $ 3 | $ 109 | $ 305 | $ 40 | $ 2,750 |
| Appropriations | 44 | 1,100 | 439 | 1 | 23,272 |
| Spending Authority from Offsetting Collections | 1 | — | 21 | 525 | 1,875 |
| **Total Budgetary Resources** | **$ 48** | **$ 1,209** | **$ 765** | **$ 566** | **$ 27,897** |
| **Status of Budgetary Resources:** | | | | | |
| New Obligations and Upward Adjustments (Total) | $ 44 | $ 1,175 | $ 426 | $ 501 | $ 25,239 |
| Unobligated Balance, End of Year: | | | | | |
| Apportioned, Unexpired Accounts | 2 | 27 | 327 | 55 | 2,490 |
| Exempt from Apportionment | — | — | — | 1 | 1 |
| Unapportioned, Unexpired Accounts | — | — | 8 | — | 44 |
| Unexpired Unobligated Balance, End of Year | 2 | 27 | 335 | 56 | 2,535 |
| Expired Unobligated Balance, End of Year | 2 | 7 | 4 | 10 | 123 |
| Unobligated Balance, End of Year (Total) | 4 | 34 | 339 | 66 | 2,658 |
| **Total Status of Budgetary Resources** | **$ 48** | **$ 1,209** | **$ 765** | **$ 567** | **$ 27,897** |
| **Outlays, Net:** | | | | | |
| Outlays, Net (Total) | $ 41 | $ 1,067 | $ 376 | $ (34) | $ 22,253 |
| Distributed Offsetting Receipts (-) | — | — | — | (4) | (4) |
| **Agency Outlays, Net** | **$ 41** | **$ 1,067** | **$ 376** | **$ (38)** | **$ 22,249** |

# Required Supplementary Information

## Combining Statement of Budgetary Resources
## For the Fiscal Year Ended September 30, 2020

| (In Millions) | Space Operations Mission | Science Mission | Exploration Mission | Aeronautics Mission | Safety, Security and Mission Services | STEM Engagement Mission |
|---|---|---|---|---|---|---|
| **Budgetary Resources:** | | | | | | |
| Unobligated Balance from Prior Year Budget Authority, Net | $ 395 | $ 859 | $ 247 | $ 36 | $ 836 | $ 13 |
| Appropriations | 4,135 | 7,073 | 5,960 | 784 | 2,973 | 120 |
| Spending Authority from Offsetting Collections | — | — | — | — | 1,697 | — |
| **Total Budgetary Resources** | **$ 4,530** | **$ 7,932** | **$ 6,207** | **$ 820** | **$ 5,506** | **$ 133** |
| **Status of Budgetary Resources:** | | | | | | |
| New Obligations and Upward Adjustments (Total) | $ 4,361 | $ 7,277 | $ 5,999 | $ 788 | $ 4,561 | $ 121 |
| Unobligated Balance, End of Year: | | | | | | |
| Apportioned, Unexpired Accounts | 111 | 640 | 188 | 30 | 929 | 9 |
| Unapportioned, Unexpired Accounts | 1 | — | 9 | — | 12 | — |
| Unexpired Unobligated Balance, End of Year | $ 112 | 640 | 197 | 30 | 941 | 9 |
| Expired Unobligated Balance, End of Year | 57 | 15 | 11 | 2 | 4 | 3 |
| Unobligated Balance, End of Year (Total) | 169 | 655 | 208 | 32 | 945 | 12 |
| **Total Status of Budgetary Resources** | **$ 4,530** | **$ 7,932** | **$ 6,207** | **$ 820** | **$ 5,506** | **$ 133** |
| **Outlays, Net:** | | | | | | |
| Outlays, Net (Total) | $ 4,364 | $ 6,743 | $ 5,382 | $ 826 | $ 2,737 | $ 106 |
| Distributed Offsetting Receipts (-) | — | — | — | — | — | — |
| **Agency Outlays, Net** | **$ 4,364** | **$ 6,743** | **$ 5,382** | **$ 826** | **$ 2,737** | **$ 106** |

(Continued)

| (In Millions) | Office of Inspector General | Space Technology Mission | Construction and Environmental Compliance and Restoration | Other | Total |
|---|---|---|---|---|---|
| **Budgetary Resources:** | | | | | |
| Unobligated Balance from Prior Year Budget Authority, Net | $ 3 | $ 80 | $ 340 | $ 45 | $ 2,854 |
| Appropriations | 42 | 1,100 | 432 | 1 | 22,620 |
| Spending Authority from Offsetting Collections | 1 | — | 21 | 518 | 2,237 |
| **Total Budgetary Resources** | **$ 46** | **$ 1,180** | **$ 793** | **$ 564** | **$ 27,711** |
| **Status of Budgetary Resources:** | | | | | |
| New Obligations and Upward Adjustments (Total) | $ 44 | $ 1,091 | $ 502 | $ 527 | $ 25,271 |
| Unobligated Balance, End of Year: | | | | | |
| Apportioned, Unexpired Accounts | — | 82 | 270 | 27 | 2,286 |
| Unapportioned, Unexpired Accounts | — | — | 18 | — | 40 |
| Unexpired Unobligated Balance, End of Year | — | 82 | 288 | 27 | 2,326 |
| Expired Unobligated Balance, End of Year | 2 | 7 | 3 | 10 | 114 |
| Unobligated Balance, End of Year (Total) | 2 | 89 | 291 | 37 | 2,440 |
| **Total Status of Budgetary Resources** | **$ 46** | **$ 1,180** | **$ 793** | **$ 564** | **$ 27,711** |
| **Outlays, Net:** | | | | | |
| Outlays, Net (Total) | $ 40 | $ 973 | $ 397 | $ (23) | $ 21,545 |
| Distributed Offsetting Receipts (-) | — | — | — | (22) | (22) |
| **Agency Outlays, Net** | **$ 40** | **$ 973** | **$ 397** | **$ (45)** | **$ 21,523** |

# Required Supplementary Information
## Deferred Maintenance and Repairs for FY 2021

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.

## Changes from Prior Year

As of September 30, 2021, $2,768 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 $105 million from $2,663 billion as of September 30, 2020. 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), normal inflation increases in Current Replacement Value (CRV) of assets and high-value infrastructure assets as upgrades progress, and demolition of assets and the reduction of their DM&R.

NASA performs DM assessment on Real Property Assets in a two-year cycle. Due to the impacts of COVID-19 in FY 2020, an in-person assessment was performed at two NASA Centers and the remaining four Centers were assessed virtually. In FY 2021, the remaining assets were physically assessed. These alternating assessments result in a physical and virtual assessment of all Real Property Assets in a two-year cycle.

| (In Millions) | 2021 | 2020 |
|---|---|---|
| **Asset Category** | | |
| General PP&E - Real Property | $ 2,713 | $ 2,609 |
| Heritage Assets - Real Property | 55 | 54 |
| **Total Deferred Maintenance and Repairs** | **$ 2,768** | **$ 2,663** |

# LETTER FROM THE INSPECTOR GENERAL ON AUDIT

## NASA OFFICE OF INSPECTOR GENERAL

OFFICE OF AUDITS

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

November 15, 2021

TO: Bill Nelson
Administrator

Margaret Vo Schaus
Chief Financial Officer

SUBJECT: *Audit of NASA's Fiscal Year 2021 Financial Statements*
(Report No. IG-22-004; Assignment No. A-21-011-00)

The Office of Inspector General contracted with the independent public accounting firm Ernst & Young LLP (EY) to audit NASA's fiscal year (FY) 2021 financial statements. EY 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. 21-04, *Audit Requirements for Federal Financial Statements*.

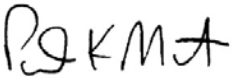
This audit resulted in a "clean" or unmodified opinion on NASA's FY 2021 financial statements (see Enclosure 1). An unmodified opinion means the financial statements present fairly, in all material respects, the financial position and results of NASA's operations in conformity with U.S. generally accepted accounting principles.

EY also reported on NASA's internal control over financial reporting and compliance with laws and regulations (see Enclosure 2). For FY 2021, EY identified one significant deficiency related to NASA's evaluation of public-private partnerships for disclosure in the financial statements and no instances of noncompliance.

In our oversight of the contract, we reviewed EY's reports 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, EY is responsible for the enclosed auditor's reports dated November 15, 2021, and the conclusions expressed therein. However, our review disclosed no instances where EY 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 if you have any questions about the enclosed report.



Paul K. Martin
Inspector General

**Enclosures – 2**

# INDEPENDENT AUDITOR'S REPORT

Building a better working world

Ernst & Young LLP
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Tysons, VA 22102

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ey.com

## Report of Independent Auditors

The Administrator and Inspector General of the
National Aeronautics and Space Administration

**Report on the Financial Statements**

We have audited the accompanying financial statements of the National Aeronautics and Space Administration (NASA), which comprise the consolidated balance sheet as of September 30, 2021, and the related consolidated statements of net cost and changes in net position and combined statement of budgetary resources for the fiscal year then ended, and the related notes to the financial statements.

***Management's Responsibility for the Financial Statements***

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

***Auditors' Responsibility***

Our responsibility is to express an opinion on these financial statements based on our audit. We conducted our audit in accordance with auditing standards generally accepted in the United States of America; 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. 21-04*, Audit Requirements for Federal Financial Statements*. Those standards and OMB Bulletin No. 21-04 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 risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, the auditors consider 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.

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

***Opinion***

In our opinion, the financial statements referred to above present fairly, in all material respects, the financial position of NASA as of September 30, 2021, and its net cost, changes in net position, and budgetary resources for the year then ended in conformity with accounting principles generally accepted in the United States.

***Report of Other Auditors on NASA's FY 2020 Financial Statements***

The financial statements of NASA for the year ended September 30, 2020, were audited by other auditors who expressed an unmodified opinion on those statements on November 16, 2020.

***Other Matters***

*Required Supplementary Information*

Accounting principles generally accepted in the United States of America require that Management's Discussion and Analysis and Required Supplementary Information as identified on NASA's Agency Financial Report's Table of Contents, 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 which 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 United States of America, 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 audit of the financial statements. We do not express an opinion or provide any assurance on the information because the limited procedures do not provide us with sufficient evidence to express an opinion or provide any assurance.

*Other Information*

Our audit was conducted for the purpose of forming an opinion on the financial statements that collectively comprise NASA's financial statements. The Other Information, as identified on NASA's Agency Financial Report's Table of Contents, is presented for purposes of additional analysis and is not a required part of the financial statements or Required Supplementary Information.

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The Other Information has not been subjected to the auditing procedures applied in the audit of the financial statements, and, accordingly, we do not express an opinion or provide any assurance on it.

**Other Reporting Required by *Government Auditing Standards***

In accordance with *Government Auditing Standards*, we also have issued our report dated November 15, 2021, on our consideration of NASA's internal control over financial reporting and on our tests of its compliance with certain provisions of laws, regulations, contracts, and grant agreements and other matters. The purpose of that report is solely to describe the scope of our testing of internal control over financial reporting and compliance and the results of that testing, and not to provide an opinion on the effectiveness of NASA's internal control over financial reporting or on compliance. That report is an integral part of an audit performed in accordance with *Government Auditing Standards* in considering NASA's internal control over financial reporting and compliance.

Ernst & Young LLP

November 15, 2021

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# Report of Independent Auditors 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*

The Administrator and the Inspector General of the
National Aeronautics and Space Administration

We have audited, in accordance with auditing standards generally accepted in the United States of America; the standards applicable to financial statement audits contained in *Government Auditing Standards*, issued by the Comptroller General of the United States; and Office of Management and Budget (OMB) Bulletin No. 21-04, *Audit Requirements for Federal Financial Statements*, the financial statements of the National Aeronautics and Space Administration (NASA), which comprise the consolidated balance sheet as of September 30, 2021, and related consolidated statements of net cost and changes in net position, and combined statement of budgetary resources for the fiscal year then ended, and the related notes to the financial statements, and have issued our report thereon dated November 15, 2021.

**Internal Control Over Financial Reporting**

In planning and performing our audit of the financial statements, we considered NASA's internal control over financial reporting (internal control) as a basis for designing 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 over financial reporting. Accordingly, we do not express an opinion on the effectiveness of NASA's internal control over financial reporting. We did not consider all internal controls relevant to operating objectives as broadly defined by the Federal Managers' Financial Integrity Act of 1982, such as those controls relevant to preparing performance information and ensuring efficient operations.

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 the entity'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.

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Our consideration of internal control over financial reporting 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. We did identify a deficiency in internal control as described below that we consider to be a significant deficiency.

**Significant Deficiency**

**Improvements Are Needed in NASA's Evaluation of Public-Private Partnerships**

Public-Private Partnerships are risk-sharing arrangements or transactions with expected lives greater than five years between public and private sector entities. Such arrangements or transactions provide a service or an asset for government and/or general public use where in addition to the sharing of resources, each party shares in the risks and rewards of said arrangements or transactions. Although NASA has identified and entered into numerous Public-Private Partnerships to meet its mission and strategic goals, NASA concluded that none of its Public-Private Partnership arrangements were required to be disclosed in its notes to the fiscal year 2021 financial statements. We determined that NASA's Public-Private Partnership analysis lacked adequate documentation to include documentation of decisions made, the sources used, input from all relevant NASA stakeholders, and application of qualitative and quantitative considerations. We also noted that the analysis did not fully meet the guidance provided within the Federal Accounting Standards Advisory Board's (FASAB) Statement of Federal Financial Accounting Standards (SFFAS) 49, *Public-Private Partnerships: Disclosure Requirements*, and OMB Circular A-136, *Financial Reporting Requirements*. Further, NASA's review controls were not sufficient to identify inconsistencies between current and prior year analyses and its training and guidance was not adequate to provide for consistent interpretation and application of the standard across NASA Centers.

**Recommendation**

We recommend that NASA design and implement adequate controls over its identification and evaluation of Public-Private Partnerships to include adequate documentation of its analysis, as well as controls over the completeness of the analysis and compliance with SFFAS 49. NASA should also provide operating procedures and training to the Centers' personnel to ensure a consistent understanding and application of policies and procedures related to the identification, evaluations, and resulting analyses of Public-Private Partnerships. Lastly, NASA should consider conducting discussions with FASAB personnel regarding identification requirements and how they should be applied to NASA specific Public-Private Partnership arrangements.

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**Compliance and Other Matters**

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 and material effect on the financial statements as well as the requirements referred to in the Federal Financial Management Improvement Act of 1996 (FFMIA). 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 disclosed no instances of noncompliance or other matters that are required to be reported under *Government Auditing Standards* and OMB Bulletin No. 21-04.

Under FFMIA, we are required to report whether NASA's financial management systems substantially comply with federal financial management systems requirements, applicable federal accounting standards, and the United States Standard General Ledger at the transaction level. To meet this requirement, we performed tests of compliance with FFMIA Section 803(a) requirements. The results of our tests disclosed no instances in which NASA's financial management systems did not substantially comply with requirements as discussed above.

**NASA's Response to Findings**

NASA's response to the finding identified in our audit is described in the accompanying letter dated November 15, 2021. NASA's response was not subjected to the auditing procedures applied in the audit of the financial statements and, accordingly, we express no opinion on it.

**Purpose of This Report**

The purpose of this report is solely to describe the scope of our testing of internal control over financial reporting and compliance and the results of that testing, and not to provide an opinion on the effectiveness of the entity's internal control over financial reporting or on compliance. This report is an integral part of an audit performed in accordance with *Government Auditing Standards* in considering the entity's internal control over financial reporting and compliance. Accordingly, this communication is not suitable for any other purpose.

Ernst & Young LLP

November 15, 2021

National Aeronautics and
Space Administration

**Mary W. Jackson NASA Headquarters**
Washington, DC 20546-0001

November 15, 2021

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 respond to your audit report on the Consolidated Financial Statements of the National Aeronautics and Space Administration (NASA) for FY 2021 and FY 2020. NASA's efforts and achievements toward improved financial management are clearly reflected in the audit opinion. For the 11th year in a row, NASA has earned an unqualified "clean" opinion with no material weaknesses on its Financial Statements.

I am particularly gratified to note NASA's resolution of the prior year significant deficiencies in NASA's Vulnerability Management Process and Financial Systems' Information Technology General Application Controls. This is a direct result of the commitment and effort to financial management by the entire Agency. As a result of our continual successful mitigation of IT findings related to the financial accounting system, NASA remains substantially compliant with the Federal Financial Management Improvement Act.

I understand that the independent auditors identified one significant deficiency related to Improvements Needed in NASA's Evaluation of Public-Private Partnerships in Accordance with SFFAS 49. The Agency is committed to working collaboratively with the Office of the Inspector General (OIG) and the independent audit firm to resolve this deficiency as quickly as possible.

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.

Margaret V Schaus

Chief Financial Officer
Margaret V. Schaus

SECTION 3

# OTHER INFORMATION


79

SpaceX's Crew Dragon "Endeavour," atop the company's Falcon 9 rocket, leaves the SpaceX integration hangar adjacent to NASA Kennedy Space Center's Launch Complex 39A for rollout to the launch pad on April 16, 2021. NASA astronauts Shane Kimbrough and Megan McArthur, JAXA astronaut Akihiko Hoshide, and ESA astronaut Thomas Pesquet, who arrived at Kennedy on April 16, will fly to the International Space Station on NASA's SpaceX Crew-2 mission. Liftoff is targeted for Thursday, April 22, at 6:11 a.m.

PHOTO CREDIT — NASA Kennedy/Space X

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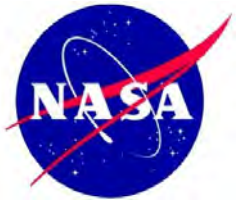
NASA
National Aeronautics and Space Administration

**Office of Inspector General**

**Office of Audits**

# 2021 Report on NASA's Top Management and Performance Challenges

**November 15, 2021**



## Office of Inspector General

To report, fraud, waste, abuse, or mismanagement, contact the NASA OIG Hotline at 800-424-9183 or 800-535-8134 (TDD) or visit https://oig.nasa.gov/hotline.html. You can also write to NASA Inspector General, P.O. Box 23089, L'Enfant Plaza Station, Washington, D.C. 20026. The identity of each writer and caller can be kept confidential, upon request, to the extent permitted by law.

To suggest ideas or request future audits, contact the Assistant Inspector General for Audits at https://oig.nasa.gov/aboutAll.html.

# TABLE OF CONTENTS

# MESSAGE FROM THE INSPECTOR GENERAL

This report presents the Office of Inspector General's (OIG) independent assessment of the top management and performance challenges facing NASA.[1] For 2021, we identified eight challenges and linked each challenge to one or more of NASA's strategic goals and objectives (see Appendix A).[2]

- Challenge 1: Returning Humans to the Moon
- Challenge 2: Improving Management of Major Projects
- Challenge 3: Sustaining a Human Presence in Low Earth Orbit
- Challenge 4: Managing and Mitigating Cybersecurity Risk
- Challenge 5: Improving Oversight of Contracts, Grants, and Cooperative Agreements
- Challenge 6: Attracting and Retaining a Highly Skilled and Diverse Workforce
- Challenge 7: Managing NASA's Outdated Infrastructure and Facilities
- Challenge 8: Managing the Impacts of COVID-19 on NASA's Mission and Workforce

NASA stands at the forefront of aeronautics, science, and space exploration and is responsible for numerous scientific discoveries and technological innovations. The Agency's achievements in long-term human space flight missions such as Apollo, the Space Shuttle Program, and the International Space Station (ISS or Station) are unparalleled. Likewise, science and aeronautics research such as the continuing Voyager missions into interstellar space and the X-15 hypersonic aircraft demonstrate NASA's position as a global leader in space and aeronautics. To maintain its preeminence, NASA must remain agile in an environment of shifting Administration priorities, evolving international interests, and unanticipated global events such as the ongoing Coronavirus Disease 2019 (COVID-19) pandemic.

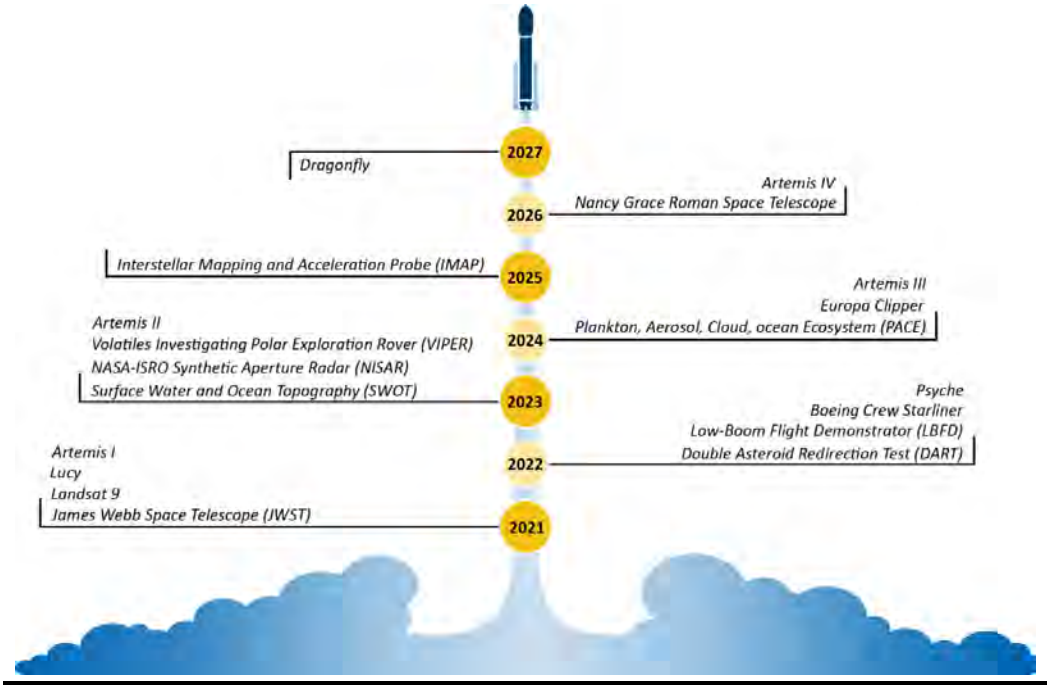
In 2020, NASA altered—essentially overnight—how it does business to protect its employees and contractors from the COVID-19 virus by closing facilities and having 90 percent of its workforce operate from home for an extended period of time. Nonetheless, NASA maintained vital operations such as the ISS and successfully launched and landed the Perseverance Rover on Mars as well as the first commercial flight of astronauts into space, closing a 9-year crew transportation gap after the end of the Space Shuttle Program in 2011. To avoid another gap—this time in a low Earth orbit destination when the ISS retires—NASA is again pursuing alternative acquisition approaches, such as purchasing services instead of using traditional developmental contracts, to become a customer on commercially owned and operated space destinations. The Agency is increasingly relying on public-private partnerships and alternative acquisition approaches in an attempt to achieve cost savings and accelerate development of new technologies, including several key systems for its Artemis mission to return humans to the Moon. This shift in acquisition approaches, however, does not negate the Agency's long-standing challenge to temper its culture of optimism and develop more realistic cost and schedule estimates for its many and varied major projects (see Figure 1). In addition, NASA continues to face long-standing challenges with

[1] The Reports Consolidation Act of 2000 (Pub. L. No. 106–531) requires NASA to include in its performance and accountability report a statement by the Inspector General summarizing the most serious management and performance challenges facing the Agency and the progress made in managing them.

[2] NASA, *NASA Strategic Plan 2018* (February 12, 2018; last accessed October 7, 2021).

cybersecurity, workforce gaps, and aging infrastructure. As the Agency moves forward with key decisions on several of its major projects, addressing the challenges discussed in this report will be paramount to its success.

**Figure 1: Agency Timeline of Major Projects and Missions**




Source: NASA OIG presentation of Agency information.

Note: Indian Space Research Organisation (ISRO).

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. These eight highlighted challenges are not the only significant issues that confront NASA. Moreover, identification of an issue as a top challenge does not denote lack of attention on the Agency's part. Rather, most of these issues are long-standing, difficult challenges that are central to NASA's core missions and will likely remain top challenges for many years. Consequently, they require consistent, focused attention from NASA leadership and ongoing engagement with Congress, the public, and other stakeholders.

This year's list includes many of the same challenges discussed in previous reports. However, we reframed the Artemis and workforce challenges to reflect the most up-to-date Agency perspectives on these issues, and we added a standalone COVID-19 challenge because the impact of the pandemic on NASA's operations will cost billions of dollars, lead to schedule delays, and affect how the Agency conducts business for years to come. Our discussion of each challenge includes an explanation of why it is a challenge, identification of NASA's progress in addressing the challenge, and remaining work that needs to be done.

In this report and all related work, the OIG is committed to providing independent, objective, and comprehensive oversight of NASA programs, projects, and personnel with the singular goal of improving Agency outcomes. To that end, we plan to conduct audits and investigations in the coming year that focus on NASA's continuing efforts to address these and other challenges.

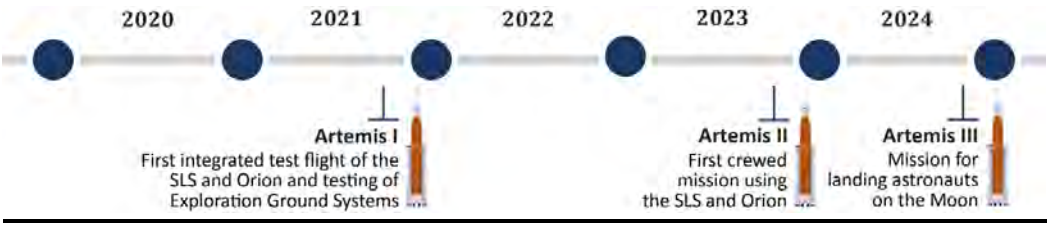
Paul K. Martin
Inspector General

# Challenge 1: Returning Humans to the Moon

## Why This Is a Challenge

The Artemis program—currently NASA's most ambitious and costly ongoing activity—is projected to cost the Agency $93 billion by fiscal year (FY) 2025 and will require decades-long engagement from NASA and its commercial and international partners to build and support multiple exploration systems, conduct research and technology demonstrations to return humans to the Moon, and prepare for an eventual crewed mission to Mars.[3] Artemis will return astronauts to the Moon more than 50 years after the last Apollo mission, and NASA intends to maintain an ongoing lunar presence (see Figure 2). The date of the long-awaited return, however, remains a question since development delays compounded by the COVID-19 pandemic will preclude NASA from meeting its goal of landing astronauts on the Moon by late 2024.

**Figure 2: Planned Artemis Missions Through Moon Landing**




Source: NASA OIG presentation of Agency information.

Note: Space Launch System (SLS) and Orion Multi-Purpose Crew Vehicle (Orion). Exploration Ground Systems is comprised of the ground hardware, software, and Launch Control System.

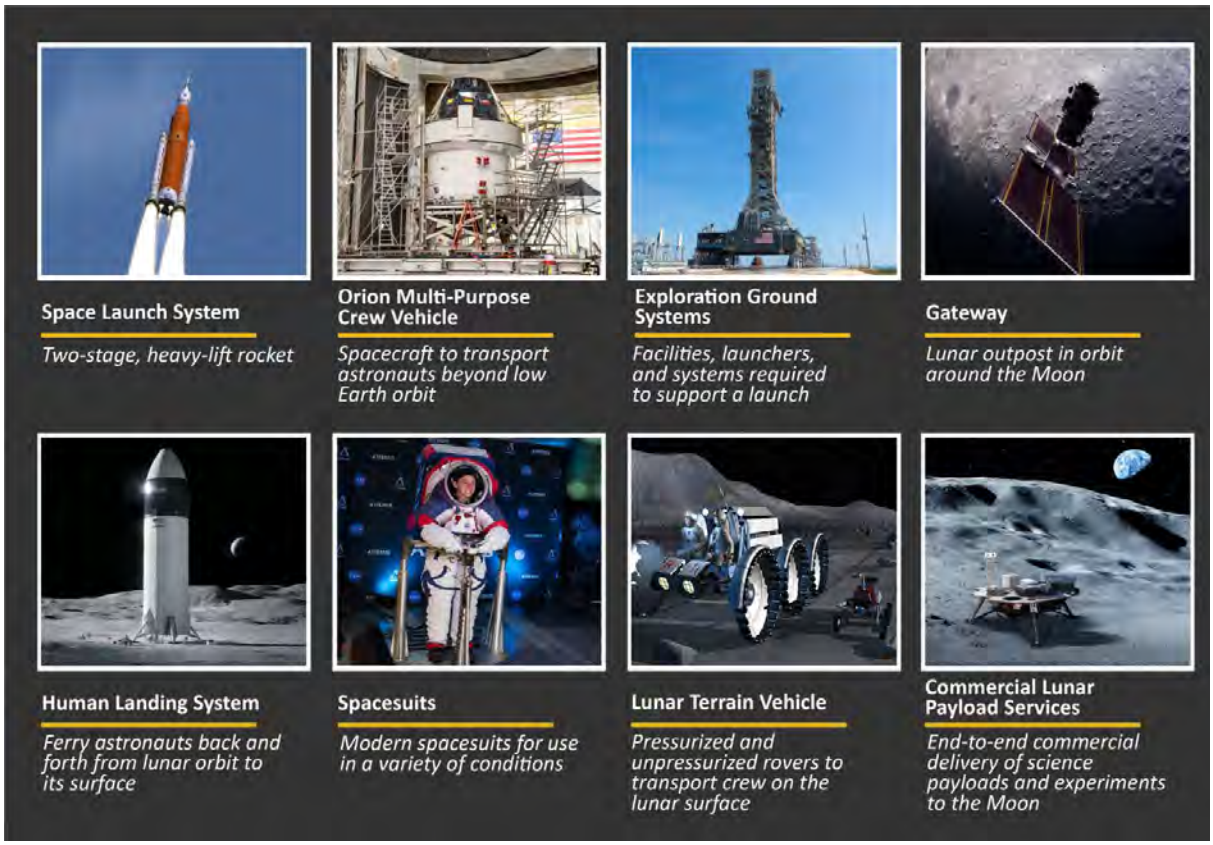
Artemis is a multi-mission program that allows NASA to extend the length and complexity of lunar missions over time. The first three missions—Artemis I, II, and III—culminate with astronauts landing on the Moon with Artemis III. NASA will use the Space Launch System (SLS) heavy-lift rocket and Orion Multi-Purpose Crew Vehicle (Orion) capsule in all three missions. Artemis I will be an uncrewed test flight, and Artemis II will fly astronauts to the Moon's orbit and back. For Artemis III, the Orion capsule—with four astronauts on board—will dock in lunar orbit with a Human Landing System (HLS) to transport astronauts to the lunar surface. Beginning with Artemis III, the astronauts will require next-generation spacesuits, known as Exploration Extravehicular Mobility Units, to explore the lunar surface. Prior to the astronauts' arrival, NASA intends to explore the lunar landing area with robotic systems as part of the Commercial Lunar Payload Services initiative.[4] Subsequent Artemis missions are expected to

[3] We derived the $93 billion figure from examining NASA's obligations, appropriations, and budget projections across all Mission Directorates for programs and projects involved in the Artemis program from FY 2012 through FY 2025.

[4] Initiated in 2018, NASA's Commercial Lunar Payload Services initiative seeks to rapidly acquire lunar delivery services from American companies for payloads that advance capabilities for science, exploration, and commercial development of the Moon.

include a longer-term presence on the Moon that incorporates additional systems including a lunar orbiting outpost called the Gateway and Lunar Terrain Vehicles to transport crew on the Moon's surface. See Figure 3 for images of the various Artemis systems in development. NASA intends to use its human presence on the Moon as a research platform to understand planetary processes, conduct experimental science, and investigate and mitigate long-term exploration risks to humans.

**Figure 3: Artemis Systems in Development**




Source: NASA OIG presentation of Agency information.

As we have consistently reported in previous reports, NASA's greatest challenge with its human exploration ambitions is development of the systems required to get humans to the Moon and Mars safely with the funding Congress has allocated and within the timeframe the Administration has imposed. In September 2020, more than a year after the White House directed NASA to escalate its timeline to land the first woman and next man on the Moon by 2024, the Agency estimated it would need approximately $28 billion between FYs 2021 and 2025 to achieve the initial crewed lunar landing 4 years ahead of its original schedule.[5] Funding is needed primarily to support development of multiple

[5] The $28 billion figure is for Phase I of the Artemis missions and includes costs for Artemis I, II, and III, but does not include the Gateway.

Artemis systems including the SLS rocket and Orion capsule to transport astronauts to lunar orbit, a Moon orbiting outpost known as Gateway, the HLS to ferry astronauts to the lunar surface, and new spacesuits for the astronauts to operate outside of their spacecraft and on the lunar surface. However, Congress appropriated only $850 million in FY 2021 out of an estimated need of $3.4 billion for the HLS. As a result, the Agency selected a single company, thereby affecting NASA's acquisition strategy to promote competition and redundancy.[6] To mitigate the risk of having only one provider, NASA decided to accelerate its Lunar Exploration Transportation Services procurement to allow other companies to develop technologies and potentially receive a contract to deliver astronauts to the Moon. We also found that delays in development of the Agency's next-generation spacesuits—attributed to technical challenges, funding issues, and COVID-19 impacts—will preclude the new suits from being ready for flight until April 2025 at the earliest and will cost NASA more than a billion dollars for their development and assembly.[7] These are only two recent examples in a series of long-standing challenges to build the systems required for the Agency's Artemis missions and follow-on Mars exploration plans.

## Progress in Addressing the Challenge

Artemis systems are making progress in their development and procurement. Over the past year, NASA's SLS, Orion, and Exploration Ground Systems Programs that form the Exploration Systems Development (ESD) Division have made steady progress, and although in a November 2021 report we found that NASA's planned November 2021 Artemis I launch date is not feasible, the Programs are in our estimation positioned to launch the first Artemis mission by summer 2022.[8] In addition, NASA completed all the contract awards necessary for the initial Gateway capability when it awarded Northrop Grumman a fixed-price contract in July 2021 for the final design and build phase of the Habitation and Logistics Outpost where astronauts will live and conduct research on the Gateway. Development continues for the electrical power system for the Gateway's Power and Propulsion Element. For Artemis III, NASA allowed flexibility for HLS proposers to either dock with the Gateway or directly with the Orion. NASA's award to Space Exploration Technologies Corporation (SpaceX) for the Artemis III demonstration includes its HLS Starship linking up directly with the crewed Orion in lunar orbit to ferry astronauts to and from the Moon's surface. NASA aims to have the Gateway operational in time for Artemis IV. Lastly, the Agency continues to develop its next-generation spacesuit capabilities, including a testing suit, two qualification suits, an ISS demonstration suit, and two lunar flight suits. Overall, NASA has made progress towards executing the first three Artemis missions, culminating with the planned return of astronauts to the surface of the Moon.

**Artemis I.** Four years after inception of the Artemis program but over 10 years into development of its SLS rocket and Orion capsule, NASA's preparations are nearly complete for the inaugural uncrewed flight of its rocket/capsule combination. The stacking of the SLS's Core Stage, Upper Stage, and Solid Rocket Boosters on the Mobile Launcher is complete, and NASA is conducting tests on the Orion before placing

[6] In April 2021, NASA selected SpaceX for the contract award, concluding that its proposal was the most highly rated, and that HLS funding availability did not allow for a second award.

[7] NASA OIG, *NASA's Development of Next-Generation Spacesuits* (IG-21-025, August 10, 2021). The $1 billion includes $420.1 million spent from 2007 through December 2020 and planned spending of $625.2 million from FY 2021 through FY 2025. The work covered by this funding includes design, testing, qualification, an ISS demonstration suit, two flight-ready suits, related support, and future suit production costs. Related support includes vehicle support hardware, training hardware and facilities, testing facilities, and extravehicular activity tools.

[8] NASA OIG, *NASA's Strategy for the Artemis Missions* (IG-22-003, November 15, 2021).

it on top of the rocket.[9] Once the Orion is stacked, fully integrated, and testing is complete, the system will be transported to Launch Pad 39B for additional testing and eventual launch. While NASA was attempting to launch the system by the end of 2021, in November 2021 we reported that a launch before summer 2022 is more likely due to the first-time challenges integrating a system of this magnitude and the impacts of the COVID-19 pandemic and multiple adverse weather events.[10] With respect to budget, NASA acknowledged the need to control the systems' cost and schedule through a June 2020 rebaselining of the SLS and Exploration Ground Systems Programs. For Artemis I, officials reported that additional cost increases and schedule slippages are expected to be minimal given the high probability of a launch before mid-2022.

**Artemis II.** For Artemis II, the Orion Program decided to purchase a second set of core avionics for its capsule and will only reuse non-core avionics. Given that astronauts will be flying on this second mission, the Agency needs to add to Orion an environmental control and life support system which is not on Artemis I. To reduce the risk of flying this system for the first time with astronauts on board, the Artemis II flight plan will include additional time in low Earth orbit to test the system before continuing to the Moon. NASA is actively building all the elements for Artemis II, but due to the reuse of the non-core avionics—considered on the critical path—launch preparations will take approximately 27 months between the first two Artemis flights.[11] Given that this flight is crewed, adjustments will also be made to the Mobile Launcher after Artemis I; however, these adjustments are not expected to impact the planned December 2023 launch date.

**Artemis III.** Besides continued production of the SLS and Orion, Artemis III preparations include development and testing of the HLS Starship being built by SpaceX. The HLS contract has faced numerous challenges from the start, beginning with Government Accountability Office (GAO) protests by two companies—Blue Origin Federation, LLC and Dynetics, Inc.—that were denied in July 2021.[12] Although the protests resulted in a 6-month delay to HLS development according to Agency officials, SpaceX still planned to conduct an orbital flight test of its Super Heavy Booster and Starship by the end of 2021. A subsequent civil suit brought by Blue Origin denied in November 2021 further delayed HLS development and testing.

Crosscutting all Artemis missions are NASA's efforts to reduce future costs of ESD systems. In January 2021, the Human Exploration and Operations Mission Directorate's Associate Administrator announced that a senior advisor would lead a sustainability assessment team to develop ideas on how to make ESD systems more cost effective. Further, as part of the recent FY 2023 budget process, programs were directed to present potential cost-saving actions. Among the ideas suggested were collaboration with contractors on process improvements and a reduction in both the civil servant and contractor workforce. For example, in June 2021 the SLS Program forecasted a 13 percent reduction in labor hours between the production of Core Stage 1 and Core Stage 2. As previously reported, Orion is moving forward on a number of initiatives aimed at reducing production costs with the Program aiming

[9] The Mobile Launcher is the ground structure that will be used to assemble, process, and launch NASA's SLS rocket and Orion spacecraft from Launch Pad 39B at the Agency's Kennedy Space Center in Florida in support of Artemis mission objectives.

[10] IG-22-003.

[11] Critical path is the sequence of tasks that determines the longest duration of time needed to complete a project. It is important to identify the critical path and the resources needed to complete the critical tasks along the path if a project is to be completed on time and within its allocated resources.

[12] NASA awarded contracts to three companies for initial design work of the HLS—SpaceX, Blue Origin, and Dynetics—which concluded in April 2021 when SpaceX was selected to further develop and demonstrate its HLS.

to transition to a fixed-price contract structure for Artemis IX and beyond.[13] There are also plans to reuse Orion's high-value interior components, including avionics and life support systems beginning on Artemis V, and to reuse the entire assembled pressure vessels and all interior components for two missions beginning with Artemis VI. Additionally, NASA hopes to leverage economies of scale to reduce costs by 21 percent by ordering Orion capsules in batches of three with the first order in 2019 for Artemis III through V.

### Key Implemented Recommendations

Confirm at selection the launch system provider for the co-manifested Power and Propulsion Element and Habitation and Logistics Outpost will meet spacecraft mass, length, and other requirements (IG-21-004).

Ensure total development and production contract costs (for Orion) currently not reported as part of the Agency Baseline Commitment are included in quarterly financial status reporting to the Office of the Chief Financial Officer, Office of Management and Budget, and Congress (IG-20-018).

Ensure procurement officials minimize the availability of award fees (for Orion) when contract modifications and value increases are the result of shortcomings in contractor performance and require documentation of the rationale for any award fees granted (IG-20-018).

For new acquisitions of SLS deliverables, develop a cost accounting model that separates each deliverable into its own contract line item number for tracking costs, performance, and award fees (IG-20-012).

## Work That Needs to Be Done

Despite progress towards developing its Artemis systems, NASA still needs to produce a comprehensive estimate that consolidates all Artemis costs across Mission Directorates. Because Artemis is not a formal program as defined by the Agency's Space Flight Program and Project Management Requirements, an Artemis-wide full life-cycle cost estimate was not required. Instead, NASA's disparate programs and projects individually submit budget estimates through their divisions and directorates to the Office of the Chief Financial Officer. Without understanding and accurately reporting the overall cost of current and future missions, Congress will lack the information needed to make informed decisions about NASA's long-term funding needs, and the Agency will be challenged to make Artemis a sustainable venture.

Overall, NASA has experienced cost increases of $4.3 billion for SLS, Orion, and Exploration Ground Systems. Furthermore, given that we estimate the cost of the SLS/Orion system at $4.1 billion per launch for at least the first four Artemis missions, NASA must continue to identify ways to make its ESD systems much more affordable.[14] Otherwise, relying on such an expensive heavy-lift rocket system will, in our judgment, inhibit if not derail NASA's ability to sustain its long-term human exploration goals. We have also reported over the last several years that ESD continues to struggle to control its costs and

[13] NASA OIG, *NASA's Management of the Orion Multi-Purpose Crew Vehicle Program* (IG-20-018, July 16, 2020).

[14] The $4.1 billion total cost represents production of the SLS, Orion, and the operations needed to launch the space flight system including materials, labor, facilities, and overhead, but does not include any money spent concurrently on the development of next-generation technologies such as the SLS's Exploration Upper Stage, Orion's docking system, or Mobile Launcher-2.

schedule using more traditional acquisition methods for development and production of its exploration systems, including sole-sourced development and cost-plus production contracts that have suffered from undefined contract requirements and overly generous award fees to underperforming contractors. However, NASA's Commercial Crew Program shows how competitively awarded fixed-price contracts can control costs if requirements are properly defined. NASA has applied this acquisition model to the Gateway's Power and Propulsion Element and HLS procurements and intends to use a commercial services approach for next-generation spacesuits.

Besides reducing costs, NASA needs to develop a realistic, risk-informed schedule that includes sufficient margin to better align Agency expectations with the development schedule. The Artemis I launch date has slipped 3 years, which has delayed the launch date for Artemis II. Although the Agency continues to work towards a late 2024 Moon landing, a Human Exploration and Operations Mission Directorate-directed schedule risk analysis showed that 2026 is a more likely date. While developmental delays in such a complex program are to be expected, NASA has consistently been challenged to manage space flight-related schedules for these primary reasons:

- Changing and evolving requirements, both internally and externally driven (including congressional and presidential directives);
- Developing an overly optimistic schedule for employees and contractors to work toward in the hope it will speed development;
- Underestimating the scope of work and technical challenges in developing human-rated systems; and
- Numerous severe weather events and COVID-19 restrictions affecting both production and testing.

Finally, NASA will continue to face risks maturing the design and critical technologies for the HLS until it ensures its new tailored programmatic approach meets the intent of traditional oversight milestones. While the HLS Program leveraged lessons learned and is modeled, in part, after the Commercial Crew Program, HLS tailored its programmatic milestone approach to better fit a services model approach versus the traditional hardware development program. The tailored approach replaces the traditional hardware development milestones with annual synchronization reviews that provide oversight of provider development.[15] NASA also stood up "collaboration teams" and insight teams that will work with SpaceX throughout HLS development. In our judgment, this is a useful resource but may not compensate for the oversight provided by the design and operational milestone reviews. Notably, NASA's initial success in defining its safety and engineering requirements during the initial HLS design phase will help ensure SpaceX and future HLS contractors understand the human rating standards they are required to achieve. Nonetheless, as was done in the Commercial Crew Program, the Agency will need to utilize a program board to evaluate hazards and variations to NASA standards to ensure safety and human rating standards are met.

[15] For example, NASA is replacing the following milestone reviews that occur in a traditional acquisition: Key Decision Point-D is the milestone event that allows a project to proceed to Assembly, Integration and Test, and Launch; Key Decision Point-E moves the project into Operations and Sustainment. A Systems Integration Review ensures segments, components, and subsystems are on schedule to be integrated into the system. The Operational Readiness Review ensures that all system and support (flight and ground) hardware, software, personnel, procedures, and user documentation accurately reflect the deployed state of the system.

## Key Unimplemented Recommendations

Baseline the Gateway requirements and specifications in contract modifications prior to updating and awarding the Power and Propulsion Element and Habitation and Logistics Outpost fixed-price contracts (IG-21-004).

Ensure Power and Propulsion Element and Habitation and Logistics Outpost delivery and launch dates are realistic by including sufficient schedule margin in their development schedules (IG-21-004).

Ensure the maturity of system requirements are fully understood before selecting the acquisition method and contract type for future acquisition strategies supporting Artemis and Mars missions by describing the state of the program requirements in the acquisition strategy memorandum for each new acquisition (IG-21-004).

To the extent practicable, adjust Orion's production schedules for Artemis IV and V to better align with the successful demonstration of Artemis II to reduce schedule delays associated with potential rework (IG-20-018).

Review Human Exploration and Operations Mission Directorate and NASA program management policies, procedures, and Agency Baseline Commitment reporting processes to provide greater visibility into current, future, and overall cost and schedule estimates for the SLS Program and other human space flight programs (IG-20-012).

### *Ongoing and Anticipated Future Audit Work*

**NASA's Management of Its Astronaut Corps**
This audit will assess to what extent NASA's processes for sizing, training, and assigning its astronaut corps align with the Agency's current and future mission needs.

**Mobile Launcher-2**
This audit will examine the extent to which NASA has met its cost, schedule, and performance goals for the Mobile Launcher-2 development contract.

# Challenge 2: Improving Management of Major Projects

## Why This Is a Challenge

For six decades, NASA has been the world's leader in space exploration, advancing knowledge of Earth while making discoveries about the furthest reaches of the universe with its portfolio of major projects.[16] These projects include satellites equipped with advanced sensors to study the Earth; rovers to collect soil and rock samples on other celestial bodies; telescopes intended to explore the far reaches of the universe; and complex systems to support transportation of humans to the ISS, Moon, and beyond. NASA is planning to invest at least $69 billion over the life cycle of its portfolio of 34 major projects currently in development. However, this investment is likely to increase because the number of projects in development is expected to grow as the Agency plans for 8 of 13 major projects in formulation—including 6 Artemis projects—to enter development in 2021. Historically, NASA's major projects have cost significantly more and taken much longer to complete than initially planned with the Agency's current development projects resulting in total cumulative cost growth of $9.6 billion since their original cost baselines were set. Moving forward, NASA's ability to deliver projects on time and within budget is critical to meeting mission objectives, strategic goals, and commitments to Congress and taxpayers.

Although $7.1 billion of $9.6 billion in cumulative cost growth comes from two of NASA's 34 major projects—James Webb Space Telescope (JWST) and SLS—other major projects such as Surface Water and Ocean Topography (SWOT), NASA-Indian Space Research Organisation (ISRO) Synthetic Aperture Radar (NISAR), Low-Boom Flight Demonstrator (LBFD), and Laser Communications Relay Demonstration (LCRD) have also experienced cost growth, schedule delays, or both—some of which can be attributed to the COVID-19 pandemic.[17]

- *James Webb Space Telescope.* JWST is an infrared observatory designed to help understand the origin of the universe, creation and evolution of the first stars and galaxies, and formation of stars and planetary systems. Under development since 2008, in June 2018 NASA established a revised life-cycle cost commitment of $9.7 billion and launch readiness date of March 2021—$828 million more and 2 years later than the baselines established by the project in 2011. Since then, technical challenges, delays related to COVID-19, and issues with Ariane 5, the European Space Agency's rocket that will launch JWST, have pushed the date out until at least December 2021.
- *Surface Water and Ocean Topography.* SWOT will use its wide-swath radar altimetry technology to take repeated high-resolution measurements of the world's oceans and freshwater bodies to develop a global survey. SWOT entered implementation in 2016 with a life-cycle cost commitment of $755 million and an April 2022 launch readiness date. Because SWOT used

[16] GAO categorizes "major projects" as those with life-cycle costs over $250 million. GAO, *NASA: Assessments of Major Projects* (GAO-21-306, May 20, 2021).

[17] The status of SLS is discussed in Challenge 1, *Returning Humans to the Moon*. COVID-19 impacts on cost growth are discussed in Challenge 8, *Managing the Impacts of COVID-19 on NASA's Mission and Workforce*.

most of its cost and schedule reserves to mitigate instrument delivery delays prior to COVID-19, it did not have sufficient reserves to cover additional delays related to the pandemic.[18] Based on a recent assessment, NASA concluded SWOT will exceed its launch readiness date by 14 months and incur $67.5 million in cost overruns to cover schedule delays and COVID-19 impacts.

- *NASA-ISRO Synthetic Aperture Radar.* NISAR is a joint project between NASA and ISRO to study Earth's ice masses and ecosystems. NASA's FY 2022 budget provides an additional $104 million to support life-cycle cost increases associated with delayed delivery of the S-band SAR instrument and COVID-19 impacts.[19] The updated NISAR life-cycle cost exceeds the Agency's development estimate of $661 million by more than 15 percent and the baseline launch readiness date of September 2022 by 12 months.
- *Low-Boom Flight Demonstrator.* LBFD is a flight demonstration project that plans to show that noise from supersonic flights—a sonic boom—can be reduced to levels acceptable to the public for commercial use in overland flights. In August 2020, NASA approved a net increase of $74.7 million over the LBFD Project's life-cycle cost estimate of $582.4 million and a delay of 5 months beyond its planned January 2022 first flight because the contractor delayed releasing design drawings and had quality issues with supplier deliveries.
- *Laser Communications Relay Demonstration.* LCRD is a technology demonstration mission to advance two-way optical (laser) communication technology for Earth using the LCRD relay satellite. In May 2021, LCRD's launch readiness date was delayed due to launch vehicle readiness issues and launch slot availability, with November 22 or 23, 2021, providing the next available launch opportunity. The mission previously experienced a $47.8 million life-cycle cost increase, with officials anticipating an additional $6.1 million for funding to retain key staff to support this latest launch delay.

**Conceptual Image of LCRD Relaying Data Between the International Space Station and the Ground**

Source: NASA.

Due to the Agency's history of persistent cost growth and schedule delays in the majority of its major projects, 30 years ago GAO first designated NASA's acquisition management as a high risk and since then has identified a variety of management weaknesses that have exacerbated this challenge.[20] NASA has historically struggled to provide reliable life-cycle cost estimates for complex projects involving multiple, first-of-their-kind components. This includes projects such as JWST, and missions such as Artemis that involve multiple iterations of major projects without a definitive life-cycle end date, like the SLS rocket

[18] Cost reserves are for costs that are expected to be incurred—for instance, to address project risks—but are not yet allocated to a specific part of the project. Schedule reserves are extra time in project schedules that can be allocated to specific activities, elements, and major subsystems to mitigate delays or address unforeseen risks.

[19] The NISAR S-Band SAR instrument is a synthetic aperture radar that actively collects data by producing its own energy and then recording the amount of that energy reflected back after interacting with Earth.

[20] GAO first cited the Agency's acquisition management as a high-risk area in 1990. GAO, *High-Risk Series: Dedicated Leadership Needed to Address Limited Progress in Most High-Risk Areas* (GAO-21-119SP, March 2, 2021) is the most recent list in which NASA's acquisition management was cited as a high risk.

and Orion capsule, which because they are not completely reusable will be built multiple times for an indefinite number of years.[21] Overall, NASA remains challenged to complete its major projects within their planned costs and schedules due to a culture of optimism, underestimating technical complexity, and funding instability—all long-standing issues.

## Progress in Addressing the Challenge

NASA's efforts in the last few years to improve management of its major projects have shown indications of improved performance for several projects, including Landsat 9 and Psyche, which have seen reduced costs.[22] In fact, GAO's 2021 High-Risk Series report listed NASA's acquisition management as one of only seven high-risk areas throughout the entire federal government that showed progress toward meeting criteria for removal from the High-Risk List over the past 2 years.[23] Progress toward improving NASA's acquisition management is demonstrated by the Agency's commitment to implement its 2018 Corrective Action Plan, which was designed to address the causes of cost and schedule concerns highlighted in GAO's High-Risk List.[24] In August 2020, NASA updated the Plan and reported completing six of nine initiatives, closing and rewriting one initiative, and adding three new initiatives to expand data collection efforts, implement a schedule repository, and conduct financial evaluations of potential contractors prior to award.

As a result of the Corrective Action Plan's initiatives, NASA has developed best practices, added additional requirements, and implemented external monitoring related to cost and schedule of major projects. For example, NASA published a Technology Readiness Assessment Best Practices Guide that established standard definitions and best practices for critical technologies needed for exploration, science, and technology mission systems to meet operational performance requirements within defined cost and schedule parameters.[25] In addition, NASA added requirements for all projects with life-cycle costs over $1 billion to conduct a Joint Cost and Schedule Confidence Level analysis at additional life-cycle phases to help reduce cost and schedule growth, improve transparency, and increase the likelihood of meeting project expectations.[26] Further, NASA plans to broaden its use of Earned Value Management by delegating all applicable contracts to the Defense Contract Management Agency to integrate information on a project's cost, schedule, and technical efforts for surveillance by

[21] NASA indicated that it expects the cost of the SLS and Orion to decrease over time as the designs stabilize and production processes mature.

[22] Landsat 9, launched in September 2021, is the latest satellite in the Landsat series, which has provided a continuous space-based record of the Earth's land surface observations to study, predict, and understand the consequences of land surface dynamics, such as deforestation. Psyche, scheduled to launch in 2022, will be the first mission to visit a metal asteroid and aims to understand iron cores, a previously unexplored component of the early building blocks of planets.

[23] NASA now meets three of five criteria for removal from GAO's High-Risk List (leadership commitment, action plan, and monitoring) and partially meets the other two (capacity and demonstrated progress).

[24] NASA, *2020 High Risk Corrective Action Plan* (August 2020, last accessed June 24, 2021) is the Agency's most recent update to the Corrective Action Plan.

[25] NASA Office of the Chief Technologist SP-20205003605, *Technology Readiness Assessment Best Practices Guide* (June 30, 2020).

[26] A Joint Cost and Schedule Confidence Level analysis produces a point-in-time estimate that includes all cost and schedule elements in project life-cycle Phases A through D (i.e., concept and technology development through system assembly, integration and testing, and launch), incorporates and quantifies known risks, assesses the impacts of cost and schedule to date, and addresses available annual resources, among other things.

management and decision makers.[27] Prior to its 2020 update to the Corrective Action Plan, NASA only surveilled 37 percent of its contracts. NASA is also requiring that these same applicable contracts submit data to NASA's new centralized schedule repository to improve access to historical data and include Earned Value Management data during project review.

### Key Implemented Recommendations

Ensure total development and production contract costs currently not reported as part of the Agency Baseline Commitment are included in quarterly financial status reporting to the Office of the Chief Financial Officer, Office of Management and Budget, and Congress (IG-20-018).

Document and provide the Joint Cost and Schedule Confidence Level analysis approach used by LBFD to the NASA Chief Knowledge Officer to serve as a reference for future large-scale X-plane development projects (IG-20-015).

Establish a process to be used during source evaluation boards and source selections that includes direct contact with the Center Earned Value Management Working Group Representative and cognizant Defense Contract Management Agency office to verify all contractor proposed information related to Earned Value Management (IG-20-015).

Direct Boeing to complete delivery of the two Core Stages and the Exploration Upper Stage using an Earned Value Management System with realistic schedule assumptions and appropriate cost estimates through the end of the contract in 2021 (IG-19-001).

## Work That Needs to Be Done

We have consistently reported on NASA's culture of optimism and the effects this has had on project management. NASA's ability to overcome technological and scientific obstacles to accomplish its objectives has become part of the Agency's culture and helped foster a belief that NASA can accomplish anything. However, many of the Agency's planned missions are ambitious endeavors that need to be grounded in more realistic cost and schedule commitments, which NASA needs to remain cognizant of when establishing baselines for the newly announced Earth System Observatory and Venus missions.[28] NASA should carefully consider its commitment to Congress and other stakeholders and seek to establish sustainable budgets and realistic timelines that take into account the Agency's overall goals and priorities. To put NASA's budget into historical context, during the Apollo missions of the late 1960s the Agency's budget reached a high of 4.4 percent of the overall federal budget, while NASA's current funding amounts to 0.5 percent of the federal budget. Artemis is NASA's most ambitious and costly mission to date, with a projected cost of $93 billion through FY 2025. Given that the Agency is

[27] Earned Value Management measures the value of work accomplished in a given period and compares it with the planned value of work scheduled for that period and the actual cost of work accomplished. At the Defense Contract Management Agency, surveillance is often a multifunctional insight effort to review and analyze contractor plans, schedules, policies, procedures, systems, processes, process outputs, and/or products to determine compliance to contractual, statutory, regulatory, or contractor requirements.

[28] The Earth System Observatory will provide key information to guide efforts related to climate change, disaster mitigation, fighting forest fires, and improving real-time agricultural processes. NASA recently selected two new missions to Venus, Earth's nearest planetary neighbor, to understand how Venus became an inferno-like world when it has so many other characteristics similar to Earth, and how it may have been the first habitable world in the solar system, complete with an ocean and Earth-like climate.

anticipated to operate with an annual budget of approximately $25 billion for the next several years, absent transparent and accurate reporting of cost and schedule commitments, it will be difficult for NASA, Congress, and external stakeholders to make informed decisions that will ensure the success of current and future programs and projects. To this end, NASA must redouble its efforts to ensure that its science and space exploration projects are grounded in accurate estimates and 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 Joint Cost and Schedule Confidence Level policy, as well as demonstrate sustained progress completing initiatives in its 2020 Corrective Action Plan.

Furthermore, when taking on a mission, requirements should be clearly defined, affordable, captured, and communicated early in the development effort to reduce the risk of costly design changes.[29] NASA has begun to acquire major Artemis systems such as the Gateway and HLS through public-private partnerships, but it has still not fully defined the lunar system architecture or established requirements for its lunar missions. Consequently, NASA will need to address potential requirements and technology development knowledge gaps in Artemis projects due to a lack of firm requirements before entering implementation.

### Key Unimplemented Recommendations

Implement the National Academies recommendation to establish a common interface for Commercial Lunar Payload Services contractors between instrument and spacecraft or to require that each commercial provider supply a document that describes provider and payload capabilities (IG-20-023).

Evaluate whether the monetary threshold for performing internal Earned Value Management is sufficient or additional criteria would be beneficial regarding the dollar-value of tasks related to providing government furnished equipment and performing in-house development work (discrete work) compared to NASA personnel performing integration, review, and management functions (level-of-effort work) (IG-20-015).

Review Human Exploration and Operations Mission Directorate and NASA program management policies, procedures, and Agency Baseline Commitment reporting processes to provide greater visibility into current, future, and overall cost and schedule estimates for the SLS Program and other human space flight programs (IG-20-012).

### *Ongoing and Anticipated Future Audit Work*

**NASA's Multi-Mission Program Cost Estimating and Reporting Practices**
This audit will assess the effectiveness of the Agency's cost estimating and reporting practices for large, multi-mission programs such as those supporting the Artemis program.

**Audit of the Volatiles Investigating Polar Exploration Rover (VIPER) Mission**
This audit will assess NASA's management of VIPER relative to achieving technical objectives, meeting established milestones, and controlling costs.

[29] GAO, *Best Practices: Capturing Design and Manufacturing Knowledge Early Improves Acquisition Outcomes* (GAO-02-701, July 15, 2002).

**Review of Astrophysics Portfolio**
This audit will evaluate the current state of the Agency's Astrophysics portfolio, identify and assess risks to future missions, and provide recommendations in support of the next decadal survey.

**Review of NASA's Management of the Johns Hopkins University Applied Physics Laboratory Portfolio**
This audit will assess NASA's processes and controls ensuring the effective management of the contracts and portfolio of Agency projects developed by the Johns Hopkins University Applied Physics Laboratory.

# Challenge 3: Sustaining a Human Presence in Low Earth Orbit

## Why This Is a Challenge

For more than 20 years, humans have continuously lived and worked in space, building the ISS, conducting microgravity research, and testing new technologies required for long-term deep space travel to the Moon and Mars including those needed for the Agency's near-term Artemis missions. At a cost of approximately $3 billion annually to operate the ISS and transport astronauts to and from the Station, NASA's activities in low Earth orbit—the region in space from 100 to 600 miles above the Earth's surface—consume about one-third of the Agency's annual human space flight budget.[30] This expense is expected to continue through the Station's anticipated retirement in 2030.[31]

The continuous operation of research and technology demonstrations in low Earth orbit is critical to achieving NASA's goals in science, technology, and human space flight. The unique microgravity laboratory offered by the ISS has delivered benefits in human health, Earth observations and disaster response, innovative technology, global education, and the economic development of space. Without the availability of a low Earth orbit platform to conduct critical health research and demonstrate key technologies, NASA would be faced with the difficult decision of accepting a higher level of risk or delaying human missions to the Moon and Mars.

While the U.S. segment of the ISS is structurally certified to operate until 2028, recent events highlight some of the risks associated with the harsh space environment, which require continuous assessment of the Station's operational performance.[32] Since October 2020, astronauts have identified several cracks in the Russian-built Service Module Transfer Tunnel that are causing cabin air to leak at twice the normal rate.[33] While the current amount of cabin air leakage does not pose an immediate risk to astronaut health and safety, and to date, ISS teams have not observed any indications that crack growth is continuing towards a catastrophic failure, cracks can grow over time increasing risk. NASA and Russia's space agency continue to investigate the cause of the leaks and potential structural impacts. In addition, in February 2021 NASA identified a hole in the Station's Canadarm2 caused by a micrometeoroid or orbital debris.[34] On-orbit inspections revealed that the damage would have no

[30] The ISS orbits roughly 250 miles above the Earth's surface.

[31] The United States Innovation and Competition Act of 2021 (S.1260), a bill approved by the Senate in June 2021, would extend ISS operations through September 30, 2030.

[32] Currently, the U.S. portions of the Station are certified to operate through 2028—30 years after the first segment of the ISS was launched.

[33] The Service Module—the structural and functional center of Russia's ISS segment and the third oldest segment of the Station—is currently the source of multiple cabin air leaks of unknown cause, some of which have yet to be located.

[34] Orbital debris consists of human-made objects in space that no longer serve a useful purpose. With the rapid increase of space activity and the state of orbital debris in low Earth orbit, we reported in January 2021 that the Agency's mitigation-only activities focused solely on prevention were insufficient to stabilize the orbital debris environment. NASA OIG, *NASA's Efforts to Mitigate the Risks Posed by Orbital Debris* (IG-21-011, January 27, 2021). Canadarm2—part of Canada's contribution to the ISS—is used to conduct regular maintenance checks and operations on the outside of the Station; move supplies, equipment, and astronauts conducting spacewalks; and capture visiting vehicles to connect them to the Station.

impact on the arm's operations through the end of the Station's certified life. In July 2021 the ISS also experienced a loss of attitude control after Russia docked its new Multi-Purpose Laboratory Module.[35] The new module inadvertently fired its thrusters, resulting in the vehicle becoming inverted and losing satellite communications for several minutes on two separate occasions. After the event, NASA assessed the inadvertent thruster firing anomaly data and determined there was no structural damage or long-term concerns as a result of structural loading. While NASA determined that these events do not pose an immediate threat to the Station's operational longevity, either in response to an emergency event or at the end of the Station's useful service life, NASA and its partners will eventually have to come to a decision to initiate its decommissioning and deorbit.

Looking forward, NASA plans to maintain a human presence in low Earth orbit after the ISS is retired by becoming a customer of commercially owned and operated space destinations, which will require a sustained but largely undetermined financial investment by the federal government and private companies. To further its goal to become one of many customers in a commercial low Earth orbit economy, NASA has made several attempts over the past decade to commercialize space. The Agency's initial efforts to commercialize low Earth orbit were unsuccessful after 10 years of trying to develop a commercial market and relying on the Center for the Advancement of Science in Space, Inc. (CASIS) to advance research endeavors for the commercial sector.[36] In response, NASA released a plan in 2019 focused on near-term actions to expand commercial opportunities in space beyond what was initially allowed under CASIS, including private astronaut missions to the ISS. However, Congress authorized NASA to spend only $17 million to support commercial low Earth orbit development in FY 2021—just over 10 percent of the Agency's requested $150 million.

Key to maintaining a presence in low Earth orbit is reliable and cost-effective transportation of cargo and crew. Between the end of the U.S. Space Shuttle Program in 2011 and the first commercial crew mission in November 2020, NASA faced a 9-year transportation gap where it was forced to pay Russia for crew transportation to the Station. In the intervening years, NASA's Commercial Cargo and Crew Programs have enabled commercial partners to successfully transport cargo to and from the ISS since 2012 and crew since 2020. However, the road to developing a commercial crew transportation capability has been long. While SpaceX has successfully launched three commercial crew missions to the ISS, as of November 2021 the Boeing Corporation (Boeing), the other of the Agency's two commercial crew partners, has encountered numerous delays and technical issues that have to date thwarted its first crewed flight. Crew transportation is crucial, not just for fully utilizing the ISS, but also for developing and utilizing future commercial destinations to maintain a continuous human presence in low Earth orbit.

NASA continues to face challenges with low Earth orbit transportation and commercialization, as we have reported in previous audits and prior top management and performance challenges reports. Addressing these challenges is more urgent as NASA works to avoid the possibility of a gap in maintaining a human presence in low Earth orbit without the ISS or a commercial destination.

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[35] Attitude is the orientation of the ISS with respect to the Earth and Sun, which is important for maintaining communications, microgravity, power, and thermal levels on the Station.

[36] CASIS is a non-profit organization that manages the ISS U.S. National Laboratory, a U.S. government-funded laboratory with principal research facilities located in the U.S. Orbital Segment of the ISS. In August 2011, NASA signed a 10-year, $136 million cooperative agreement with CASIS to manage all non-NASA research on the ISS. In July 2017, NASA extended the cooperative agreement to September 2024 and added another $60 million to the agreement.

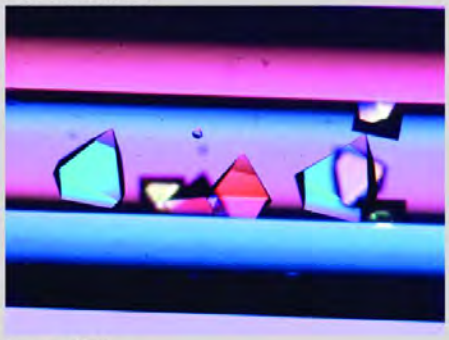
## Progress in Addressing the Challenge

To its credit, during a pandemic that closed NASA's facilities and forced 90 percent of its workforce to operate from home, the first certified commercial flight of astronauts was launched into space in November 2020 from Crew Dragon, SpaceX's commercial crew transportation vehicle. This flight represents the first time in 9 years that American astronauts were able to launch on a U.S. vehicle since the end of the Space Shuttle Program.

In June 2021, NASA also completed installation of its new Roll-Out Solar Array to increase the Station's power production and ensure its future power requirements are met through the life of the ISS including power needed for new commercial modules. Astronauts also replaced the Station's aging batteries with more efficient lithium-ion batteries. In addition, NASA installed the first privately-funded commercial airlock on the ISS in late 2020—the NanoRacks Bishop Airlock increased the Station's capability for transferring equipment, payloads, and deployable satellites to meet growing customer demands.

In FY 2021, NASA invested more than $13 million in seed money for seven companies to develop in-space production applications in what industry studies indicate are the most promising areas for profitable manufacturing in space, such as advanced fiber optics, crystals, and regenerative medicine. Most of these in-space production applications are sponsored by CASIS, which in response to long-standing issues with oversight, its organizational structure, and its integration with the scientific community, is working with NASA to implement a six-point plan to ensure they maximize the benefit of the ISS National Laboratory for the remainder of its time in orbit.

**Protein Crystals Formed in Microgravity Aboard the ISS**



Source: NASA.

In addition, NASA is expanding commercial access to low Earth orbit beyond the scientific research and development allowed in the National Laboratory by enabling commercial and marketing activities onboard the ISS, such as shooting photographs and videos of an Estēe Lauder skin serum using the backdrop of space, and allowing private astronaut missions, such as the first Axiom Space mission expected to launch to the ISS in February 2022. In fact, due to the level of demand for private astronaut missions to the Station, in June 2021 NASA moved to an annual competitive process for selecting up to two private astronaut missions per year based on availability.

Finally, NASA is contributing to the development of low Earth orbit commercial destinations. In 2020, the Agency awarded Axiom Space a firm-fixed-price contract of $140 million to provide at least one habitable commercial module attached to the ISS, which will detach and become a free-flying destination prior to deorbiting the Station. In July 2021, NASA announced its Commercial Low Earth Orbit Destinations initiative to encourage development of a commercial successor to the ISS through public-private partnerships.

### ● Key Implemented Recommendations

Continue to ensure the purchase of future commercial space services complies with government contracting regulations (IG-20-005).

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

## Work That Needs to Be Done

Reliable transportation to low Earth orbit continues to be a priority for the Agency. Despite recent progress, the Commercial Crew Program continues to be challenged by Boeing's CST-100 Starliner vehicle, which encountered numerous delays and technical issues that precluded a second uncrewed test flight planned for July 2021. This second test flight was necessary because Boeing's first flight in December 2019 encountered significant software glitches that prevented the capsule from reaching the ISS.[37] Given the ongoing root cause analysis and technical issues facing the Boeing vehicle, it is not clear when the Starliner will conduct its first crewed flight. Until that time, NASA will be required to rely on SpaceX for commercial transportation to the ISS.

Whether on the ISS or a future commercial low Earth orbit destination, NASA is counting on the availability of a continuously crewed laboratory well beyond 2030 to conduct research and technology demonstrations required for deeper and longer-term space travel. Eleven of 27 technology gaps that require microgravity testing and 8 out of 12 critical human health risks that require mitigation using a microgravity environment will not be completed by the Station's proposed end-of-life in 2030.[38]

NASA intends for one or more commercial low Earth orbit destinations to be operational by 2028, allowing a 2-year overlap with the ISS before its anticipated retirement in 2030. The Agency's plan to develop a commercial economy continues to be an urgent priority so that it can avoid a gap in its ability to sustain a human presence in low Earth orbit.

### ○ Key Unimplemented Recommendations

Lead national and international collaborative efforts to mitigate orbital debris including activities to encourage active debris removal and the timely end-of-mission disposal of spacecraft (IG-21-011).

Explore alternative orbital debris radar assets to fill the data gaps caused by the increased costs of utilizing existing radars and the loss of legacy assets (IG-21-011).

Correct identified safety-critical technical issues before the crewed test flights, including parachute, propulsion, and launch abort systems, to ensure sufficient safety margins exist (IG-20-005).

[37] NASA and Boeing cooperated to form a joint Independent Review Team in December 2019 following the Starliner's first test flight. The assessment examined the three primary anomalies experienced during the initial test. NASA officially closed all actions recommended by the Independent Review Team which included additional dress rehearsals, refurbishing of the first Orbital Flight Test crew module, and outfitting a new service module.

[38] Eight of the 11 technology gaps that require microgravity testing are individual components of the Environmental Control and Life Support System, which will be integrated into a single system on the ISS by 2029.

### *Ongoing and Anticipated Future Audit Work*

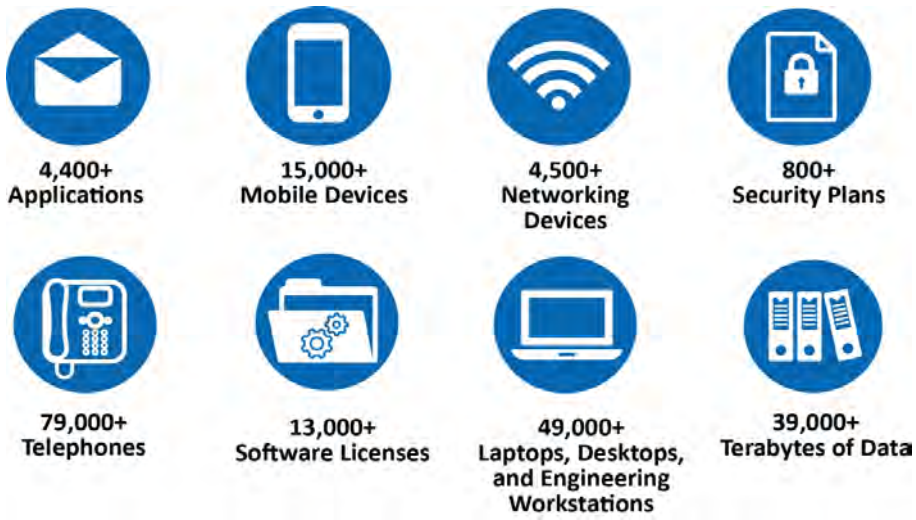
**NASA's Management and Utilization of Low Earth Orbit**
This audit will examine NASA's utilization and management of the ISS and its plans and progress toward developing a commercial market in low Earth orbit.

# Challenge 4: Managing and Mitigating Cybersecurity Risk

## Why This Is a Challenge

Cybersecurity is profoundly difficult and complex to manage, especially in an ever-changing threat environment where mitigation is a marathon, not a sprint. Over the past 20 years, we identified securing NASA's information technology (IT) systems and data as a top management challenge due, in large part, to the Agency's deficient IT management practices.[39] Given its more than 500 IT systems, high-profile mission, and broad connectivity with the public, educational institutions, research facilities, and other outside organizations, NASA is a larger and more attractive potential target for cybercriminals than most government agencies (see Figure 4).

**Figure 4: NASA IT by the Numbers**




Source: NASA OIG representation of Agency data.

With more than 72,000 applications and devices connecting to NASA's networks, effectively managing and mitigating cybersecurity risk is key to ensuring mission success—a fact underscored by mandatory telework as a result of the COVID-19 pandemic and the 2020 SolarWinds cyberattack.[40] To this end,

[39] NASA's IT systems include institutional systems that support the day-to-day work of Agency employees, such as laptop and desktop computers, and mission-specific systems that support the Agency's aeronautics, science, and space exploration programs, such as the Deep Space Network, which supports interplanetary spacecraft missions.

[40] Hackers believed to be operating on behalf of the Russian Foreign Intelligence Service breached software provider SolarWinds and deployed a malware-laced update to infect the networks of multiple U.S. companies and government networks, including NASA.

the Office of the Chief Information Officer (OCIO) allocated approximately $69 million during FY 2021 to implement institutional cybersecurity measures because challenges and threats continue to evolve as adversaries routinely attempt to compromise NASA's IT assets.[41] For instance, in 2019 two Chinese nationals, members of a hacking group operating in China, were indicted on criminal charges for gaining unauthorized access to a NASA computer to steal data. Separately, in April 2020 we issued a Management Referral detailing the unauthorized access and deletion of data from an Agency IT system following an employee's separation. The investigation found that a contractor was permitted access to a NASA system following termination in which artifacts were deleted in violation of Agency policy and best practices. In addition, our investigation found that mission IT personnel did not follow established NASA incident response procedures that precluded the possibility of pursuing criminal charges against the former employee related to the potential intentional destruction of Agency data.

To help frame the scope and urgency of cybersecurity, the Federal Information Security Modernization Act (FISMA) and Federal Information Technology Acquisition Reform Act (FITARA) ratings provide broad insight into NASA's cyber health.[42] During the 2021 FISMA evaluation, NASA's information security program showed some improvement but still fell short of the Office of Management and Budget's watermark for a program to be considered effective.[43] Similarly, in July 2021 NASA received an overall FITARA grade of C+ given its challenges in managing cyber risks.

Strengthening foundational cybersecurity efforts, such as Enterprise Architecture and Enterprise Security Architecture—the blueprints for how an organization analyzes and operates its IT and cybersecurity—continues to be challenging as the Agency struggles to balance two competing priorities: protecting against cyber threats and fulfilling its mission. As we reported in May 2021, the Agency's cybersecurity preparedness is strained due to ambiguity surrounding the requisite technical integration between Enterprise Architecture and Enterprise Security Architecture as well as disjointed internal management structures and funding authorities.[44]

The Agency's organizational structure has three primary levels with varying responsibilities—and numerous lines of funding control—for cybersecurity management. Typically, missions fund their own computer networks and IT personnel; therefore, in most cases the mission directorate personnel rather than OCIO have visibility over the operational and security aspects of mission networks. This long-standing practice of having missions with independent budgets and sometimes competing interests impedes the Agency's ability to build a comprehensive Enterprise Architecture.

While the OCIO has responsibility for institutional governed IT that support the day-to-day work of NASA employees, missions are left to their own discretion to interpret and implement requirements and, importantly, absorb costs associated with cybersecurity. Smaller missions lack assets (people, tools, and funding) to devote to cyber efforts and tend to prioritize gathering science while putting cybersecurity low on their "to-do" lists.

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[41] OCIO personnel oversee the systems and security capabilities that comprise NASA's institutional networks, data centers, web services, and computers.

[42] FISMA, as amended in 2014 (Pub. L. No. 113-283), requires agencies to develop, implement, and document an agency-wide information security program. FITARA puts federal agency Chief Information Officers in control of their agency's IT investments.

[43] NASA OIG, *Evaluation of NASA's Information Security Program under the Federal Information Security Modernization Act for Fiscal Year 2021* (ML-22-001, November 9, 2021).

[44] NASA OIG, *NASA's Cybersecurity Readiness* (IG-21-019, May 18, 2021).

Adopting an integrated Enterprise Architecture and Enterprise Security Architecture would not only dramatically improve situational awareness but would also enable NASA's decision makers to effect positive change on the Agency's cybersecurity posture. However, these efforts take time to implement and require sustained leadership commitment. This year, we focused on three specific cybersecurity challenges the Agency is facing with an emphasis on practical issues where meaningful improvement and near-term progress is achievable: (1) improper use incidents, (2) mobile device security, and (3) assessment and authorization (A&A) process.[45]

- *Improper Use Incidents.* Improper use incidents result from a violation of an organization's acceptable use policies. In a May 2021 audit, we found that improper use incidents increased from 249 in 2017 to 1,103 in 2020—a 343 percent growth—with failing to protect Sensitive But Unclassified information the most prevalent abuse.[46] For instance, unencrypted email containing Sensitive But Unclassified data, Personally Identifiable Information, and International Traffic in Arms Regulations data continues to expose the Agency to unnecessary cyber risk that can affect national security, loss of intellectual property, and compromise of employee and contractor data.[47]
- *Mobile Device Security*. The OCIO manages over 15,000 mobile devices that store, process, and transmit Agency information, thereby requiring continuous protection. In an August 2020 audit, we found that the OCIO is not adequately monitoring and enforcing the business rules established for mobile devices, potentially exposing the email system and data to viruses, malware, or hacking through connected mobile devices.[48] Moreover, since the outbreak of COVID-19, exposure to cyber threats has increased because NASA's workforce has shifted to a work-from-home environment, increasing the usage of mobile devices.
- *Assessment and Authorization Process*. To ensure its IT systems meet cybersecurity requirements, NASA is required to perform a thorough A&A review process for newly introduced systems and annually for all other systems. In May 2021, we reported that NASA is inconsistent and ineffective with its A&A process because of its decades-long decentralized approach to cybersecurity.[49] Over the past 6 years, we have reported that certain types of assessment data have been ignored or discarded as irrelevant during the A&A process, leaving systems incorrectly categorized at lower risk impact levels than their criticality requires and resulting in increased vulnerability to cyber risks.

[45] A&A consists of a review of security policies and procedures (management controls); physical facility infrastructure (operational controls); and network testing, server testing, application security testing, penetration testing, and scanning (technical controls). End products of A&A include an authorization to operate the IT system, risk-based decisions on the application of individual controls, and a plan of action and milestones to address identified deficiencies.

[46] IG-21-019. Sensitive But Unclassified has been replaced by a newly mandated government-wide initiative and renamed as Controlled Unclassified Information. NASA was issued a waiver that permitted both information classifications to coexist until October 1, 2021.

[47] Personally Identifiable Information is any data, such as a social security number or date of birth, that could potentially identify a specific individual. International Traffic in Arms Regulations control the export and import of defense-related articles and services on the United States Munitions List and affects the manufacture, sale, and distribution of technology.

[48] NASA OIG, *Audit of NASA's Policy and Practices Regarding the Use of Non-Agency Information Technology Devices* (IG-20-021, August 27, 2020).

[49] IG-21-019.

## Progress in Addressing the Challenge

The Agency has taken steps to improve its management and mitigation of cybersecurity risks over the last several years. Most important has been the stability of having a tenured Senior Agency Information Security Officer in place for more than 4 years—longer than any other in NASA history. The continuity of leadership has been critical for the OCIO, and the Agency as a whole, to advance cybersecurity readiness. Additionally, NASA senior management has made a combination of strategic, risk management, and collaboration decisions that have begun to strengthen the Agency's cybersecurity posture.

- *Strategic Decisions*. Agency officials formed a Cybersecurity Program Management Board with key senior team members to broaden visibility and provide input into programmatic decision-making to better manage cyber risk for programs, projects, and initiatives. In addition, NASA implemented security enforcements requiring End-of-Life/End-of-Support systems to be upgraded in order to remotely connect to NASA's Virtual Private Network (VPN).
- *Risk Management Decisions*. NASA replaced and expanded the Agency's secure VPN infrastructure in the fall of 2019, an action that proved critical for supporting the unanticipated move in March 2020 to mandatory telework for approximately 90 percent of the Agency's workforce during the COVID-19 pandemic. Likewise, NASA has deployed Agency Endpoint Threat Detection and Response software across more than 50,000 systems.[50] The Agency is also creating a mobile VPN for government furnished iOS phones and tablets that utilize Mobile Device Management, allowing secure access over the internet to files stored on shared drives.[51]
- *Collaboration Decisions*. In 2020, NASA embedded a cybersecurity executive within the Artemis program to provide coordination and codify a tailored cross-Center enterprise cybersecurity risk approach for the program. The Agency also established the Cybersecurity Integration Team—comprised of stakeholders across the Agency including all mission organizations—which issued guidance to improve High Value Asset identification and management.[52]

Lastly, the OCIO is in the process of implementing two important cyber-related initiatives. In January 2022, under the Mission Support Future Architecture Program, Center Chief Information Security Officers and cybersecurity staff will be realigned from the Center OCIO to the Senior Agency Information Security Officer, moving the Agency towards an enterprise computing model that would centralize and consolidate IT capabilities, such as software management and cybersecurity. Additionally, in February 2022 the OCIO anticipates it will award the Cybersecurity and Privacy Enterprise Solutions and Services contract that expects to eliminate duplicative cyber services and the need for Center-based IT security contracts.

[50] Endpoint detection and response software is used to gather and analyze security threat-related information from computer workstations and other endpoints with the goal of finding security breaches as they happen and facilitating a quick response to discovered or potential threats.

[51] iOS is a mobile operating system for Apple-manufactured devices such as the iPhone and iPad.

[52] A High Value Asset is information or an information system that is so critical to an organization that the loss or corruption of this information or loss of access to the system would have serious impact to the organization's ability to perform its mission or conduct business. These sensitivities make High Value Assessments of particular interest to criminal, politically-motivated, or state-sponsored actors for either direct exploitation of the data or to cause a loss of confidence by the public.

### Key Implemented Recommendations

Require the Jet Propulsion Laboratory Cybersecurity/Identity Technologies and Operations Group to identify and remediate weaknesses in the security problem log ticket process and provide periodic aging reports to the Jet Propulsion Laboratory Chief Information Officer detailing the status of open security problem log tickets, pending patches, and outdated security waivers (IG-19-022).

Ensure OCIO and Office of Strategic Infrastructure representatives are included in functional reviews of NASA's critical infrastructure assets and facility security assessments so that cyber and facility interdependencies are addressed appropriately (IG-17-011).

## Work That Needs to Be Done

As cyber threats continue to evolve and become more sophisticated, they pose ongoing challenges for NASA to fortify and safeguard its IT systems. Space is both a collaborative and competitive business; NASA's potential cyber threats are as varied as its missions. The ongoing tension between collaboration and competition will continue to define space activities in the coming years requiring the Agency to combat threats in order to maximize the utility of space partnerships while protecting intellectual property against theft.

While NASA has implemented countermeasures to reduce the likelihood and overall risk associated with cyber threats, it continues to face challenges in improving its defenses to protect mission data and thwart vulnerabilities. The Agency's cybersecurity preparedness continues to be strained due to ambiguity surrounding the technical integration between Enterprise Architecture and Enterprise Security Architecture and gaps in visibility of the mission networks. To counter a broad range of exploitation techniques and to continue forward progress, the OCIO needs to (1) reduce improper use incidents, (2) ensure that mobile device security is addressed, and (3) implement a consistent A&A process. Additionally, as the Mission Support Future Architecture Program and Cybersecurity and Privacy Enterprise Solutions and Services contract come to fruition, sustained focus by Agency leadership is critical to integrating these dual initiatives into its enterprise-wide cyber portfolio to avoid implementation gridlock.

Furthermore, previous concerns such as the large size of the Agency's web footprint and emerging concerns related to the supply chain warrant continued action by NASA officials. Activities to streamline websites, revamp the main website, create an Agency web-archiving program, and implement a new Agency web governance structure are ongoing. As of July 2021, NASA has completed a comprehensive internal review of 2,867 websites and is working toward implementing a new nasa.gov information architecture to streamline the Agency web space. Finally, like many other agencies, NASA is dependent on a supply chain that is vulnerable to disruption and cyber threats, and the impact on NASA IT systems must be monitored with a sense of urgency because much of the supply chain issues stem from the dependence on single and sole-source nations, primarily China.

## Key Unimplemented Recommendations

Improve the patch and vulnerability management program (IG-21-005).

Assign the personnel resources necessary to ensure the Agency's security plans for systems that inherit the controls within the Agency's new hybrid common controls system are updated and that those hybrid controls are removed from the Agency Common System security plan (IG-21-010).

Integrate Enterprise Architecture and Enterprise Security Architecture and develop metrics to track the overall progress and effectiveness of Enterprise Architecture (IG-21-019).

Collaborate with the Chief Engineer on strategies to identify and strengthen Enterprise Architecture gaps across mission and institutional IT boundaries (IG-21-019).

### *Ongoing and Anticipated Future Audit Work*

**Review of NASA's Information Security Program under the Federal Information Security Modernization Act for Fiscal Year 2021**
As required by FISMA, this annual review will evaluate NASA's information security program for FY 2021.

**Audit of NASA's Insider Threat Program**
This audit will examine whether the Agency has established and implemented an effective insider threat program in accordance with federal policies, NASA policies, and best practices.

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

## Why This Is a Challenge

NASA uses contracts, grants, and cooperative agreements to fund research and development activities and purchase services, supplies, and equipment to support every facet of its operations. In FY 2020, NASA spent approximately $19.7 billion of its $27.7 billion in available resources on contracts, grants, and cooperative agreements awarded primarily to businesses, educational institutions, and nonprofit organizations. The breadth and scale of these acquisitions underlie the significant challenge NASA faces to ensure the Agency receives good value for its investments and that recipients spend NASA funds appropriately to accomplish agreed-upon goals.[53] Moreover, the Agency is also increasingly relying on public-private partnerships and alternative acquisition approaches in an attempt to achieve cost savings and accelerate development of new technologies, including several key systems for its Artemis mission to return humans to the Moon.

**Contract, Grant, and Cooperative Agreement Definitions**

***Contract***
Mutually binding legal relationship obligating the seller to furnish the supplies or services and NASA to pay for them. Contracts include but are not limited to awards, job orders, task letters, purchase orders, letter contracts, and bilateral contract modifcations.

***Grant***
A type of financial assistance a federal agency enters into with a recipient that supports or stimulates a public purpose. A grant does not provide for substantial involvement or collaboration between NASA and the recipient.

***Cooperative Agreement***
An arrangement where NASA provides funds to a recipient for a specific purpose. A cooperative agreement typically requires substantial collaboration between the Agency and the recipient.

NASA has faced long-standing challenges with oversight of its contracts, grants, and cooperative agreements. GAO first designated the Agency's acquisition management as a high risk in 1990, and it has remained a high-risk area for three decades due to persistent cost growth and schedule delays in many of NASA's major projects.[54] Similarly, we have highlighted acquisition as an Agency management challenge for the past 15 years with identified weaknesses in both oversight of the acquisition process and the readiness of its acquisition workforce.

NASA also continues to be challenged with oversight of its acquisition process. Most recently, in a July 2021 audit of NASA's cooperative agreements with the Universities Space Research Association, we reported that the Agency needed to take additional steps to improve its management and financial oversight of cooperative agreements, especially with regard to significant extensions and augmentations to those agreements.[55] Furthermore, our financial statement audits over the past decade have

[53] NASA's contracts are managed by the Office of Procurement, while grants and cooperative agreements are issued by the NASA Shared Services Center and managed by the Office of the Chief Financial Officer.

[54] This issue is discussed in Challenge 2, *Improving Management of Major Projects*.

[55] NASA OIG, *NASA's Management of Universities Space Research Association's Cooperative Agreements* (IG-21-022, July 14, 2021). Funded extensions are supplements used to extend grants that require additional funding beyond their expiration dates. Augmentations are supplements that can be used at any time for work outside the scope of the approved proposal.

identified challenges in timely closing out of contracts to ensure the government received what it contracted for, detected and recovered erroneous payments, made final payments to the contractors, and deobligated excess funds. Our FY 2020 financial statement audit also revealed oversight issues with the Agency's internal controls related to the grant management process that we found were not designed to effectively monitor grantees and the federal awards they received.[56] Also, over the past 3 years our Office of Investigations conducted 40 criminal investigations involving grant fraud and abuse. The investigations resulted in 4 indictments, 2 prosecutions, and 4 suspensions with NASA receiving $341,266 in restitution, $731,131 in recoveries, and $3,272,790 in civil settlements.

More broadly, NASA is challenged with Agency-wide oversight of its acquisition workforce. In an October 2020 audit, we found that NASA does not collect Agency-wide acquisition workforce workload or performance data, which limits its ability to have an accurate picture of who comprises the acquisition workforce, determine whether they are certified as required, and measure workforce performance consistently across the entire Agency.[57] Further, the practice of Center procurement offices functioning autonomously resulted in institutionalized inefficiencies such as redundant capabilities and contracts, legal and policy offices reviewing inconsistent monetary thresholds across Centers, and lack of workforce flexibility.

In our judgment, these challenges expose NASA's contracts, grants, and cooperative agreements to an increased risk of fraud, waste, and abuse. In particular, fraud and misconduct with the Agency's Small Business Innovation Research (SBIR) and Small Business Technology Transfer programs are a long-standing OIG concern. Recent examples include:

- A Kansas engineering company agreed to a civil settlement of $672,352 to resolve allegations that it submitted false claims to obtain grant funds from the SBIR and Small Business Technology Transfer programs. The investigation determined that the company received small business funding for which it was ineligible.
- A New York company agreed to a settlement of $490,000 to resolve allegations under the civil False Claims Act that it did not satisfy ownership and control requirements under the SBIR program. The company was ineligible for SBIR awards from NASA and the U.S. Department of Defense due to the involvement of Canadian investors.
- A Wyoming small business agreed to pay damages of $557,684 in a civil settlement to resolve allegations that it accepted SBIR funding to which it was not entitled from NASA, the U.S. Department of Energy, and the U.S. Department of Health and Human Services.

In addition, the ongoing COVID-19 pandemic has impacted NASA's management of its contracts. Under Section 3610 of the Coronavirus Aid, Relief, and Economic Security Act—the pandemic relief legislation known as the CARES Act—agencies are permitted to reimburse contractors for work stoppages caused by the pandemic to keep employees and subcontractors in a ready state given the closure of NASA Centers.[58] This provision is particularly relevant to an agency like NASA that relies so heavily on private contractors for its science and space exploration projects. The CARES Act provided NASA with $60 million for safety, security, and mission support to prevent, prepare for, and respond to the

[56] NASA OIG, *Fiscal Year 2020 Financial Accounting Management Letter* (IG-21-008, December 14, 2020).

[57] NASA OIG, *NASA's Management of Its Acquisition Workforce* (IG-21-002, October 27, 2020).

[58] Coronavirus Aid, Relief, and Economic Security Act, Pub. L. No. 116-136 (2020).

coronavirus. However, the Agency is planning to pay for subsequent adjustments using non-CARES Act appropriated funds and we anticipate additional significant costs to NASA in the future.

## Progress in Addressing the Challenge

NASA has taken numerous steps to address its contract management challenges. The Office of Procurement continues to implement the ongoing Mission Support Future Architecture Program, NASA's transition to an enterprise-wide workforce that leverages employees' skills for use across the Agency; developed a Strategic Workforce Plan to maintain a workforce capable of responding to current and future contracting needs; and developed an Acquisition Portfolio Assessment Team to assess all Agency contracts and identify redundant contracts managed at the Center level.

In the past year, NASA has also made several enterprise-wide changes to address acquisition management and oversight concerns. The Agency has consolidated the award and administration of grants and cooperative agreements through the NASA Shared Services Center. This consolidation is designed to improve service and data quality, standardize processes, leverage skills and investments, and provide economies of scale. NASA has also developed and implemented a new pre-award risk assessment policy and the Pre-Award Risk Assessment Tool to help standardize reviews across Centers. This tool has been in use by the NASA Shared Services Center for all recipients of new grants and cooperative agreements since October 1, 2020. In addition, NASA has made efforts to increase its efficiency in closing expired grants by incentivizing closeout contractors to complete timely and proper grant closeout.

In an August 2021 report, we found that NASA appropriately managed $60 million provided by the CARES Act. For the Section 3610 transactions, NASA developed advanced agreements, a vehicle contracting officers and contractors use for special or unusual costs, specifically designed for the unique circumstances presented by the pandemic. We found that the advanced agreements and supporting documentation for the 27 Section 3610 transactions in our sample were all pandemic-related, and the advanced agreements adequately described the conditions such as facility closures and listed the contractor employees and the job functions that could not be performed remotely.[59]

[59] NASA OIG, *Review of Coronavirus Aid, Relief, and Economic Security (CARES) Act Funding* (IG-21-024, August 9, 2021).

### Key Implemented Recommendations

Establish a process to be used during source evaluation boards and source selections that includes direct contact with the Center Earned Value Management Working Group Representative and cognizant Defense Contract Management Agency office to verify all contractor proposed information related to Earned Value Management (IG-20-015).

Provide information and training to contracting officers and source evaluation board members on the availability, use, and responsibilities of the Defense Contract Management Agency during source evaluation boards and source selections. Specifically, the NASA Federal Acquisition Regulation Supplement and NASA-Defense Contract Management Agency Memorandum of Understanding for Earned Value Management (IG-20-015).

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).

## Work That Needs to Be Done

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

Successful implementation of NASA enterprise-wide initiatives—such as the Mission Support Future Architecture Program—should provide more consistency in oversight and management of contracts, grants, and cooperative agreements, as well as sharing of lessons learned. However, as we have seen in past enterprise-wide initiatives, progress can be slow and halting due largely to the Agency's decentralized management structure, lack of insight into Agency-wide operations, and the limited authority of Headquarters officials 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. A recent recommendation made as part of our audit of NASA's acquisition workforce to link program and project managers to their contract assignments remains unresolved because the Office of Procurement lacks an existing source that contains this data. In our view, the ability to link contract assignments to acquisition workforce personnel is essential to the Office of Procurement's efforts to monitor and measure workforce performance and establish a baseline for operations at an enterprise level as part of the Agency's Mission Support Future Architecture Program.

NASA also needs to continue its work towards improving the timely closeout of contracts. In FY 2020, the Office of Procurement implemented several corrective action plans regarding timely closing out of contracts, especially the controls over the deobligation of any funds remaining on such contracts. The plans included establishing a Closeout Capability Group, Contract Closeout Guidebook, and a closeout repository to strengthen communication about closeout duties and store closeout documentation in a centralized location to expedite the closeout process. In November 2020, the Contract Closeout

Guidebook was incorporated into the NASA FAR Supplement. The Office of Procurement also continuously monitors closeout performance at each Center and collects quarterly and annual metrics for review.

Additionally, NASA needs to improve its oversight of the grants process to include strengthening documentation requirements and developing a process for tracking questioned costs. Moving forward, ensuring proper use of NASA's resources remains a top priority and Agency contracting personnel need to be proactive in their efforts to prevent fraud, waste, and abuse.

Finally, with regard to COVID-19 contracting challenges, Agency officials have reported as much as $89 million in potential Section 3610 reimbursements as of June 2021, and they expect that amount will increase as they receive additional requests from contractors. NASA officials said they intend to follow their established contracting practices for future pandemic-related adjustments, with contracting officers responsible for ensuring invoices and claims are in line with the contracts, advanced agreements, and NASA policies. Given the significant costs and efforts that will likely be associated with these adjustments, we plan to continue our oversight work in this area.

## Key Unimplemented Recommendations

Finalize and fully implement the performance metrics dashboard to measure acquisition performance (IG-21-002).

Document contract assignments to contracting officers, contracting officer's representatives, and program and project managers in a centralized system for inclusion in the performance metrics dashboard (IG-21-002).

In coordination with the NASA Shared Services Center, comply with the Federal Grant and Cooperative Agreements Act of 1977 on the proper use of grants and contracts to allow Center and Program personnel greater visibility into partner operations and to ensure that funding levels and performance are commensurate with requirements (IG-20-023).

### *Ongoing and Anticipated Future Audit Work*

The OIG's Offices of Audits and Investigations, in conjunction with our Advanced Data Analytics Program, will continue to assist NASA in strengthening its acquisition oversight efforts by examining Agency-wide procurement and grant-making processes.[60] These efforts will include assessing actions 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. Additionally, we plan a second round of contracts with several external entities to perform incurred cost audits of NASA contractors.

**Review of NASA's Management of the Johns Hopkins University Applied Physics Laboratory Portfolio**
This audit will assess NASA's processes and controls ensuring the effective management of the contracts and portfolio of Agency projects developed by the Johns Hopkins University Applied Physics Laboratory.

[60] Since 2015, our Advanced Data Analytics Program has provided analytic products to our audit and investigative teams that show indicators of and help identify potential contract, grant, and procurement fraud. We continue to use a variety of statistical and mathematical techniques to gather, analyze, and interpret Agency and open-source data to identify fraud indicators and help target OIG audit and investigative resources.

**Science Mission Directorate's Management of Research and Analysis Grants**
This audit will evaluate whether the Science Mission Directorate and NASA Shared Services Center have sufficient controls in place to adequately oversee its Research and Analysis grants.

# Challenge 6: Attracting and Retaining a Highly Skilled and Diverse Workforce

## Why This Is a Challenge

The success of NASA's missions, programs, and projects relies on the Agency attracting and retaining a highly skilled and diverse workforce with varied technical and management skills. As of May 2021, NASA had approximately 18,000 civil service employees working at its facilities nationwide, most in science and engineering fields. Our prior work has shown that NASA faces interrelated workforce challenges including not having enough employees with the right skills in technical areas; implementation shortfalls; an aging workforce; and Science, Technology, Engineering, and Mathematics (STEM) pipeline risks. Workforce challenges are not unique to NASA but are a government-wide concern. The U.S. Office of Personnel Management's 2018 Federal Workforce Priorities Report observed that human capital challenges appeared in at least 10 percent of 221 Inspectors' General management challenges and at least 25 percent of GAO's 32 High-Risk List areas.[61] In GAO's 2021 High-Risk List, federal strategic human capital management—a high risk since at least 2001—was downgraded from "met" to "partially met," with GAO noting that persistent mission-critical skills gaps within federal agencies reduce their effectiveness.[62]

NASA OIG and GAO have reported on multiple NASA projects—Low-Boom Flight Demonstrator, Europa Clipper, and Mars 2020 to name a few—that have experienced workforce challenges, including not having enough staff at the right times or staff with the right skills.[63] Last year we reported that NASA's engineering technical disciplines faced significant risks to their specialized workforces, with particular concern to the loss of unique skillsets from retiring employees before their knowledge could be passed on to others within the Agency. More recently, we reported on NASA's challenges to develop an agile and mission-driven acquisition workforce as it continues to implement an enterprise-wide approach to procurement under the Mission Support Future Architecture Program. Our audits have shown that despite establishing strategic frameworks for change, NASA has had limited success implementing these efforts to reorganize Agency-wide operations.[64] Furthermore, the Aerospace Safety Advisory Panel noted in its 2020 Annual Report that NASA was not addressing certain workforce issues at the strategic level, risking an "erosion of expertise and experience in the NASA workforce, thereby

[61] U.S. Office of Personnel Management, *2018 Federal Workforce Priorities Report* (February 2018).

[62] GAO-21-119SP.

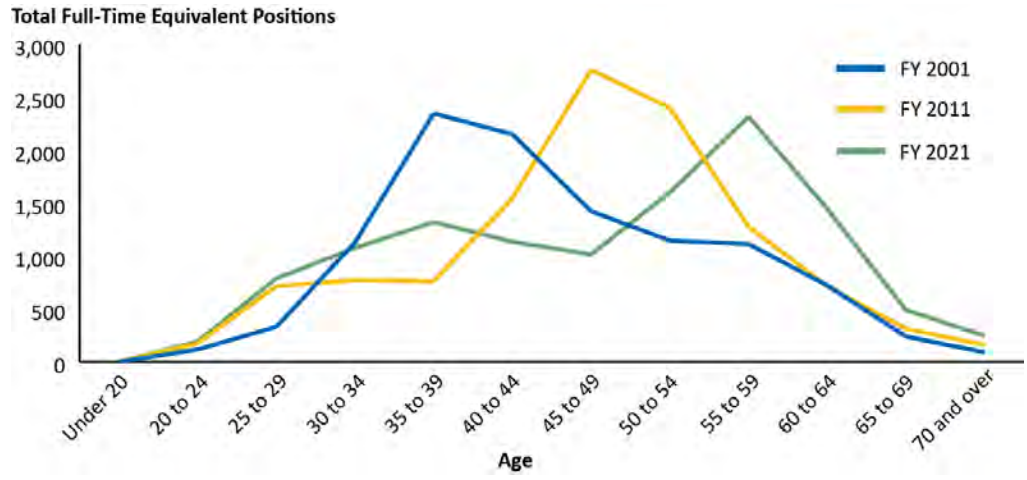
[63] NASA OIG, *Management of the Low-Boom Flight Demonstrator Project* (IG-20-015, May 6, 2020), *Management of NASA's Europa Mission* (IG-19-019, May 29, 2019), and *NASA's Mars 2020 Project* (IG-17-009, January 30, 2017). GAO, *NASA: Assessments of Major Projects* (GAO-18-280SP, May 1, 2018). The Europa Clipper plans to launch in October 2024 to Jupiter's moon Europa and over a 4-year period investigate whether conditions on the moon are potentially suitable for life. The Mars 2020 Perseverance Rover, which launched in July 2020 and landed in February 2021, seeks to better understand the geology of Mars, identify evidence of ancient life, collect Martian surface samples, and test new technologies.

[64] NASA OIG, *NASA's Planetary Science Portfolio* (IG-20-023, September 16, 2020) and IG-21-002.

undermining NASA's ability to effectively manage the highly complex risk problems of future exploration programs, including those envisioned for the Artemis campaign."[65]

Our prior top management and performance challenges reports have also highlighted that NASA's workforce age distribution should raise additional human capital concerns. Nearly 12,000 of NASA's 18,000 civil service employees (65 percent) fall under the occupation category "science and engineering"—the portion of the workforce that provides technical capabilities to enable space flight and science missions. Within this category, 6,000 are more than 50 years old, and of those employees approximately 3,000 are eligible to retire in 2021. These potential impending retirements, shown in Figure 5, could result in a significant loss of institutional knowledge and skills.

**Figure 5: Science and Engineering Workforce Trend**




Source: NASA OIG presentation of Agency workforce data.

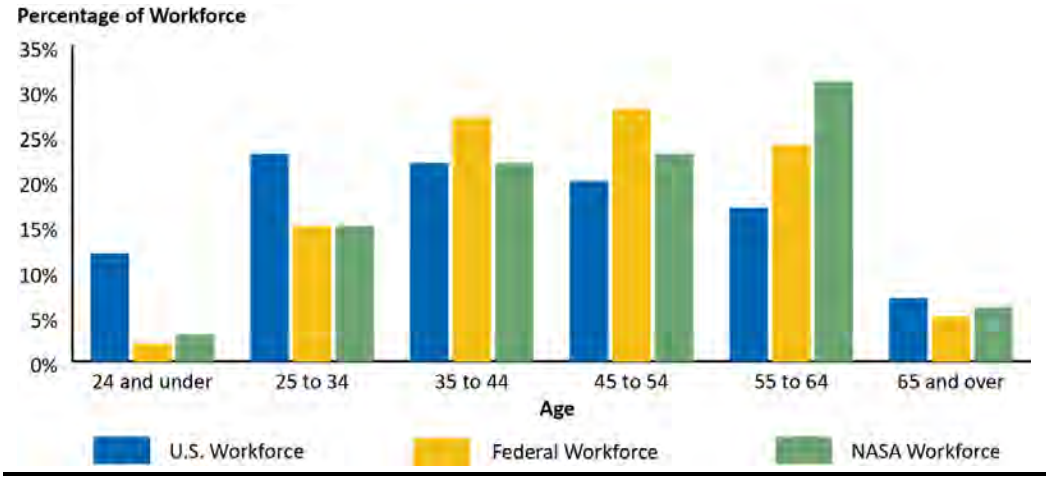
The Partnership for Public Service recently reported that agencies struggle with staffing shortages and report gaps in knowledge and skills. These issues are compounded by an aging federal workforce with a wave of retirements threatening to further stretch staffing capabilities as roughly one-third of employees onboard at the beginning of FY 2019 were eligible to retire by the end of FY 2023.[66] The Office of Personnel Management reported for June 2021 that there were six times more federal employees older than 50 than under 30 (44.1 percent compared to 6.9 percent).[67] It is noteworthy that NASA has a significantly larger percentage of its workforce in the 55 to 64 year age range than the federal average (see Figure 6).

[65] Aerospace Safety Advisory Panel, *Annual Report for 2020* (January 2020). The Panel evaluates NASA's safety performance, advises the Agency on ways to improve that performance, and reports to both NASA and Congress.

[66] Partnership for Public Service, *A Time for Talent—Improving Federal Recruiting and Hiring* (August 2020). Partnership for Public Service is a nonpartisan, nonprofit organization that works to make the government more effective and efficient.

[67] The Office of Personnel Management serves as the chief human resources agency and personnel policy manager for the federal government.

**Figure 6: Workforce Distribution by Age in May 2021**




Source: NASA OIG presentation of U.S. Department of Labor, Office of Personnel Management, and NASA data.

Additionally, as an agency highly dependent on skilled STEM workers to accomplish its mission, NASA remains at risk from a shortage of such staff. The U.S. Bureau of Labor Statistics reported the STEM labor market is highly segmented into different disciplines, sectors, and skill levels with varying degrees of supply and demand.[68] In 2018, the Executive Director of the American Institute of Aeronautics and Astronautics testified before Congress about a STEM worker shortage in the aerospace community.[69] The Institute also highlighted in its work the need to increase diversity and foster inclusion by encouraging women and underrepresented minorities to pursue careers in the aerospace industry and emphasized that STEM school curriculums should be aligned to current workforce needs.[70]

## Progress in Addressing the Challenge

For the past 9 years, NASA has been voted the best large agency to work for in the federal government and again held the top rank in 2020 according to the Partnership for Public Service.[71] NASA is attempting to cultivate a diverse and innovative workforce with the right balance of skills and experience to provide an inclusive work environment. Moreover, NASA added "inclusion" as an Agency core value in FY 2020.[72] To this end, NASA is rolling out at least two initiatives—"Agency Unity Campaign" for employees emphasizing mission success through increased collaboration, connection,

[68] Yi Xue and Richard C. Larson, U.S. Bureau of Labor Statistics, *Monthly Labor Review,* "STEM crisis or STEM surplus? Yes and yes" (May 2015).

[69] NASA's Cost and Schedule Overruns: Acquisitions and Program Management Challenges. Before the Subcommittee on Space, Committee on Science, Space, and Technology, 115th Congress (2018) (statement of Executive Director Daniel L. Dumbacher). The American Institute of Aeronautics and Astronautics' membership includes nearly 30,000 engineers and scientists from 88 countries involved in global aerospace.

[70] American Institute of Aeronautics and Astronautics, *A&D Workforce: Industry Overview, Industry Challenges, and Industry Needs* (February 2021).

[71] The Partnership for Public Service's results were calculated based on responses to the Office of Personnel Management's annual Federal Employee Viewpoint Survey.

[72] NASA core values are safety, integrity, teamwork, excellence, and inclusion.

and communication, and "Mission Equity," a comprehensive effort to assess expansion and modification of NASA programs, procurements, grants, and policies, and examine potential barriers and challenges for communities that are historically underrepresented and underserved.

Furthering its efforts to strategically hire staff with the right skills, NASA's Office of the Chief Human Capital Officer (OCHCO) is undertaking activities to better align the Agency's workforce to its current and future missions. This includes aligning specific OCHCO goals to NASA's strategic objectives. Other initiatives include implementing a flexible and agile workforce approach through the Strategic Workforce Plan and replacing NASA's aging talent acquisition system with one that will enable the Agency to more strategically hire, develop, and manage its workforce. OCHCO has also made efforts to reduce the hiring cycle time, leverage special hiring authorities, clear the hiring backlog from prior years, and work with Centers and Mission Directorates to develop plans to lessen the impact of a future retirement wave.

As the Agency plans to improve the pipeline of candidates to fill current and future open positions, it is making efforts to attract and retain underserved and underrepresented students in engineering and other STEM fields in partnership with minority serving and other higher education institutions. One important change from previous years is that in its FY 2022 budget request NASA did not recommend eliminating its Office of STEM Engagement funding. Instead, the Agency requested $147 million for FY 2022 after receiving $127 million from Congress in FY 2021. The Minority University Research and Education Project, which is administered through NASA's Office of STEM Engagement and provides financial assistance via competitive awards to minority serving institutions, is seeing the largest increase, with $10 million more requested for 2022 over what it received in 2021. Further, NASA is integrating metrics and using data to inform decisions on how to better reach the public, engage stakeholders, and evaluate outcomes. Critically, the STEM Engagement strategy is designed to enable relevant student contributions to NASA's mission and work.

### Key Implemented Recommendations

Develop procedures for periodic communication of the available hiring authorities (IG-20-023).

Evaluate current and future critical technical staffing requirements by project over the next 5 years (IG-19-019).

Create standardized guidance for performing annual capability assessments that considers, at a minimum, the appropriate time and resources for performing the assessments and the required data, analyses, and expected goals or results (IG-17-015).

## Work That Needs to Be Done

To maintain a world-class workforce, NASA must fill current critical workforce gaps and prepare for those on the horizon by planning how to mitigate a forthcoming wave of retirements. Furthermore, the ability to successfully address that risk will require the Agency to have detailed visibility into workforce skill types—data that the Agency currently does not collect. The Center for Space Policy and Strategy recently emphasized the need for agencies to use data to measure their success in investing in their STEM workforce, stating "there should be a continuous evaluation of what works and what does not

work."[73] Having the right data will also help NASA meet the Succession Planning and Knowledge Transfer priority outlined in the 2018 Federal Workforce Priorities Report, which notes that agencies should maintain "a multi-faceted succession plan that is designed to capture the valuable knowledge and insights of current employees, convey captured knowledge to new and retained employees, and create and utilize a multi-generational pipeline."

NASA management knows it will need a significant number of well-trained engineers, scientists, statisticians, accountants, human resources and procurement professionals, IT developers, and support specialists into the next decade. They must continue to work to ensure that their ongoing investments develop a continuous stream of candidates with the passion and skills to study the Earth, the Sun, and solar system; conduct aeronautics research, testing, and development; and lead crewed and uncrewed space exploration efforts. Looking forward to a post-pandemic environment, NASA will need to confront head-on the challenges and opportunities in managing a workforce using much greater telework and remote work flexibilities.

## Key Unimplemented Recommendations

Finalize and fully implement the performance metrics dashboard to measure acquisition performance (IG-21-002).

Engage relevant Centers and technical capability leaders to identify budgetary and accounting system solutions within the current budgetary and full cost accounting system to adequately fund and sustain critical technical discipline capabilities needed to support current and future projects (IG-20-023).

Review and identify opportunities based on existing NASA leading practices to foster and monitor mentoring to ensure a robust pipeline for Planetary Science Division-related disciplines (IG-20-023).

### *Ongoing and Anticipated Future Audit Work*

We will continue to monitor progress on the Agency's workforce master plan and examine specific workforce issues as part of broader OIG audits and reviews.

**Review of Astrophysics Portfolio**
This audit will evaluate the current state of the Agency's Astrophysics portfolio, identify and assess risks to future missions, and provide recommendations in support of the next decadal survey.

**NASA's Management of Its Astronaut Corps**
This audit will assess to what extent NASA's processes for sizing, training, and assigning its astronaut corps align with the Agency's current and future mission needs.

**NASA's Diversity, Equity, Inclusion, and Accessibility Efforts**
This audit will evaluate NASA's efforts to advance diversity, equity, inclusion, and accessibility throughout the Agency.

[73] The Center for Space Policy and Strategy provides nonpartisan research and strategic analysis in support of the development of well-informed, technically defensible, and forward-looking space and technology policy. The Center is part of The Aerospace Corporation, a nonprofit organization that advises the government on complex space enterprise and systems engineering problems. Colleen Stover, *Developing Future Space Workers: Leadership Needed Today* (April 2021).

# Challenge 7: Managing NASA's Outdated Infrastructure and Facilities

## Why This Is a Challenge

Over the past 60 years, NASA and its commercial partners have relied on the Agency's facilities and infrastructure, including laboratories, launch complexes, test stands, and wind tunnels, to develop new and innovative technologies to advance space exploration missions, scientific research, and aeronautics. NASA is one of the largest property holders in the federal government with $40 billion in physical assets and an inventory of more than 5,000 buildings and structures across 12 states and at its headquarters in Washington, D.C. However, over 75 percent of its facilities are beyond their original design life and require a significant investment in maintenance, including 166 abandoned properties worth $291 million that present a safety and maintenance liability due to their structural or interior deficiencies. To achieve its current exploration and research goals, the Agency needs to be smart about what facilities to invest, divest, or consolidate and maintain in a safe condition.

While it strives to keep its facilities operational, NASA faces a deferred maintenance backlog estimated at $2.8 billion as of 2021, which has resulted in unscheduled maintenance costing up to three times more to repair or replace equipment after it has failed than if NASA conducted regular scheduled maintenance. Further compounding this issue, in March 2020 the Agency implemented its emergency pandemic response plan that closed facilities across the country except those necessary to protect critical infrastructure and ongoing missions. Consequently, NASA was forced to scale back work on construction and maintenance projects, resulting in increased costs and schedule delays. In a September 2021 audit, we found that 101 construction projects across the Agency reported nearly $11 million in contractor requests for equitable adjustment, and facility closures delayed project schedules by 5 months on average.[74]

For facilities the Agency is not currently utilizing but may need to meet future mission needs, NASA has several options. The Agency may retain the property in its present state, demolish the property, transfer the property to the General Services Administration for sale, or make the property available for lease. Leasing has several benefits including generating revenue that the Agency can use to help reduce expenses and defray the costs of maintaining and improving facilities. In addition, leasing enables NASA to keep facilities in its inventory that although may be underutilized currently, may be needed for future projects. The challenge is ensuring that leasing does not replace disposing of property that is no longer needed now or in the foreseeable future.

In addition, we found in a December 2020 audit that hazardous materials pose a safety risk to NASA installations. Hazardous materials are used on a daily basis, including acids, bases, and oxidizers in research laboratories; propellants and fuels in engine testing; ethanol-based solvents in engineering laboratories; ammonia, acetone, and glycols in flight equipment operations; and chemicals in simulated

[74] NASA OIG, *NASA's Construction of Facilities* (IG-21-027, September 8, 2021). A contractor may submit a request for equitable adjustment to the government for payment when unforeseen or unintended changes occur within the contract causing an increase in contract costs such as government modification of the contract, differing site conditions, defective or late-delivered government property, or issuance of a stop work order.

planetary environmental testing. These materials can be toxic, reactive, flammable, or explosive and, if poorly managed, can result in costly cleanup efforts, damage to facilities and equipment, personal injury, and loss of mission capabilities. Our review found that hazardous materials are not managed uniformly across NASA and the Agency lacks adequate internal controls for managing its hazardous materials inventory.[75]

Overall, NASA remains challenged to make the difficult decisions to invest, divest, or consolidate unneeded infrastructure; effectively communicate those decisions to stakeholders; and withstand the inevitable political pressure to retain unnecessary capabilities and facilities at Centers throughout the country—all long-standing issues that we have discussed in previous top management and performance challenges reports. These decisions will become even more essential following the COVID-19 pandemic, which has resulted in widespread telework and highlighted issues about the number and size of facilities the Agency will need in the future.

## Progress in Addressing the Challenge


Aerial View of Launch Complex 39B with Exploration Ground Systems' Mobile Launcher for Artemis I on the Pad

Source: NASA.

One key goal of NASA's Construction of Facilities (CoF) program is to modernize the Agency's infrastructure into fewer, more sustainable facilities and repair failing infrastructure to reduce overall maintenance costs. Between FYs 2016 and 2020, NASA received nearly $1.8 billion in CoF funding that has resulted in an increasing number of projects to construct and facilities to upgrade. For example, the Exploration Ground Systems Program at Kennedy Space Center is upgrading infrastructure and facilities required for the Artemis program, including modernization of Launch Pad 39B and modification of the Vehicle Assembly Building to accommodate the SLS rocket and Orion capsule. Langley Research Center utilized a large portion of its CoF funds to construct the Measurement Systems Laboratory, a 175,000 square foot facility for research and development of new measurement concepts, technologies, and systems. In addition, the Center plans to begin construction on its Flight Dynamics Research Facility, a wind tunnel the Center will utilize for enhanced vertical spin testing of aircraft and spacecraft. The Jet Propulsion Laboratory continued construction on an array of antennas known as the Deep Space Network and also began construction of a 5-story, 85,000 square foot laboratory known as the Flight Electronics Integration Facility that will support spacecraft avionics and electronic hardware fabrication and testing. Glenn Research Center constructed a 64,000 square foot multi-use office building known as the Research Support Building along with a 55,000 square foot Aerospace Communications Facility that will be utilized for radio frequency communications technology research and development. Other significant projects included construction of a 41,000 square foot facility at Ames Research Center known as the Biosciences Collaborative Facility that houses laboratories for space biology, astrobiology, and synthetic biology and construction of the Goddard Space Flight Center's Instrument Development Facility, a 54,200 square foot multi-story laboratory and office facility.

[75] NASA OIG, *NASA's Management of Hazardous Materials* (IG-21-006, December 3, 2020).

In relation to hazardous materials, NASA is updating policies and procedures to designate appropriate officials to approve hazardous materials purchases, track and report hazardous material inventories, and inspect and evaluate storage sites.

### Key Implemented Recommendations

Establish a unified purchase card policy and designate an appropriate official at each Center to ensure hazardous material acquisitions made via purchase cards are appropriately approved, received, and tracked (IG-21-006).

Inspect and evaluate Centers' 90-day storage facilities and processes and make improvements as warranted (IG-21-006).

## Work That Needs to Be Done

Over the past few years, 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 "rightsize" NASA's workforce, facilities, and other supporting assets; construction of new assets such as test stands; NASA's efforts to reduce unneeded infrastructure and facilities; and the process to select, prioritize, and fund CoF projects. Common themes from these reviews are NASA's slow implementation of corrective actions, inconsistent implementation of Agency policies, the need for stronger life-cycle cost considerations in facility construction decisions, and a decentralized strategy and decision-making process.

For example, in September 2021 we reported that NASA's process for selecting and prioritizing CoF projects is largely driven by Centers regardless of Agency goals, mission needs, or economic efficiencies.[76] Further, at the time NASA lacked an Agency-wide facility master plan that considered consolidation of activities between Centers. Instead, the Agency has relied primarily on Center-based planning and may not be constructing the highest priority projects to meet future mission needs while diluting funds needed for repairs. We also reported that CoF projects incurred significant cost overruns ranging from $2.2 million to $36.6 million and took longer to complete than initially planned with projects running 3 months to more than 3 years behind schedule.

In December 2020 we reported that hazardous materials were not managed uniformly across the Agency, the Centers we visited did not consistently implement adequate controls, and employees and contractors at times circumvented existing controls to acquire hazardous materials.[77] Also, some storage facilities were in need of improvements and repairs, and one hazardous waste facility required physical improvements. As a result, NASA has accepted increased risks associated with the acquisition of hazardous materials that could result in personal injury or property and environmental damage.

[76] IG-21-027.

[77] IG-21-006.

## Key Unimplemented Recommendations

Develop and institute an Agency-wide process to prioritize and fund institutional and programmatic CoF projects that align with Agency-level missions and require business case analyses to be completed and considered as part of the process prior to the projects' approval (IG-21-027).

Reexamine policies regarding oversight of the CoF program to identify alternative approaches to more effectively oversee the program (IG-21-027).

Require Center Directors to inspect and replace, as required, laboratory hazardous material storage structures and improve shelters that do not follow Centers for Disease Control and Prevention guidelines or comply with Agency requirements (IG-21-006).

### *Ongoing and Anticipated Future Audit Work*

**Audit of Ames Research Center's Lease Management Practices**
This audit will examine Ames Research Center's implementation and management of its lease agreements.

**NASA's Efforts to Upgrade Its Space Communications Infrastructure**
This audit will assess NASA's progress towards upgrading the Agency's Space Network and Deep Space Network and the ability of the networks to support current and future mission requirements.

# Challenge 8: Managing the Impacts of COVID-19 on NASA's Mission and Workforce

## Why This Is a Challenge

Since March 2020, NASA and the entire federal workforce has faced unprecedented challenges due to the COVID-19 pandemic. In an effort to protect public health and safety, many businesses and government agencies—including NASA—changed the way they operate to restrict physical access to facilities, resulting in disruptions to the Agency's tens of thousands of civilian and contractor employees, materials, and supply chain that have increased costs, delayed launch readiness dates, and impacted operational activities.

During the first 6 months of the pandemic, we found that 56 of NASA's programs and projects were impacted and could potentially incur a total lifetime cost growth of $3 billion.[78] In addition, we estimated that the pandemic would continue to affect 35 programs and projects into FY 2022 and beyond. As of July 2021, the top-line estimate of the total lifetime cost for these delays and challenges decreased to approximately $2.75 billion. After more than 19 months in a mandatory telework mode for the bulk of its workforce, NASA continues to face similar challenges as it did during the onset of the pandemic, such as an inability to conduct on-site activities, workforce startup inefficiencies, and delivery delays of government furnished equipment. For example, the estimated cost impact to the Nancy Grace Roman Space Telescope for FY 2021 and beyond increased from $400 million in October 2020 to $502 million in April 2021 due to continued loss of efficiency, reduced availability of supply chain vendors, and limited on-site work access at Goddard Space Flight Center and the Jet Propulsion Laboratory.[79]

Illustration of Nancy Grace Roman Space Telescope

Source: NASA.

In addition, the dramatic shift in NASA's operations during which the Agency closed 12 of its 18 major facilities and required 90 percent of its workforce to work from home for an extended period of time has raised fundamental questions about how the workforce will "return to on-site work" after it is deemed safe to do so. As of September 2021, over 85 percent of NASA's workforce was still teleworking full-time, and many will continue to work from home until further guidance from the Centers for Disease Control and Prevention and Office of Management and Budget advise otherwise. Also, in September 2021 the Administration released a pair of Executive Orders requiring COVID-19 vaccinations

[78] NASA OIG, *COVID-19 Impacts on NASA's Major Programs and Projects* (IG-21-016, March 31, 2021).

[79] Scheduled to launch no earlier than 2026, the Nancy Grace Roman Space Telescope (formerly known as the Wide Field Infrared Survey Telescope) is a NASA observatory designed to study dark energy and dark matter, search for and image exoplanets, and explore topics in infrared astrophysics.

for federal employees and contractors.[80] While last year we discussed the effects of COVID-19 in each of the top management and performance challenges sections of this report, this year we added it as a stand-alone challenge because it is clear that the impact of the pandemic on NASA's operations will cost billions of dollars, lead to significant schedule delays in multiple projects, and affect how the Agency conducts business for years to come.

## Progress in Addressing the Challenge

Despite the ongoing challenges NASA continues to face due to COVID-19, the Agency has demonstrated flexibility and adaptability in its operations. The Office of the Chief Financial Officer began categorizing and tracking COVID-19's impact on NASA programs and projects beginning in April 2020. Officials from NASA's Mission Support Directorate as well as the Agency's four Mission Directorates—Aeronautics Research, Human Exploration and Operations, Science, and Space Technology—provided the Office of the Chief Financial Officer monthly updates initially (and quarterly updates starting in October 2020) highlighting issues and impact levels. This regular communication across the organization allowed the Agency to be responsive and agile in order to continue critical operations.

Work on NASA programs and projects in formulation and development continues, as do operations on other missions. For example, in addition to maintaining ISS operations, NASA successfully launched the first astronauts on a Commercial Crew Program mission to the ISS, launched and landed the Mars 2020 Perseverance Rover on the Red Planet, and launched the Sentinel-6 Michael Freilich spacecraft.[81] To accommodate new work-life dynamics resulting from COVID-19, NASA successfully expanded its telework capabilities and continued software development remotely. In addition, NASA used about 35 percent of its $60 million CARES Act appropriation to pay for contractor leave authorized under Section 3610. Our August 2021 review of the Agency's CARES Act spending found that NASA appropriately managed these funds to meet congressional mandates as well as Agency and federal guidance.[82]

### Key Implemented Recommendations

There are no key implemented recommendations related to COVID-19.

## Work That Needs to Be Done

Since uncertainties surrounding the pandemic likely will remain well into 2022, NASA must continue to address and anticipate impacts to its programs, projects, and workforce. Agency managers will need to continuously monitor workforce and supply chain readiness, and update program and project cost and schedule estimates. While NASA will be unable to quantify the complete impact of the pandemic until

[80] Requiring Coronavirus Disease 2019 Vaccination for Federal Employees, Exec. Order No. 14043, 86 Fed. Reg. 175 (September 9, 2021) and Ensuring Adequate COVID Safety Protocols for Federal Contractors, Exec. Order No. 14042, 86 Fed. Reg. 175 (September 9, 2021).

[81] The Sentinel-6 Michael Freilich spacecraft launched in November 2020 to collect data on global sea level, atmospheric temperature and humidity, and how oceans are rising in response to climate change.

[82] IG-21-024.

after the COVID-19 emergency has subsided, the Agency has established a long-term baseline for normal operations. Looking forward, the Agency faces new challenges in implementing a far-reaching return-to-onsite-work plan for large swaths of its workforce that likely will embrace significantly expanded telework and remote work flexibilities. We plan to continue monitoring the impact of COVID-19 on NASA's programs and projects as well as NASA's return to on-site work efforts.

## Key Unimplemented Recommendations

There are no key unimplemented recommendations related to COVID-19.

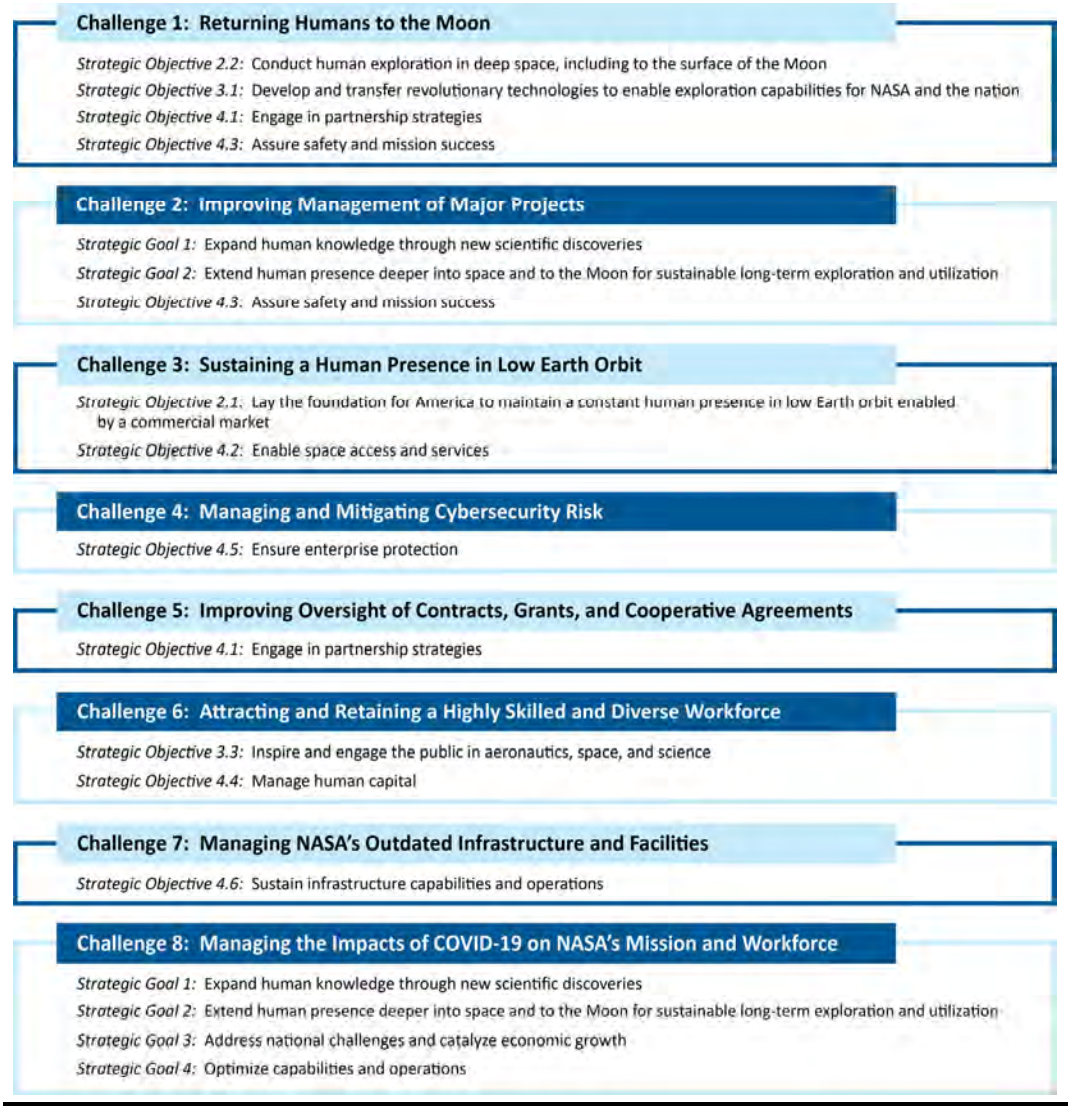
### *Ongoing and Anticipated Future Audit Work*

We will continue to monitor COVID-19 impacts as part of a series of broader OIG audits and reviews. Also, when appropriate, we will conduct a review of NASA's return-to-work efforts.

# APPENDIX A: STRATEGIC GOALS AND OBJECTIVES

The figure below shows the eight challenges we identified for 2021 and the related NASA strategic goals and objectives.

**Figure 7: 2021 Top Management and Performance Challenges Linked to NASA Strategic Goals and Objectives**




Source: NASA OIG analysis of the Agency's 2018 Strategic Plan.

# APPENDIX B: ACRONYMS

| | |
|---|---|
| A&A | assessment and authorization |
| CARES Act | Coronavirus Aid, Relief, and Economic Security Act |
| CASIS | Center for the Advancement of Science in Space, Inc. |
| CoF | Construction of Facilities |
| COVID-19 | Coronavirus Disease 2019 |
| ESD | Exploration Systems Development |
| FISMA | Federal Information Security Modernization Act of 2014 |
| FITARA | Federal Information Technology Acquisition Reform Act |
| FY | fiscal year |
| GAO | Government Accountability Office |
| HLS | Human Landing System |
| ISRO | Indian Space Research Organisation |
| ISS | International Space Station |
| IT | information technology |
| JWST | James Webb Space Telescope |
| LBFD | Low-Boom Flight Demonstrator |
| LCRD | Laser Communications Relay Demonstration |
| NISAR | NASA-ISRO Synthetic Aperture Radar |
| OCHCO | Office of the Chief Human Capital Officer |
| OCIO | Office of the Chief Information Officer |
| OIG | Office of Inspector General |
| SBIR | Small Business Innovation Research |
| SLS | Space Launch System |
| STEM | Science, Technology, Engineering, and Mathematics |
| SWOT | Surface Water and Ocean Topography |
| VIPER | Volatiles Investigating Polar Exploration Rover |
| VPN | Virtual Private Network |

# APPENDIX C: RELEVANT OIG REPORTS

## Returning Humans to the Moon

*NASA's Strategy for the Artemis Missions* (IG-22-003, November 15, 2021)

*NASA's Development of Next-Generation Spacesuits* (IG-21-025, August 10, 2021)

*Artemis Status Update* (IG-21-018, April 19, 2021)

*NASA's Management of the Gateway Program for Artemis Missions* (IG-21-004, November 10, 2020)

*NASA's Management of the Orion Multi-Purpose Crew Vehicle Program* (IG-20-018, July 16, 2020)

*Audit of NASA's Development of Its Mobile Launchers* (IG-20-013, March 17, 2020)

*NASA's Management of Space Launch System Program Costs and Contracts* (IG-20-012, March 10, 2020)

*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

*Artemis Status Update* (IG-21-018, April 19, 2021)

*COVID-19 Impacts on NASA's Major Programs and Projects* (IG-21-016, March 31, 2021)

*NASA's Management of the Gateway Program for Artemis Missions* (IG-21-004, November 10, 2020)

*NASA's Planetary Science Portfolio* (IG-20-023, September 16, 2020)

*NASA's Management of the Stratospheric Observatory for Infrared Astronomy Program* (IG-20-022, September 14, 2020)

*NASA's Management of the Orion Multi-Purpose Crew Vehicle Program* (IG-20-018, July 16, 2020)

*Management of the Low-Boom Flight Demonstrator Project* (IG-20-015, May 6, 2020)

*NASA's Management of Space Launch System Program Costs and Contracts* (IG-20-012, March 10, 2020)

*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)

Appendix C

## Sustaining a Human Presence in Low Earth Orbit

*NASA's Efforts to Mitigate the Risks Posed by Orbital Debris* (IG-21-011, January 27, 2021)

*NASA's Management of Crew Transportation to the International Space Station* (IG-20-005, November 14, 2019)

*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)

## Managing and Mitigating Cybersecurity Risk

*Evaluation of NASA's Information Security Program under the Federal Information Security Modernization Act for Fiscal Year 2021* (ML-22-001, November 9, 2021)

*NASA's Cybersecurity Readiness* (IG-21-019, May 18, 2021)

*Fiscal Year 2020 Federal Information Security Modernization Act Evaluation—A Contractor-Operated Communications System* (IG-21-015, March 24, 2021)

*Fiscal Year 2020 Federal Information Security Modernization Act Evaluation—A Center Command and Control System* (IG-21-014, March 2, 2021)

*Fiscal Year 2020 Federal Information Security Modernization Act Evaluation—A Center Communications System* (IG-21-013, February 16, 2021)

*Fiscal Year 2020 Federal Information Security Modernization Act Evaluation—An Agency Common System* (IG-21-010, December 22, 2020)

*Audit of NASA's Fiscal Year 2020 Financial Statements* (IG-21-005, November 16, 2020)

Cybersecurity at NASA: Ongoing Challenges and Emerging Issues for Increased Telework during COVID-19. Before the House of Representatives Subcommittee on Space and Aeronautics, Committee on Science, Space, and Technology, 116th Congress (2020) (statement of NASA Inspector General Paul Martin)

*Audit of NASA's Policy and Practices Regarding the Use of Non-Agency Information Technology Devices* (IG-20-021, August 27, 2020)

*Evaluation of NASA's Information Security Program under the Federal Information Security Modernization Act for Fiscal Year 2019* (IG-20-017, June 25, 2020)

*NASA's Management of Distributed Active Archive Centers* (IG-20-011, March 3, 2020)

*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)

*Industrial Control System Security within NASA's Critical and Supporting Infrastructure* (IG 17-011, February 8, 2017)

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

*Review of Coronavirus Aid, Relief, and Economic Security (CARES) Act Funding* (IG-21-024, August 9, 2021)

*NASA's Management of Universities Space Research Association's Cooperative Agreements* (IG-21-022, July 14, 2021)

*Fiscal Year 2020 Financial Accounting Management Letter*, Prepared by CliftonLarsonAllen LLP (IG-21-008, December 14, 2020)

*NASA's Management of Its Acquisition Workforce* (IG-21-002, October 27, 2020)

*NASA's Management of the Stratospheric Observatory for Infrared Astronomy Program* (IG-20-022, September 14, 2020)

*Management of the Low-Boom Flight Demonstrator Project* (IG-20-015, May 6, 2020)

*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)

## Attracting and Retaining a Highly Skilled and Diverse Workforce

*NASA's Management of Its Acquisition Workforce* (IG-21-002, October 27, 2020)

*NASA's Planetary Science Portfolio* (IG-20-023, September 16, 2020)

*Management of the Low-Boom Flight Demonstrator Project* (IG-20-015, May 6, 2020)

*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)

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

## Managing NASA's Outdated Infrastructure and Facilities

*NASA's Construction of Facilities* (IG-21-027, September 8, 2021)

*NASA's Management of Hazardous Materials* (IG-21-006, December 3, 2020)

*Audit of NASA's Development of Its Mobile Launchers* (IG-20-013, March 17, 2020)

*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)

## Managing the Impacts of COVID-19 on NASA's Mission and Workforce

*Review of Coronavirus Aid, Relief, and Economic Security (CARES) Act Funding* (IG-21-024, August 9, 2021)

*COVID-19 Impacts on NASA's Major Programs and Projects* (IG-21-016, March 31, 2021)

# AGENCY RESPONSE TO OIG REPORT ON NASA'S TOP MANAGEMENT AND PERFORMANCE CHALLENGES

National Aeronautics and
Space Administration
Office of the Administrator
Mary W. Jackson NASA Headquarters
Washington, DC 20546-0001

November 9, 2021

TO: Inspector General

FROM: Administrator

SUBJECT: Agency Response to Office of Inspector General Report, "2021 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, "2021 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, NASA continues to aggressively pursue the mitigation and remediation of findings related to the audit recommendations issued by your office, including those that underpin your observations as cited in your 2021 Report on NASA's Top Management and Performance Challenges.

While NASA fundamentally agrees that the eight areas outlined in your 2021 report constitute significant challenges for the Agency, this response highlights the following mitigation and remediation efforts relative to each challenge outlined in your report that have either been taken or are currently under way. These efforts substantively demonstrate NASA's commitment to addressing its most significant management and performance challenges faced by the Agency:

**Challenge 1: Returning Humans to the Moon by 2024**

NASA agrees that landing the first woman and the first person of color on the Moon by 2024 is a significant challenge, but the Agency is still trying to develop this capability in a timely manner to ensure the safety of the crew and meet Artemis objectives. Despite challenges associated with the COVID-19 virus, an extended delay due to the Human Landing System (HLS) protest, and multiple storms severely affecting NASA facilities and workforce, NASA continues to make substantial progress towards the launch of Artemis missions.

NASA continues its preparation for Artemis I, which will be the first test flight of the launch vehicle that will carry astronauts into space for the lunar missions. Simultaneously, the

Agency has met numerous technical and programmatic milestones for Artemis II, which will be the first crewed mission in the Artemis sequence. After the successful completion of the Hot Fire test on the Space Launch System (SLS) Core Stage (CS) in March 2021, during which all four RS-25 engines were ignited to produce 1.6 million pounds of thrust, the CS was transported to Kennedy Space Center for final integration and testing activities. CS mating to the Mobile Launcher (ML) and Solid Rocket Boosters started on June 9, 2021. Since then, most of the remaining major hardware has been integrated in the Vehicle Assembly Building and the full system has been powered up. The Umbilical Release and Retract Test, which validated the ways by which connections between the rocket and the ML will disengage at lift-off, was completed in September 2021. After the Orion Crew Vehicle is stacked, only four key milestone tests−the Integrated Vehicle Interface Verification Test, the Communications End-to-End Test, the Countdown Sequence Test, and the Wet Dress Rehearsal−will stand before the Artemis I launch.

NASA has also made tremendous progress toward the Artemis II launch and forward development for Artemis III missions and beyond. The arrival of the Artemis II European Service Module in October 2021, now positions the Orion program to mate Service and Crew Modules together and complete qualification and testing before delivery to Kennedy Space Center. Work on Core Stages Two, Three, and Four has continued in spite of serious damage to the Michoud Assembly Facility caused by Hurricane Ida. Development on the SLS Block 1B variant and the Mobile Launcher 2 has continued in preparation for a recurring cadence of missions with increasingly complex needs.

While progress and schedules have been impacted due to contract award protests and ongoing litigation, NASA continues to make progress with the HLS program. NASA has awarded a contract for a design, development, and demonstration of a lunar lander which will deliver the first crew to the lunar surface on the Artemis III mission. HLS has also accelerated the HLS services acquisition approach, and in a standalone procurement (Broad Agency Announcement Appendix N), HLS has selected five companies to perform risk reduction activities to advance the industry's proposed content for lunar landing services.

The Gateway Program continues to make significant progress with the completion of Gateway Key Decision Point (KDP)-0. The Program has transitioned focus to the preliminary design and contractual updates across the Program. Element-level Preliminary Design Reviews (PDRs) are nearing completion, and a Program-level PDR-informed sync review is scheduled to occur in the first half of FY 2022. Contracts have been finalized for Gateway's Habitation and Logistics Outpost (HALO), to include Power and Propulsion Element (PPE) integration and launch. Updates to PPE contracts have been made to synchronize requirements. NASA has developed a strategy for competitive procurement of EVA (Extra-Vehicular Activity) suits with the release of the xEVAS (Exploration Extravehicular Services) Request for Proposal (RFP) in September 2021. Meanwhile, NASA has completed in-house builds of xEMU (Exploration Extravehicular Mobility Unit) Development Verification Test (DVT) systems, and the test reports will be used by future partners to reduce development risk.

NASA has also implemented a number of the OIG's key recommendations to improve cost, schedule, and technical performance and is working to complete implementation of the remaining open OIG recommendations.

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

NASA sees program management excellence as a core capability, critical for enabling its bold mission of exploration and discovery. NASA's program management discipline includes rigorous processes, encompassing program formulation, approval, implementation, and evaluation. NASA also has guidelines for bringing together the people, resources, and processes necessary to execute the Agency's most challenging and complex programs.

NASA maintains an unwavering commitment to the continued growth of its program and project management disciplines. For example, NASA is focused on improving program planning and control, while increasing transparency for the Agency's external stakeholders. NASA leadership continues to evaluate the considerable progress made to date implementing the initiatives contained in the Agency's High-Risk Corrective Action Plan (CAP). In July 2020, NASA leadership determined that seven of nine CAP initiatives had been fully completed, including the creation of a technology readiness assessment best practices document, an update to the Agency's probabilistic programmatic policy (i.e., Joint Confidence Level (JCL)), and increased transparency by inclusion of original Agency Baseline Commitments in external reporting for re-baselined projects, among other initiatives.

NASA leadership also added four initiatives to a renewed CAP in July 2020. New initiatives under way include a full implementation of a Schedule Repository, an Exploration Systems Development Mission Directorate (ESDMD)/Space Operations Missions Directorate (SOMD) Exploration Systems Development (ESD)/Advanced Exploration Systems(AES) cost and schedule transparency effort, enhancements to the Cost *Analysis Data* Requirement (CADRe) data collection for Category 3 Class D projects, and the adoption of a risk assessment and financial evaluation of contractors' activity. The 2020 CAP is accessible via the NASA Reports and Transcripts Web page[1]. NASA's progress on and renewal of the CAP is evidence that the Agency is committed to pursuing the most critical changes to increase transparency, improve cost and schedule estimation, and maintain focus on accountability. Several of these changes can be found in the Agency's most recent revision to its formal Space Flight Program and Project Management Requirements document (NPR 7120.5F), which was released in August 2021.

NASA also continues to make substantial progress in the implementation of the Program Management Improvement and Accountability Act (PMIAA). As part of PMIAA implementation, the Agency appointed a Program Management Improvement Officer (PMIO) within the Office of the NASA Associate Administrator (AA). The PMIO has convened an Agency stakeholder team to lead the implementation of PMIAA and has conducted three rounds of annual NASA portfolio reviews focused on the identification,

[1] https://www.nasa.gov/sites/default/files/atoms/files/nasa_high_risk_corrective_action_plan_2020.pdf

capture, and improvement of Project Management (PM) practices. Practices that have been addressed include improvements to schedule analyses, improvements to life-cycle reviews, and furthering implementation of tailoring approaches. The NASA PMIO is also implementing a program management integration function on behalf of the NASA AA with support from the Office of the Chief Financial Officer (OCFO), the Office of the Chief Engineer (OCE), and in partnership with the Mission Directorates and field Centers. This integration will promote overall synergy and integration of PM practices and capabilities across the Agency to further enhance PM performance and mission success.

NASA's missions will tackle activities that have never been done before, incorporating the leading edge of technology, as the Agency pursues the challenging goals that can only be accomplished in the hostile environment of space. This requires NASA to develop one-of-a-kind spacecraft and new technologies. The Agency cannot do this without taking on considerable risks. While doing so, NASA aggressively works to understand and manage those risks, while also communicating them to the Agency's stakeholders. One of the key ways the Agency attempts to manage expectations with external stakeholders is by waiting until KDP-C to make cost and schedule commitments. Only by KDP-C are technical designs and risk assessments mature enough to make these important commitments. Two of the cost growth examples cited by the OIG (the Europa Clipper and the Nancy Grace Roman Space Telescope) are measured against early estimates of cost instead of cost commitments. The Science Mission Directorate (SMD) has made substantial investment in pre-formulation mission studies and technology development in order to address some of the concerns identified by the OIG and continues to study large missions to identify best practices for future flagships[2]. Moreover, Independent Review Boards are being formed prior to KDP-B to identify cost risks and reduce "requirement creep," leading to improved early cost estimation. When cost performance is assessed against KDP-C baselines established since the implementation of the 70 percent JCL requirement, major SMD missions have, on average, cost two percent less than the NASA commitment. Due to the nature of NASA's mission, some projects will exceed cost or schedule commitments; however, by adopting the 70 percent JCL methodology, NASA is able to effectively manage the overall portfolio, including the occasional large overruns. Agency 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, thus, cannot encourage innovation and discovery without accepting some risk and some uncertainty.

NASA has institutionalized senior-level reviews to understand and address the ongoing risks that its portfolio of challenging missions faces. NASA's ongoing monthly internal Baseline Performance Review (BPR), chaired by the NASA AA, has continued to evolve and refine to better reflect portfolio performance against external commitments, focusing discussion on issues requiring leadership awareness, and the identification of solutions to challenges as they arise. NASA also maintains a variety of additional formal councils to ensure the right people and resources are brought together on a regularly occurring basis. These include the

[2] The SMD Large Mission Study recommends ways of improving SMD's cost and schedule performance on very large, multi-billion-dollar science missions. The study draws on the collected experiences of a diverse team of experts from the civil, commercial, and defense space communities. Recommendations are being applied to future large SMD missions such as Mars Sample Return and others.

recently formed NASA Acquisition Strategy Council, which addresses 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.

As NASA strives to return humans to the surface of the Moon, and beyond, the Agency 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 the risks that inform those estimates; and demonstrate progress in program management improvement efforts. As an example, NASA will establish production and operations cost reporting for SLS and Exploration Ground Systems (EGS) with a completion of a KDP-E milestone in early FY 2022. Additionally, the SLS Block 1B Exploration Upper Stage + capabilities and ML-2 Agency Baseline Commitments are also scheduled to be established by spring 2022. Both the production and operations estimates, as well as baseline cost commitments, will be reported to external stakeholders through established processes.

NASA takes its commitment to Congress and the American people seriously, and with stabilization of the Artemis manifest will be able to ensure exploration goals are achievable with better cost estimates, schedules, plans, and acquisition strategies that leverage public/private partnerships and international contributions. To this end, the EGS, SLS, and Orion programs are implementing a series of affordability initiatives that align with the ongoing transition from development to operations.

**Challenge 3: Sustaining a Human Presence in Low Earth Orbit**

NASA agrees with this challenge. The International Space Station (ISS) is now entering its third and most productive decade of utilization, including research advancement, commercial value, and global partnership. The first decade of ISS was dedicated to assembly, and the second was devoted to research and technology development and learning how to conduct these activities most effectively in space. The third decade is one of results, in which exploration and human research technologies will be verified to support deep space exploration, medical and environmental benefits will continue to be returned to humanity, and the groundwork will be laid for a commercial future in space. ISS continues to support cutting-edge research that benefits humanity, including in-space manufacturing of novel materials; life-saving medical products; understanding Earth's climate; and Science, Technology, Engineering, and Mathematics (STEM) engagement. NASA's leadership of ISS ensures it will remain the preeminent destination in low-Earth orbit (LEO) until commercially owned and operated platforms are available.

Today, with commercial crew and cargo transportation systems online, the ISS is busier than ever. The ISS National Laboratory (ISSNL), responsible for utilizing 50 percent of NASA's resources aboard the ISS, hosts hundreds of experiments from other Government agencies, academia, and commercial users to return benefits to people and industry on the ground. Meanwhile, NASA's research and development activities aboard are advancing the technologies and procedures that will be necessary to send the first woman and first person of color to the Moon and the first humans to Mars.

The ISS is also now entering an era of robust commercial use, taking advantage of the utilities it provides to develop the capabilities industry needs to move from being dependent on NASA for access to space to providing the access NASA will need to continue its mission in LEO after the lifetime of the ISS. Commercial crew and cargo transportation are well known examples, and today they provide the vital lifeline from Earth to the ISS. There are over 20 commercial facilities operating aboard ISS today–including a 3D printer, a bioprinter, external Earth observation and materials platforms, and an airlock–that are available for use by both NASA and other paying customers. NASA awarded the use of an ISS docking port to Axiom Space, which plans to attach a series of commercial modules that will eventually detach to become a LEO free-flying destination. In addition, NASA issued a solicitation for proposals that were due in August 2021, for the formulation and design of Commercial LEO Destinations (CLDs) project capabilities, which will stimulate U.S. private industry development of free-flying orbital destination capabilities and create a market environment in which commercial LEO destination services are available to both Government and private-sector customers. It is NASA's goal to be one of many customers purchasing only the goods and services the Agency needs. CLDs, along with commercial crew and cargo transportation, will provide the backbone of the LEO economy after the ISS retires.

To give future commercial providers a business model to work toward, NASA is refining its white paper on "Forecasting Future NASA Demand in Low-Earth Orbit: Quantifying Demand,"[3] which will define NASA's anticipated service requirements for future CLD providers. These forecasts will include not only the anticipated NASA demand for crew accommodation, technology testing, human research, and science, but also capture the future needs of LEONL (Low-Earth Orbit National Laboratory) and potential international partner users. The intent of this activity is to allow future CLD and launch providers to scale their activities to meet the future needs of the U.S. Government, while also allowing them to design for private use of the capabilities. Given the unique barriers of access to space, NASA and the ISSNL are partnering to support and incubate promising commercial in-space manufacturing applications, such as advanced materials, regenerative medicine, and tissue engineering through the ISSNL, with the goal of creating sustained, self-sufficient demand for future CLD services. Other demand-enabling initiatives include allocating a portion of ISS resources for commercial-use activities and private astronaut missions on a reimbursable basis.

NASA's Commercial Crew Program (CCP) is delivering its goal of safe, reliable, and cost-effective transportation to and from the ISS from the U.S. through a partnership with American private industry. This partnership is changing the arc of human spaceflight history by opening access to LEO and the ISS to more people, more science, and more commercial opportunities. The space station remains the springboard to NASA's next great leap in space exploration, including future astronaut missions to the Moon and, eventually, to Mars.

[3] https://www.nasa.gov/sites/default/files/atoms/files/forecasting_future_nasa_demand_in_low-earth_orbit_revision_two_-_quantifying_demand.pdf

In the time since NASA certified the SpaceX crew transportation system last year, the company has launched three operational missions to the ISS, Crew-1, Crew-2, and Crew-3. Also, SpaceX recently flew the Inspiration4 mission, a commercial mission consisting of a full crew of private astronauts. In addition, NASA has contracted with Axiom Space for a private astronaut mission to the ISS early next year.

NASA's other CCP partner, Boeing, is making good progress on characterizing and correcting the issue associated with the spacecraft valves that was identified prior to the Orbital Flight Test-2 (OFT-2) mission. Once that analysis and corrective action is in place, NASA and Boeing plan to launch OFT-2 and then the Crewed Flight Test (CFT). If those flights go well, NASA will be able to certify the Boeing system for operational crewed flights, and, for the first time in history, the U.S. will have independent, redundant human access to space.

NASA and its CCP partners need to remain vigilant moving forward, but all indications are that the U.S. commercial human space transportation capability envisioned by NASA a decade ago is coming to fruition.

ISSNL Status:

NASA is pleased to report that the bulk of the actions from the 2020 ISSNL Independent Review Team (IRT) have been completed successfully. NASA and the Center for the Advancement of Science in Space (CASIS) are now in better alignment than ever and are prepared to lead new advances in space research and development and cutting-edge science on the ISS. The following is a list of the actions and a summary of the progress NASA and CASIS have made over the last year:

- Work with CASIS on the best roles and composition of the CASIS board of directors and leadership. Progress: The CASIS board of directors has a majority of new members, along with a new board chair, Dr. Elizabeth Cantwell. The current board composition is well suited to manage the unique challenges and complexities associated with CASIS.
- Support CASIS' establishment of a User Advisory Committee to provide input to the organization about how best to manage resources. Progress: The new CASIS User Advisory Committee, along with five subcommittees, has been established, members and chairs for each subcommittee have been selected, and the committee's first meeting was held on February 26, 2021.
- Create transparent project and program evaluation and prioritization processes. Progress: Six new peer-reviewed CASIS solicitations have been announced along with new project evaluation processes, based on NASA best practices. CASIS will continue to refine its payload prioritization process for better transparency.
- Identify an ISSNL program executive at NASA Headquarters as the primary liaison to CASIS. Progress: Dr. Alex Macdonald, NASA Chief Economist in the Office of the Administrator, served as the ISSNL program executive this last year and has transitioned this role to Ms. Robyn Gatens, ISS Director at NASA Headquarters, who will be the primary liaison going forward.

- Update strategic priorities for the ISSNL on an annual basis. Progress: NASA and CASIS jointly agreed to and documented new CASIS annual performance goals for 2021 and are assessing those goals annually.
- Work with CASIS to optimize the allocation of ISSNL resources to meet strategic priorities. Progress: New ISSNL programmatic goals and operating principles have been agreed to with the CASIS board and will be incorporated into an update to the CASIS Cooperative Agreement, which is in work. CASIS will continue to refine its payload prioritization process.

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

**Challenge 4: Managing and Mitigating Cybersecurity Risk**

The Office of the Chief Information Officer (OCIO) agrees that managing and mitigating cybersecurity risk is a profoundly difficult challenge and agrees with all of the reasoning in the summary paragraphs in the OIG report. The OCIO Cybersecurity and Privacy Division (CSPD) continues to improve NASA's cybersecurity posture within all Information Technology (IT) domains of NASA's infrastructure, including Corporate IT, Mission IT, and Physical IT. In addition to progress noted by the OIG, NASA has also accomplished the following to manage and mitigate specifically identified challenges:

1. Improper Use Incidents
    - OCIO agrees that technical and policy enforcement to control Improper Use is an ongoing challenge. However, OCIO does not agree that the referenced jump in Improper Use metrics represents a true escalation in risk. The increase, primarily comprised of a 301 percent jump in incident reports from FY 2018 to FY 2019, reflects improved detection and reporting provided by automated Data Loss Prevention (DLP) capabilities implemented by OCIO within the O365 environment. Additionally, increased awareness of Sensitive But Unclassified (SBU) (now Controlled Unclassified Information (CUI)) issues due to more focused staff training is another contributing factor for increased Improper Use metrics. The increase in Improper Use reporting represents improved OCIO identification and data protection capabilities, not an increase in cybersecurity risk to the Agency.

2. Mobile Device Security
    - OCIO agrees that evolving technology and increased usage patterns contribute to the challenge of managing the security of mobile devices and remote access. OCIO projects and initiatives are under way to help mitigate this challenge.

    - Network Access Control (NAC) enforcement on unauthorized devices has improved since the referenced IG report (IG-20-021), and progress continues in this area. NAC is now deployed at all NASA Centers, and closure of the corresponding IG audit finding has been requested.

- OCIO believes that e-mail access via a Mobile Device Management (MDM) solution on worker-owned mobile devices represents a greater benefit to NASA than the relative risk accepted. Benefits include enhanced connectivity and worker productivity at a low cost compared to alternative controls. The OIG's own assessment found the solution largely compliant except for three specific criteria:
    - Assertion of user need for the service, which is implied by the user request and confirmed by annual user validation of need for the service (E-mail is considered to be a Basic-Level Entitlement (BLE) for all NASA workers with logical access).
    - End-user device supply chain concerns, which are mitigated by compartmentalization of NASA data on the device by the MDM software as well as the ability to remotely wipe the device. Additionally, the NASA Security Operations Center (SOC) proactively identifies mobile connections from outside the United States and reports outside connections to the responsible Agency incident response manager if the connection source is an unauthorized traveler.
    - The possibility of operation of the mobile device outside of the United States, which is an edge case that is mitigated by instructing the user that this is not permitted. Additionally, the NASA SOC is now performing proactive monitoring for Government-Furnished Equipment (GFE) and Personally Furnished Equipment (PFE) mobile devices connecting outside the United States.

3. Assessment and Authorization Process
    - The OCIO agrees that Assessment and Authorization (A&A) is a major challenge within a diverse IT environment such as NASA and that the current state of A&A is lacking consistent rigor in its application. However, OCIO does not agree that this specific challenge should be directed towards OCIO as sole owner to mitigate. The cause for inconsistent implementation of policy cannot be blamed on the policy itself. Rather, the overall risk acceptance and authorization actions, or lack thereof, must be examined to identify and address these A&A challenges. As noted by the OIG in draft report Q-21-005-00, "we reported that NASA is inconsistent and ineffective with its A&A process because of its decades-long decentralized approach to cybersecurity." System owners are responsible for the proper execution of defined A&A policy, and the challenges pertaining to A&A must be mitigated by the responsible parties defined within the process, including NASA's missions, not solely by those responsible for developing and maintaining the process itself.

      To aid in mitigating this challenge, NASA OCIO intends to leverage the upcoming Cybersecurity and Privacy Enterprise Solutions and Services (CyPrESS) contract to provide a standardized internal security assessment team and process. This will provide a "level playing field" baseline assessment for all NASA systems, as well as realize significant cost savings for the Agency.

While the Agency continues to enhance its cybersecurity policies, processes, and governance in FY 2021, NASA recognizes there is still progress to be made, specifically in addressing Mobile Device Security and A&A. The Agency remains committed to tackling these issues and to building an even stronger, more proactive risk-based cybersecurity program that safeguards NASA's IT assets, data, and its users.

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

The NASA Office of Procurement (OP) is committed to making meaningful progress in addressing contract oversight challenges and continues to strengthen its overall procurement processes and policy. In response to an OIG recommendation, OP is pursuing the ability to link contract assignments to acquisition workforce personnel and is continuously monitoring closeout performance across the Agency. An annual closeout target metric of 6,000 contracts has been approved by Agency leadership, with quarterly reporting provided at the BPR. In FY 2021, 8,926 contracts were closed.

**Challenge 6: Attracting and Retaining a Highly Skilled and Diverse Workforce**

NASA agrees with the challenges identified in this section of the report. As the OIG has acknowledged in their report, within the last few years, NASA implemented several approaches and tools to increase agility within the workforce. To address NASA's dilemma created by low attrition and a need for new skills, the Office of the Chief Human Capital Officer (OCHCO) focused on expanding usage of time-limited appointments. Time-limited appointments do not currently count against NASA's permanent Full-Time Equivalent (FTE) "ceilings" and can be used in conjunction with the Agency's NASA-unique Direct Hire Authority to quickly recruit and hire people with new and critical skills. NASA is working with the Office of Personnel Management (OPM) to update the Government-wide time-limited appointment definition to "up to ten years" (rather than four) for STEM. Civil service employees on time-limited appointments can be part of the pipeline to permanent roles as retirements occur or they can end when the project or program is completed.

To promote workforce mobility and enable talented people to move to critical tasks, NASA launched its Talent Marketplace (TM). The Agency-wide TM gives NASA's civil service employees access to non-competitive development and/or lateral opportunities (e.g., internal detail opportunities, short-term/part-time assignments, lateral reassignments, etc.) across NASA. Managers are now able to look for talent across a wider pool than just their unit or Center, and employees are getting more diverse work experiences as a result. Through TM, NASA is embracing transparency, inclusion, and access by offering more and more opportunities remotely which enables additional cross-Agency talent to gain desirable experiences without relocation costs or personal move barriers.

Additionally, as the OIG states, "to maintain a world-class workforce, NASA must fill current critical workforce gaps and prepare for those yet to emerge." NASA has been moving to a more "demand-driven" workforce planning model/process in order to accomplish this goal. The Agency no longer employs a "back-fill only" way of performing the mission, since NASA must understand where the mission is going, Administration and Congressional priorities, what is going to be done by partners (e.g., private sector versus in-

house), what aspects of work will be performed by technology, and how technology will impact NASA's various work roles (e.g., digital transformation). OCHCO is looking at the degree to which reshaping the workforce size and skills will be possible through the use of the Agency workforce master planning process. An element of the master planning process includes projecting loss rates and the extent to which past patterns of employee tenure beyond retirement eligibility dates may change, providing opportunity for workforce reshaping.

Although not mentioned in this report, NASA is still reliant on an antiquated personnel system that does not match the complex and dynamic work NASA is required to perform. The current position-based, mid-century personnel system defines work as static and repeatable, requires lengthy hiring processes, is agnostic to the external labor market, rewards workers for longevity, disincentivizes mobility, and is overly complicated. This rigid, outdated personnel system has an impact on the Agency's ability to compete for talent in a very tight talent market and to retain talented individuals who are motivated by very different careers than in the past. NASA continues to seek workforce flexibilities for hiring, development, and other modern personnel practices. For example, NASA is seeking legislation that would allow engagement in talent exchange programs with the private sector.

**Challenge 7: Managing NASA's Outdated Infrastructure and Facilities**

NASA agrees with the challenges identified in the "*Managing NASA's Outdated Infrastructure and Facilities"* section of the OIG report. To address the challenges with outdated infrastructure and facilities, NASA is implementing a top-down mission-driven Agency Master Plan (AMP). This plan ensures that the required infrastructure is available and affordable, guides Agency investments to mission-critical assets, reduces the risk of unplanned failures, and guides divestment of assets not needed for the Agency's missions. The AMP will establish a 20-year vision for physical infrastructure and real property assets that aligns with current, evolving, and future mission requirements. NASA will use this process to identify critical capabilities and areas for asset sustainment, investment, or divestment of infrastructure. To alleviate the maintenance burden, NASA will continue to increase its funding for demolition of unneeded facilities.

NASA has also identified investment strategies using Reliability Centered Maintenance (RCM) principles to stave off the increasing deferred maintenance within the Agency. Condition Based Maintenance and a Tiered Maintenance approach for relevant and critical assets are cornerstones of this strategy. These efforts will lead to improving the condition of important building systems and facilities across the Agency and increasing the reliability of these assets to meet mission needs. Implementation of these RCM principles, with particular focus upon Tiered Maintenance, ensures the right type of maintenance is performed on the most critical assets, at the right time, and for the right reasons. RCM, paired with immediate investments in the replacement of obsolete items associated with the Agency's higher-criticality assets, can provide near-term corrective mitigation for known risks and avoid mission/schedule impacts. These maintenance strategies focus on increasing asset availability and avoiding unplanned repair costs.

These initiatives will mitigate the Agency's ongoing challenge of aging and outdated infrastructure and facilities. Through the implementation of the AMP and the ongoing investments in maintenance, demolition, repair, and recapitalization, NASA continually strives to right-size the Agency's infrastructure towards more modern and efficient facilities that will continue to meet NASA mission objectives.

**Challenge 8: Managing the Impacts of COVID-19 on NASA's Mission and Workforce**

NASA agrees with the OIG that COVID-19 is an unprecedented event and remains a challenge for the Agency mission and its workforce. As the OIG noted, COVID-19 is an unprecedented event, and NASA's understanding of the impact of COVID-19 continues to evolve. NASA agrees with the OIG's assessment that a final accounting of the full impact of COVID-19 on Agency activities will not be available until well after the Agency and its contractors and partners return to "normal." Nevertheless, NASA is proud of the resiliency of its workforce in sustaining critical national missions and for being ranked first among large Federal agencies for the Agency's response to the COVID-19 pandemic.

NASA appreciates the OIG's recognition of the Agency's operational flexibility and adaptability in the face of the COVID-19 pandemic. Of the $2.8 billion in impacts to NASA's programs and projects identified by the OIG, over 95 percent have been absorbed into Agency plans, mostly through a combination of deploying project- and Headquarters-held unallocated future expenses (UFE), program/project replans, and deferral of previously planned content. NASA has emphasized reporting on the impacts of COVID-19 through its Earned Value Management (EVM) activities and is highlighting if COVID-19 is a factor, as was the case with the Nancy Grace Roman Space Telescope and the Plankton, Aerosol, Cloud, ocean Ecosystem (PACE) spacecraft.

NASA is also taking steps to be in full compliance with the Administration's Executive Order requiring vaccination of Federal and contractor employees. The Agency is reviewing its policies for the future of work, including consideration of workforce policies which embrace teleworking and other trends that accelerated under COVID-19, in order to ensure NASA attracts and retains the world-class talent needed to carry out its mission.

Finally, as of the close of FY 2021, NASA had obligated 100 percent of the $60 million in supplemental funding the Agency received as part of the Coronavirus Aid, Relief, and Economic Security (CARES) Act.

If you have any questions regarding NASA's response to the 2021 Top Management and Performance Challenges report, please contact Anthony Mitchell, Audit Liaison Project Manager, on (202) 358-1758.

Bill Nelson

cc:
Chief Financial Officer/Ms. Schaus
Chief Information Officer/Mr. Seaton
Associate Administrator for Exploration Systems Development/Mr. Free
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Assistant Administrator for Strategic Infrastructure/Mr. Carney
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# PAYMENT INTEGRITY INFORMATION ACT (PIIA) REPORTING

## Payment Integrity Information Act

Under the parameters set forth in the Payment Integrity Information Act (PIIA) of 2019 (Public Law (P.L.) 116-117) which reorganizes and revises the previous statues which established requirements for Federal agencies to reduce improper payments set forth by the Improper Payments Information Act of 2002 (IPIA) (P.L. 107-300); the Improper Payments Elimination and Recovery Act of 2010 (IPERA) (P.L. 111-204); and the Improper Payments Elimination and Recovery Improvement Act of 2012 (IPERIA) (P.L. 112-248); 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 this evolution, NASA has stayed committed to preventing and reducing improper payments through its Payment Integrity Improvement Program (PIIP). In FY 2021, the Agency executed the aforementioned responsibilities via the Payment Integrity Information Act Assessment. For additional details related to NASA Payment Integrity Information Act Reporting, including all information previously included in the AFR, please visit https://paymentaccuracy.gov/.

## Payment Integrity Information Act Assessment

NASA executed its FY 2021 Payment Integrity 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 its risk assessment methodology to ensure proper assessment activities are conducted and to implement modifications as appropriate with regard to, changes to improper payment legislation and guidance, changes to NASA's operating environment, recommendations from external auditors, and other circumstances. NASA performed its FY 2021 Payment Integrity Risk Assessment employing the updated risk assessment methodology. This methodology incorporates seven risk conditions, each with a set of related criteria designed to account for 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. 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, NASA extracted the population ($21.5 billion) of FY 2020 disbursements from its financial management system to develop a list of NASA programs eligible to be assessed for the FY 2021 Payment Integrity 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, 2019 and September 30, 2020.

As required by OMB Memorandum M-18-14, *Implementation of Internal Controls and Grant Expenditures for the Disaster- Related Appropriations*, management conducted statistical sampling and testing on the Hurricane Harvey, Hurricane Matthew and Hurricane Irma programs (under the Institutional Construction of Facilities program). No improper payments were identified as a result of the testing.

## Actions Taken to Address Auditor Recovery Recommendations

As permitted by OMB Circular A-123, Appendix C, NASA has determined to exclude recapture audits from its Recapture Audit Program. In FY 2019, NASA performed an analysis that indicated that it was no longer cost-effective to continue conducting payment recapture audits for identifying and recovering improper payments, as evidenced by the fact that for the final 3 years of the previous recapture auditor's contract, there were no overpayments identified or recaptured through the payment recapture audit program. As a result, NASA did not receive recommendations from recapture auditors regarding actions needed to prevent overpayments. However, NASA continues to monitor and assess its payment platforms to ensure appropriate controls are in place to prevent, detect, and collect improper payments.

## Overpayments Outside the Recapture Audit

Annually, NASA performs an internal review of Overpayments Outside of Recapture Audit as a mechanism to identify and analyze the cause and amount of improper payments and total amounts recovered. The scope of the review includes cost-type and fixed priced contracts. The review includes an Agency-wide data call to allow for reporting of Agency identified overpayments and collections of improper payments. The data call is sent to the Office of the Chief Financial Officer organizations at NASA Centers, Office of Inspector General (OIG), Office of Procurement and the Headquarters Office of the Chief Financial Officer Policy & Grants Division. Examples of activities included in reporting are Agency post-payment review/audits, single audit, and self-reported overpayments, which include OIG investigation settlements. As a result, in FY 2020, NASA recovered $6.86 million, which is 42.9% of the total overpayments identified for payments outside of the recapture audit.

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 helps to mitigate the risk of improper payments across the Agency.

## Financial and Administrative Controls Relating to Fraud and 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 OIG and the Department of Justice |
| Payment Integrity Improvement Program | 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. Includes mandatory fraud prevention training, anti-fraud campaign |
| Coordination and collaboration with the 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 PIIP. 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 instances 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 OIG or the Department of Justice. In addition to NASA's PIIP, 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 AIP and PIIP 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 OIG 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 OIG's Hotline. NASA continues to provide Agency-wide fraud risk training sponsored by the AIP. This training covers the importance of fraud awareness and acquisition integrity, types of fraud, how to identify, recognize and report fraud. The training also covers fraud remedies and the AIP and OIG's roles and approaches to addressing fraud. 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 and continues to expand fraud awareness outreach as part of its plan to counter fraud within the Agency.

## Do Not Pay Initiative

OMB requires agencies to report annually on Do Not Pay (DNP) activities as it relates to the Payment Integrity Information Act of 2019.

NASA enrolled in the Department of the Treasury's DNP portal process on September 27, 2014. Its Payment Automation File is vetted against the Social Security Administration (SSA) Death Master file.

The cumulative results of these monthly reviews reported are for the period of October 1, 2020 through September 24, 2021. During this time period, there were 62,386 payments made by Treasury on behalf of NASA with a dollar value of $15.962 billion.

The review by NASA resulted in no matching improper payments for FY 2021.

# UNDISBURSED BALANCES IN EXPIRED GRANT ACCOUNTS

In December 2015, Congress passed the Commerce, Justice, Science, and Related Agencies Appropriations Act, 2016 (Division B of the Consolidated Appropriations Act, 2016, Pub. L. 114-113), which required NASA to report undisbursed balances in expired grant accounts. OMB Memorandum M-16-18, Financial and Performance Reporting on Undisbursed Balances in Expired Grant Accounts, requires this information to be included each year until instructed otherwise if the requirement is included in subsequent fiscal year's appropriations acts. 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.

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 DOLLARS) |
|---|---|---|
| 2020 | 87 | $803,167 |
| 2019 | 6 | $70,288 |
| 2018 | 0 | $- |

# GRANTS PROGRAMS INFORMATION

The Grants Oversight and New Efficiency (GONE) Act (P.L. 114-117) reporting requirements have expired. Nevertheless, to promote the efficient administration of grants programs, all reporting entities with Federal grants programs must submit a brief high-level summary of expired, but not closed, Federal grants and cooperative agreements (awards). NASA continues to ensure its grants programs operate efficiently with the timely processing of expired, but not closed, Federal grants and cooperative agreements (awards) for closeout.

The 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.

In FY 2021, there were 1,485 grant closeouts completed. This represents a 5% increase compared to FY 2020 for grants closed out. NASA recognized an increase in awards expired in the 2-3 years category with undisbursed balances and in awards expired 2-3 years with zero-dollar balances. The closeout team continues to work diligently to ensure that the grant close out process is consistent throughout the fiscal year.

NASA has implemented an automated process which sends expired grants to closeout on a weekly basis. This process improvement will continue to ensure that the agency operates with efficiency when managing and monitoring the grant close out process. This enhancement will also assist to make certain that there is no challenge of awards being transferred to close out within a timely manner.

| CATEGORY | 2-3 YEARS | 3-5 YEARS | MORE THAN 5 YEARS |
|---|---|---|---|
| Number of Grants/Cooperative Agreements with Zero Dollar Balances | 77 | 17 | 2 |
| Number of Grants/Cooperative Agreements with Undisbursed Balances | 85 | 6 | 3 |
| Total Amount of Undisbursed Balances | $793,548 | $70,288 | $167,177 |

# CIVIL MONETARY PENALTY ADJUSTMENT FOR INFLATION

## FOR THE FISCAL YEAR ENDED SEPTEMBER 30, 2021

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 | 2021 | Maximum $11,803 | Federal Register Vol.86, No. 48 (15 March 2021) Rules and Regulations www.federalregister.gov |
| Department of the Interior and Related Agencies Appropriations Act of 1989, Public Law 101-121, sec. 319 | Penalty for use of appropriated funds to lobby or influence certain contracts. | 1989 | 2021 | Minimum $20,731 | Federal Register Vol.86, No. 48 (15 March 2021) Rules and Regulations www.federalregister.gov |
| Department of the Interior and Related Agencies Appropriations Act of 1989, Public Law 101-121, sec. 319 | Penalty for use of appropriated funds to lobby or influence certain contracts. | 1989 | 2021 | Maximum $207,314 | Federal Register Vol.86, No. 48 (15 March 2021) Rules and Regulations www.federalregister.gov |
| Department of the Interior and Related Agencies Appropriations Act of 1989, Public Law 101-121, sec. 319 | Penalty for failure to report certain lobbying transactions. | 1989 | 2021 | Minimum $20,731 | Federal Register Vol.86, No. 48 (15 March 2021) Rules and Regulations www.federalregister.gov |
| Department of the Interior and Related Agencies Appropriations Act of 1989, Public Law 101-121, sec. 319 | Penalty for failure to report certain lobbying transactions. | 1989 | 2021 | Maximum $207,314 | Federal Register Vol.86, No. 48 (15 March 2021) Rules and Regulations www.federalregister.gov |

# SUMMARY OF FINANCIAL STATEMENT AUDIT AND MANAGEMENT ASSURANCES

The following tables summarize the Agency's FY 2021 Financial Statement Audit and Management Assurances. Table 1 summarizes the status of prior year—FY 2020 material weaknesses identified, if any 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

| **Effectiveness of Internal Control over Financial Reporting (FMFIA 2)** | | | | | | |
|---|---|---|---|---|---|---|
| Statement of Assurance | Unmodified | | | | | |
| Material Weaknesses | Beginning Balance | New | Resolved | Consolidated | Reassessed | Ending Balance |
| None | 0 | 0 | 0 | 0 | 0 | 0 |
| Total Material Weaknesses | 0 | 0 | 0 | 0 | 0 | 0 |
| **Effectiveness of Internal Control over Operations (FMFIA 2)** | | | | | | |
| Statement of Assurance | Unmodified | | | | | |
| Material Weaknesses | Beginning Balance | New | Resolved | Consolidated | Reassessed | Ending Balance |
| None | 0 | 0 | 0 | 0 | 0 | 0 |
| Total Material Weaknesses | 0 | 0 | 0 | 0 | 0 | 0 |
| **Conformance with Financial Management System Requirements (FMFIA 4)** | | | | | | |
| Statement of Assurance | Federal Systems conform, except for instances of non-conformance, or do not conform to financial management system requirements. | | | | | |
| Non-Conformances | Beginning Balance | New | Resolved | Consolidated | Reassessed | Ending Balance |
| None | 0 | 0 | 0 | 0 | 0 | 0 |
| Total Non-Conformances | 0 | 0 | 0 | 0 | 0 | 0 |

| **Compliance with Federal Financial Management Improvement Act (FFMIA)** | | |
|---|---|---|
| | Agency | Auditor |
| 1. Federal Financial Management System Requirements | No lack of compliance noted | No lack of compliance noted |
| 2. Applicable Federal Accounting Standards | No lack of compliance noted | No lack of compliance noted |
| 3. USSGL at Transaction Level | No lack of compliance noted | No lack of compliance noted |

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SECTION 4

# APPENDIX


The Northrop Grumman Antares rocket, with Cygnus resupply spacecraft aboard, launches from Pad-0A, Saturday, Feb. 20, 2021, at NASA's Wallops Flight Facility in Virginia. Northrop Grumman's 15th contracted cargo resupply mission for NASA to the International Space Station will deliver about 8,000 pounds of science and research, crew supplies, and vehicle hardware to the orbital laboratory and its crew.

PHOTO CREDIT — Wallops/Terry Zaperach

# CERTIFICATE OF EXCELLENCE IN ACCOUNTABILITY REPORTING AWARD

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On May 27, 2021, the Association of Government Accountants (AGA) awarded NASA its prestigious **Certificate of Excellence in Accountability Reporting (CEAR) award**. This marks the 7th consecutive year NASA has been recognized for its excellency in financial reporting.

# GLOSSARY OF ACRONYMS

| | |
|---|---|
| AA | Associate Administrator |
| A&A | Assessment and Authorization |
| AES | Advanced Exploration Systems |
| AFR | Agency Financial Report |
| AFRC | Armstrong Flight Research Center |
| AGA | Association of Government Accountants |
| AgMIP | Agricultural Model Intercomparison and Improvement Project |
| AMP | Agency Master Plan |
| AICPA | American Institute of Certified Public Accountants |
| AIP | Acquisition Integrity Program |
| APM | Airborne Particulate Monitor |
| APMC | Agency Program Management Council |
| ATV | Automated Transfer Vehicle |
| ARC | Ames Research Center |
| ARMWG | Agency Risk Management Working Group |
| ASAP | Aerospace Safety Advisory Panel |
| ASC | Accounting Standards Codification |
| BLE | Basic Level Entitlement |
| BPR | Baseline Performance Reviews |
| CADRe | Cost Analysis Data Requirement |
| CALIPSO | Cloud-Aerosol Lidar and Infrared Pathfinder Satellite |
| Caltech | California Institute of Technology |
| CAP | Corrective Action Plan |
| CARES Act | Coronavirus Aid, Relief, and Economic Security Act |
| CASIS | Center for the Advancement of Science in Space |
| CCP | Commercial Crew Program |
| CCU | Collapsible Contingency Urinal |
| CEAR | Certificate of Excellence in Accountability Reporting |
| CFO | Chief Financial Officer |
| CFO Act | Chief Financial Officers Act of 1990 |
| CFT | Crewed Flight Test |
| Challenger Trust Fund | Science, Space and Technology Education Trust Fund |
| CLD | Commercial Leo Destinations |
| CMP | Continuous Monitoring Program |
| CNES | Centre National D'Etudes Spatiales |
| CoF | Construction of Facilities |
| COTS | Commercial Off-The-Shelf |
| COVID-19 | Coronavirus |
| CRV | Current Replacement Value |
| CrIS | Cross-track Infrared Sounder |
| CS | Core Stage |
| CSPD | Cybersecurity and Privacy Division |
| CSRS | Civil Service Retirement System |
| CUI | Controlled Unclassified Information |
| CyPrESS | Cybersecurity and Privacy Enterprise Solutions & Services |
| DATA Act | Digital Accountability and Transparency Act of 2014 |

| | |
|---|---|
| DAVINCI+ | Deep Atmosphere Venus Investigation of Noble-gases, Chemistry, and Imaging |
| DCIA | Debt Collection Improvement Act |
| DLP | Data Loss Prevention |
| DM&R | Deferred Maintenance and Repairs |
| DM method | Deferred Maintenance Parametric Estimating Method |
| DNP | Do Not Pay |
| DVT | Development Verification Test |
| EC | Executive Council |
| ECS | Environmental Control System |
| EGS | Exploration Ground Systems |
| xEMU | Exploration Extravehicular Mobility Unit |
| Endeavor Trust Fund | Endeavor Teacher Fellowship Trust Fund |
| ERM | Enterprise Risk Management |
| ERMWG | Enterprise Risk Management Working Group |
| ERP | Enterprise Resource Planning |
| ESD | Exploration Systems Development |
| ESDMD | Exploration Systems Development Mission Directorate |
| ESPC | Energy Savings Performance Contract |
| EVA | Extra-Vehicular Activity |
| xEVAS | Exploration Extravehicular Services |
| Evidence Act | The Foundations for Evidence-Based Policymaking Act of 2018 |
| EVM | Earned Value Management |
| EY | Ernest & Young LLP |
| FAMU | Florida Agricultural and Mechanical University |
| FAR | Federal Acquisition Regulation |
| FASAB | Federal Accounting Standards Advisory Board |
| FASB | Financial Accounting Standards Board |
| FBWT | Fund Balance with Treasury |
| FCI | Facility Condition Index |
| FECA | Federal Employees' Compensation Act |
| FEGLI | Federal Employees' Group Life Insurance |
| FEHB | Federal Employees Health Benefits |
| FERS | Federal Employees Retirement System |
| FEVS | Federal Employee Viewpoint Survey |
| FFMIA | Federal Financial Management Improvement Act |
| FFRDC | Federally Funded Research and Development Center |
| FISMA | Federal Information Security Modernization Act of 2014 |
| FITARA | Federal Information Technology Acquisition Reform Act |
| FMFIA | Federal Managers' Financial Integrity Act |
| FPAs | Federal Program Agencies |
| FR | Financial Report |
| FRDA | Fraud Reduction and Data Analytics Act |
| FTE | Full-Time Equivalent |
| FY | Fiscal Year |
| GAAP | U.S. Generally Accepted Accounting Principles |
| GAO | Government Accountability Office |
| GFE | Government-Furnished Equipment |
| GPRAMA | Government Performance and Results Act Modernization Act of 2010 |
| GISS | Goddard Institute for Space Studies |

| | |
|---|---|
| GOES R | Geostationary Operational Environmental Satellites-R Series |
| GONE | Grants Oversight and New Efficiency |
| GRC | Glenn Research Center |
| Green Book | GAO Standards for Internal Control in the Federal Government |
| GSFC | Goddard Space Flight Center |
| GTAS | Government Treasury Account Symbol |
| G-PP&E | General Property, Plant, and Equipment |
| HALO | Habitation and Logistics Outpost |
| HEOMD | Human Exploration and Operations Mission Directorate |
| HLS | Human Landing System |
| HQ | Headquarters |
| HTV | H-II Transfer Vehicle |
| HVA | High-Value Asset |
| HVAC | Heating, Ventilating and Air Condition |
| IBNR | Incurred But Not Reported |
| IGT | Intragovernmental |
| INCLUDES | Inclusion Across the Nation of Communities of Learners of Underrepresented Discovers in Engineering and Science |
| IPERA | Improper Payments Elimination and Recovery Act of 2010 |
| IPERIA | Improper Payments Elimination and Recovery Improvement Act of 2012 |
| IPIA | Improper Payments Information Act |
| IRT | Independent Review Team |
| ISRO | Indian Space Research Organisation |
| ISS | International Space Station |
| ISSNL | ISS National Laboratory |
| IT | Information Technology |
| JAXA | Japan Aerospace Exploration Agency |
| JCL | Joint Confidence Level |
| JPL | Jet Propulsion Laboratory |
| JPSS | Joint Polar Satellite System |
| JSC | Johnson Space Center |
| JWST | James Webb Space Telescope |
| KDP | Key Decision Point |
| KSC | Kennedy Space Center |
| LaRC | Langley Research Center |
| LaRC-SI | Langley Research Center-Soluble Imide |
| LBFD | Low-Boom Flight Demonstrator |
| LCRD | Laser Communications Relay Demonstration |
| LEO | Low-Earth Orbit |
| LEONL | Low-Earth Orbit National Laboratory |
| MAVEN | Mars Atmosphere and Volatile Evolution mission |
| MDM | Mobile Device Management |
| MIT | Massachusetts Institute of Technology |
| ML | Mobile Launcher |
| MOXIE | Mars Oxygen In-Situ Resource Utilization Experiment |
| MSC | Mission Support Council |
| MSD | Mission Support Directorate |
| MSFC | Marshall Space Flight Center |
| MSWG | Management Systems Working Group |
| MUREP | Minority University Research and Education Project |

| | |
|---|---|
| M&R | Maintenance and Repairs |
| NAC | NASA Advisory Council |
| NAC | Network Access Control |
| NASA | National Aeronautics and Space Administration |
| NISAR | NASA-ISRO Synthetic Aperture Radar |
| NPR | NASA Procedural Requirements |
| NSSC | NASA Shared Services Center |
| 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 and Medical Officer |
| OCIO | Office of the Chief Information Officer |
| OFT | Orbital Flight Test |
| OFT-2 | Orbital Flight Test-2 |
| OIG | Office of Inspector General |
| OMB | Office of Management and Budget |
| OP | Office of Procurement |
| OPM | Office of Personnel Management |
| Orion | Orion Multi-Purpose Crew Vehicle |
| OSMA | Office of Safety & Mission Assurance |
| PACE | Plankton, Aerosol, Cloud ocean Ecosystem |
| PAR | Performance and Accountability Report |
| PDR | Preliminary Design Reviews |
| PFE | Personally Furnished Equipment |
| PIIA | Payment Integrity Information Act |
| PIIP | Payment Integrity Improvement Program |
| P.L. | Public Law |
| PM | Project Management |
| PMC | Program Management Council |
| PMIAA | Program Management Improvement and Accountability Act |
| PMIO | Program Management Improvement Officer |
| PPE | Power and Propulsion Element |
| President's Budget | FY 2023 Budget of the United States Government |
| PSE | Program Support Equipment |
| QAD | Quality Assurance Division |
| RCM | Reliability Centered Maintenance |
| RFP | Request for Proposal |
| RMB | Risk Management Board |
| R&D | Research and Development |
| REALM | Radio-frequency Identification Enabled Autonomous Logistics Management |
| RFID | Radio-frequency Identification |
| Saffire V | Spacecraft Fire Safety V |
| SAP ECC | Systems, Applications & Products ERP Central Component |
| SAT | Senior Assessment Team |
| SBIR | Small Business Innovation Research |
| SBR | Statement of Budgetary Resources |
| SBU | Sensitive But Unclassified |
| SDRs | Special Drawing Rights |
| SERFE | Spacesuit Evaporation Rejection Flight Experiment |

| | |
|---|---|
| SES | Senior Executive Service |
| SFFAS | Statement of Federal Financial Accounting Standards |
| SoA | Statement of Assurance Process |
| SOC | Security Operations Center |
| SOMD | Space Operations Mission Directorate |
| SLS | Space Launch System |
| SMC | Senior Management Council |
| SMD | Science Mission Directorate |
| SNC | Statement of Net Cost |
| SPLICE | Safe and Precise Landing Integrated Capabilities Evolution |
| SR&T | Supporting Research and Technology |
| SSA | Social Security Administration |
| SSC | Stennis Space Center |
| SSMS | Safety, Security, and Mission Services |
| STEM | Science, Technology, Engineering, and Mathematics |
| SWOT | Surface Water and Ocean Topography |
| TM | Talent Marketplace |
| Treasury | U.S. Department of the Treasury |
| U.S. | United States |
| UAM | Urban Air Mobility |
| UFE | Unallocated Future Expenses |
| UNICORN | Unified Comprehensive Operational Risk Network |
| UWMS | Universal Waste Management System |
| VIPer | Volume of Integrated Performance |
| VPN | Virtual Private Network |
| Webb | James Webb Space Telescope |
| WFF | Wallops Flight Facility |

# CONNECT WITH NASA


Bryan Jackson, grandson of Mary W. Jackson, left, and Raymond Lewis, son-in-law of Mary W. Jackson, right, unveil the Mary W. Jackson NASA Headquarters sign during a ceremony officially naming the building, Friday, Feb. 26, 2021, at NASA Headquarters in Washington, DC. Mary W. Jackson, the first African American female engineer at NASA, began her career with the agency in the segregated West Area Computing Unit of NASA's Langley Research Center in Hampton, Virginia. The mathematician and aerospace engineer went on to lead programs influencing the hiring and promotion of women in NASA's science, technology, engineering, and mathematics careers. In 2019, she posthumously received the Congressional Gold Medal.

PHOTO CREDIT — NASA/Joel Kowsky

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It is difficult to say what is impossible, for the dream of yesterday is the hope of today and the reality of tomorrow.

**Dr. Robert Hutchings Goddard**

# THANK YOU

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We offer special thanks to our graphic designer, **Darren Fuller.**

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National Aeronautics and Space Administration

The SpaceX Crew Dragon Resilience spacecraft is lifted onto the GO Navigator recovery ship after it landed with NASA astronauts Mike Hopkins, Shannon Walker, and Victor Glover, and Japan Aerospace Exploration Agency (JAXA) astronaut Soichi Noguchi aboard in the Gulf of Mexico off the coast of Panama City, Florida, Sunday, May 2, 2021.

PHOTO CREDIT — NASA/Bill Ingalls