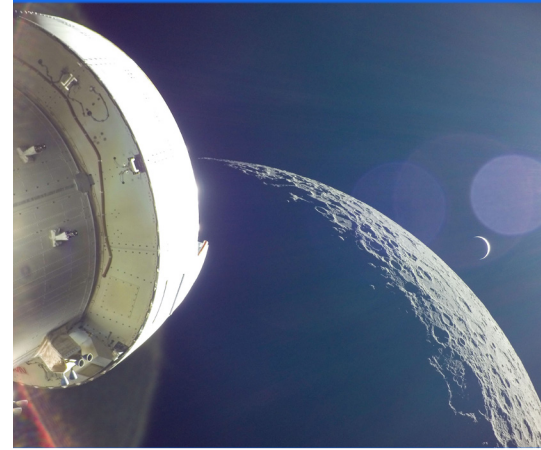


National Aeronautics and Space Administration



NASA OFFICE OF THE CHIEF INFORMATION OFFICER  
**2022 IT Annual Report**



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# Introduction from NASA's Chief Information Officer

In 2022, most of the world started emerging from the COVID-19 pandemic. NASA continued leveraging technology to keep missions moving forward, leading to an astronomical year marked by one amazing NASA success after another. Information technology (IT) and the people behind it are an essential part of NASA's mission success. In the Office of the Chief Information Officer (OCIO) it's our job to provide safe, secure, reliable, and ever-advancing IT capabilities and services. As NASA reaches new heights of discovery into deep space and beyond, OCIO was proud to partner on history-making missions. These included the launch and splashdown of the Artemis I, the groundbreaking images from NASA's James Webb Space Telescope, the innovative LOFTID technology demonstration, and the smashing success of the DART mission, which changed the trajectory of an asteroid.

To support agency missions over the next decade, OCIO redesigned NASA's IT Operating Model to deliver more efficient and high-quality services. We did this by adopting a matrix model, familiar to NASA centers and mission organizations, working to deliver consistent services to our customers while simultaneously modernizing our IT and data capabilities and maximizing always-limited resources.

This transformation has touched not just NASA but our OCIO workforce of more than 2,000 civil servant and contract personnel, thousands of operational IT services, and a large and complex financial budget. We did this at a time in which NASA's mission needs are increasing and centers are returning to site following extended remote work. Ubiquitous and rapidly evolving collaboration tools enable NASA employees to work securely no matter where they are and help shape the Future of Work at NASA. We've been able to deliver more modern and inclusive collaboration spaces that have jumpstarted our hybrid meeting proficiency—although there is more work to come in 2023 on that front.

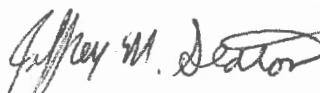
Emerging technologies have paved the way for us to make significant progress in cybersecurity. We have begun to implement a zero-trust architecture and improved NASA's internet perimeter to combat cyberattacks, malware threats, and enhanced our network resilience.

NASA's Digital Transformation is connecting, integrating, and facilitating solutions to accelerate the transformation of NASA's work, workforce, and workplace. We have delivered the agency's first Enterprise Data Platform, which is a data discovery tool where NASA employees—and eventually the public—can visualize the agency's data with ease. Users will be able to search multiple data sets, publications, and other assets simultaneously using a customizable dashboard.

I am very excited to share at least a few of the major accomplishments we have made across our "One IT" community through this 2022 NASA Information Technology Annual Report. Our success is a direct result of many people's efforts, flexibility, and agility to support the day-to-day operations of the NASA customer experience whether in person or remote.

I hope you enjoy learning more about our key achievements. Thank you for your continued support of NASA IT. We look forward to building on our successes in FY 2023.

With Gratitude,



Jeff Seaton



# IT Strategic Framework

NASA's IT strategic vision outlines our strategic IT direction, goals, priorities, and future environment to make our vision of the future a reality. The NASA Chief Information Officer is responsible for ensuring that NASA's information assets are acquired and managed consistent with Federal policies, procedures, and legislation. The agency uses its IT Strategic Plan to guide the direction, mission alignment, investments, and accountability of NASA's IT community.

## IT Vision

Exploring the secrets of the universe for the benefit of all.

## IT Mission

We empower NASA's people and partners to achieve mission success through secure, evolving information technology and accessible data.

## IT Values

NASA's core values of Safety, Integrity, Inclusion, Teamwork, and Excellence mandate individual and organizational behavior across the agency at all levels.

Progress toward the plan and related metrics helps NASA personnel improve agency outcomes by driving discoveries as a strategic partner, accelerating results through productivity, sharing NASA's data and results, and increasing quality, resiliency, and cost-effectiveness.

We are currently formulating the update to NASA's IT Strategic Plan in alignment with the update to the NASA Strategic Plan released in 2022. NASA will focus on consistent IT service delivery, reliable operations, expanded digital capabilities, and proactive, resilient cybersecurity, all supported by an engaged, customer-focused IT team.

## The strategic use of IT contributes to NASA's mission success in several ways





# A Year in Numbers

A few remarkable numbers from the OCIO's FY 2022 accomplishments, benefitting customers across the agency. Keep reading for the stories behind these achievements!

60% potential reduction in processing time with the ARMD Flight Data Portal

**60% Reduction**

**40+ Missions Supported**

40+ missions supported by NASCOM

Transitioned over 6.5 petabytes of data into Langley's new Central Storage System tape library

**6.5 Petabytes of Data**

**220TB Extra Storage**

32 new Mission Cloud Platform customers, more than 100 now hosted

220TB additional SSC Data Center storage

Blocking approx. 5B malicious network access attempts daily, 1.5M email threats weekly

**5B Blocked Attacks**

**120TB Storage Upgraded**

Storage for 120TB of test data across 2.3M files upgraded at SSC

Wallops Marsh Fiber project created a 23-mile fiber optic cable round trip

**23 Miles of Cable**

**10x Data Transfer Rate**

10x greater data transfer rates from upgraded AFRC data centers

100K Armstrong images digitized to date

**100K Images Digitized**

**10 New Video Curricula**

10-video training curriculum developed for Modern & Inclusive Collaboration Spaces

Created approx. 133 hybrid conference spaces across Goddard, HQ, and Wallops

**133 Hybrid Spaces**

**109 Consolidated Sites**

OneNASA Intranet Project consolidated 109 sites into one intranet

Images.nasa.gov handled 5M hits and 13M file requests during James Webb Space Telescope events

**13M File Requests**

**80% on FISMA Report**

Received 80% on the FY22 Annual FISMA OMB Report

9,600 labor hours saved with intelligent automation of manual processes

**9,600 Hours Saved**

**45sec Go/No-Go Demo**

45-second Go/No-Go recommendation generated in first US AI/ML demo on the ISS

# Sharing NASA's Data and Results

## Through Open, Appropriate Access

Across NASA, the OCIO's IT teams deliver the services that allow our missions to share their data and results with a broad spectrum of stakeholders, including international space agencies, research partners, and the public. These services vary widely, from projects like the Enterprise Data Platform (EDP) which celebrated its first operational release and allows its users to significantly accelerate rapid insights from key data sets, to updating Armstrong Flight Research Center's data center storage infrastructure which increased data transfer rates ten times. They also include a full-scale communications campaign, coordinating across several NASA offices to educate employees on post-COVID-19 policy changes. Here are a few more examples of how the OCIO shares NASA's data and results:

- The Section 508/IT Accessibility Lead was hired to go beyond compliance and provide better services and support for those with disabilities and remove barriers to inclusion. The OCIO also partnered with the Office of Diversity and Equal Opportunity to educate civil servant and contractor communities about responsibilities in complying with Section 508 of the Rehabilitation Act.
- The Aeronautics Research Mission Directorate Flight Data Portal (AFDP) system replaced the end-of-life Armstrong Flight Research Center (AFRC) Flight Data Archive System (FDAS). AFDP is a web-based integration portal, allowing researchers easy access to flight data and its supporting information, regardless of researcher or mission locations. Scientists can remotely upload and register flight data and quickly search, access, extract, and download flight test data for further analysis, with a 60% potential reduction in processing time. AFDP will support a variety of missions, including the Quesst Mission



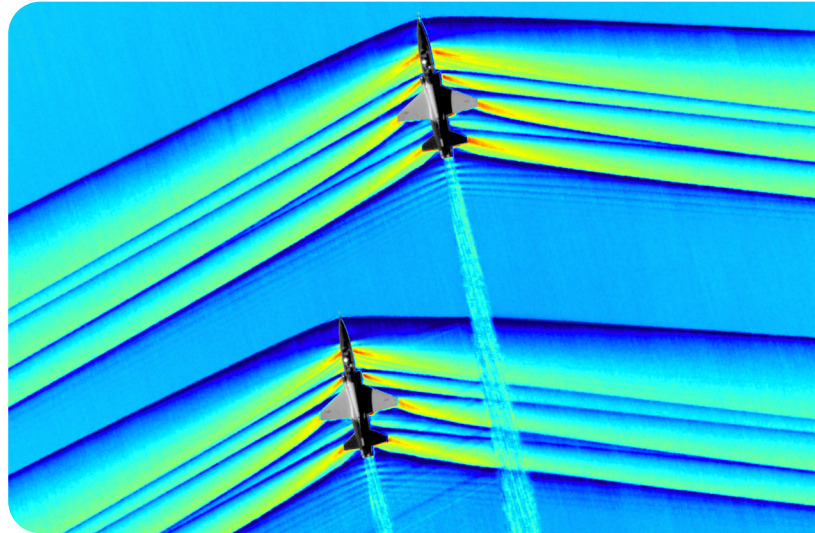
use of the X-59 Low Boom Flight Demonstrator and Aeronautics's Evaluation and Test Capabilities (AETC).

- The Stennis Space Center Data Center (SDC) significantly improved storage systems through equipment upgrades, controls, and process improvements. The migration of SDC server infrastructure included enhancements to support mass data storage volumes for video data storage processing head nodes updates, and expansion of tape backup libraries. These updates provided an additional 220 terabytes of storage, greater availability, increased bandwidth, high performance scores, and stronger data security.
- Johnson Space Center's Network & Telecommunications Services Multimedia Team worked above and beyond to support the Orion spacecraft and the Office of Communications (OCOMM) during the Artemis I mission. Throughout the duration of key Artemis I events, this team reconfigured schedules and equipment to screen in-flight imagery and quickly provide it to OCOMM for public release, significantly faster than requested. These efforts were made concurrent to, and without impacting, the team's existing multimedia support for International Space Station operations.

# Increasing Mission Quality and Effectiveness Through Data and Technology

Data and information technology empower NASA's missions to reach great heights, inspiring not just our nation, but the world. The NASA Enterprise Automation Services office has implemented intelligent automation of manual processes that represent approximately 9,600 labor hours or 4.6 full-time employees. At AFRC, the OCIO's Photo Team helped develop an airborne schlieren camera system capable of imaging shock waves with high resolution and was recognized for their work by the SCHlieren, Airborne Measurements, & Range Operations for QueSST (SCHAMROQ) Phase II Project. The new NASA Data Catalog enables users to find, organize, document, report, share, reuse, and collaborate with data. The OCIO is developing a Services Directory and a Services Catalog to help customers discover IT services, as well as facilitate ordering, provisioning, and service management. Continue reading for more examples of increasing mission quality and effectiveness in 2022:

- Network and telecommunications services play a critical role in enabling NASA to perform its missions. The NASA Ground Communications System (NASCOM) provided the terrestrial network for voice, data, and video between ground space communications receivers and mission platforms for more than 40 launches and missions, including ISS spacewalks, the DART Terminal Impact on the asteroid Dimorphos, and Space-X Falcon-9. At Wallops Flight Facility, the Wallops Facility-Unique & Specialized Engineering (FUSE) Team provided the integrated, specialized, and crosscutting IT security, project management, cable plant, video, voice, telemetry, and network support services for six additional missions.
- The OCIO's Service Management Office spearheaded two significant efforts to provide near real-time incident response situational awareness for impactful degraded IT services or unplanned outages. These critical platforms are building blocks for quick-view dash-



boards offered to all NASA personnel and improved incident response times across OCIO service lines.

- The Mission Cloud Platform (MCP) expanded access for 32 more NASA customers, now hosting more than 100 science and mission projects. This platform adds government service delivery to commercial cloud services giving organizations across NASA the power of cloud with centralized service management and security. MCP streamlines and standardizes the onboarding and security processes while building shared services for missions to consume. New features for 2022 reduced allocation time down from hours to minutes, better communicated updates, and allowed for more secure data. The MCP team received two Agency Group Achievement Awards for outstanding achievements in developing, securing, and implementing the MCP.
- Glenn Research Center's OCIO team helped develop the Human Research Program, cross-cutting Computation Modeling Project's Medical Extensible Dynamic Probabilistic Risk Assessment Tool (MEDPRAT) V2.0. This tool simulates crew health during spaceflight in order to quantify the impact of health and performance risks. MEDPRAT will inform mission planning, research prioritization, spaceflight medical risk quantification, and trade space analyses. The MEDPRAT team received a Spaceflight Awareness Award, with a Trailblazer Award to Technical Lead Lauren McIntyre.



# Accelerating Mission Results

## Through Increased Productivity

By increasing the quality and productivity of IT services, NASA's OCIO teams across the agency facilitate the expansive work and accelerated results of the flight, science, space exploration, and technology missions. Everyday, OCIO teams are upgrading infrastructure to better connect our facilities and partners, improve cybersecurity, stabilize systems, and expand features. Our teams also connect with stakeholders to engage with customers and share. At NASA Headquarters, the monthly IT Project Review Meetings gather the Headquarters community to improve communications and transparency; encourage information sharing and collaboration; and educate about new tools. Below are a few more examples of how the OCIO is accelerating mission results:

- After the COVID-19 pandemic, more NASA personnel are returning to work onsite, either full time or with a hybrid schedule, while others continue to telework fulltime. A number of OCIO projects to support our hybrid workforce have been deployed or are in development. In 2022, the Enterprise Book a Space Hoteling Reservation Tool was launched. This tool allows NASA employees to easily reserve shared workspaces, such as desks, cubicles, and offices (also known as hoteling). Personnel can filter options based on date, time, and location selected. The Modern & Inclusive Collaboration Spaces project jumpstarted hybrid meeting proficiency with a ten-video training curriculum, completed in partnership with Future of Work initiative, and co-sponsored "Innovation Labs" at every center to seed future hybrid technology exploration.
- Center teams also prepared for NASA's "Future of Work," by implementing hybrid meeting technologies for conference rooms, providing ongoing hybrid meeting support, implementing new conference room scheduling systems, and sharing network information with operations teams. Hybrid meeting



rooms and technologies allow personnel to collaborate and meet whether in the office, in the field, or at home. Technology advancements will ensure continued improvements in user experience.

- The agency internal website for artificial intelligence and machine learning (AI/ML) has become a focal point for all activities related to AI/ML at NASA, hosting more than 37,000 site visits. The site provides information about AI/ML training, tools, cloud services, workshops, strategies, and more and has been praised for serving as a model for similar websites. AI/ML service providers can list their services or use it as a portal to their own sites. In 2022, the AI/ML monthly newsletter debuted to hundreds of NASA personnel.
- The Wallops Marsh Fiber team completed the fiber cable installation across the marsh, developing a modernized, geographically diverse fiber optic cable pathway from Wallops Island to the Main Base. The previous fiber optic cable at Wallops was one 72-strand fiber optic cable that was about 30 years old and very unreliable. The new fiber cable eliminates the risks associated with the old cable and provides redundancy, increased speeds, and strengthened cybersecurity protection.



# Increasing Mission Safety and Resilience

## Through Adaptive Cybersecurity

In an environment of increasingly creative and sophisticated threat-actors, NASA must constantly protect its networks, operational technology, intellectual property, sensitive information, critical mission systems, and data from intrusion, corruption, and theft. The Cybersecurity & Privacy Division, along with service lines, developed an automated cybersecurity scorecard to allow NASA leaders and systems owners to understand cyber risks associated with systems under their purview and take immediate action on existing vulnerabilities. Application & Platform Services reduced the risks to the application portfolio, including removing more than 210 end of life applications and reducing applications with less secure authentication methods. The Russia Services and Identity, Credential, and Access Management teams, along with the Office of Protective Services, implemented additional authentication measures in Russia. Continue reading for more examples of increasing mission safety and resilience:

- In addition to internal objectives, NASA's cybersecurity is also measured by the Office of Management and Budget (OMB) and Office of Inspector General (OIG). In Fiscal Year 2022, NASA's Federal Information Security Modernization Act (FISMA) OIG rating rose to "Level 3: Consistently Implemented" from "Level 2: Defined," a significant improvement. NASA also received an overall score of 80% on the FY22 Annual FISMA OMB Report, primarily due to improving NASA's ability to manage cybersecurity risk to systems, assets, data, and capabilities.
- NASA has made significant progress moving towards a Zero Trust Model security framework for traffic and access. In this model, all resource access attempts require verification of the identity and authentication of users and devices, regardless of where they are located, to reduce the risk of data breach. Progress includes upgrading foundations across centers to a Software Defined Network for micro segmentation and implementing NASA O365



with contextual factors such as user, device, location, and real-time risk information to control what a specific user can access, and how and when they have access to NASA data.

- The OCIO's Enterprise Email Architecture Team (EEAT) reviews, designs, and mitigates email vulnerability findings across NASA's email networks to secure and simplify legacy email architectures. This team mitigated an email spoofing vulnerability discovered through testing. Additional testing confirmed resolution of the issue.
- NASA's internet perimeter has been improved to better combat cyberattacks and malware threats, while enhancing network resilience. The OCIO blocks approximately 5 billion malicious and unauthorized traffic attempts to access internal networks and systems per day. Additionally, new cybersecurity tools and configurations were implemented inspect all inbound and outbound email, blocking approximately 1.5 million threats weekly.
- In 2022, NASA continues to be recognized as a Supply Chain Risk Management (SCRM) leader in the federal government. The Cybersecurity & Privacy Division SCRM lead has coordinated, briefed, shared documentation, and trained most of the federal executive branch as agencies began to implement their SCRM programs.

# Increasing Mission Cost-Effectiveness

## By Driving Efficiency and Reinvesting the Difference

In addition to providing innovative, secure, resilient, and adaptive services to our customers, the OCIO must also seek efficiencies within the organization to expand mission access to IT and reinvest in IT services. A centralized IT Acquisition office was established for consistent policy, performance, and oversight. Continued license management progress was made by completing seven software audits, focusing resources on mission work rather than corrective or audit fees. Additionally, implementation of the ServiceNow SAMPro tool supports license management and monitors license use to reduce duplication or over-purchase. Below are other OCIO efforts to seek efficiency and increase mission cost-effectiveness:

- In October 2022, the OCIO completed organization realignment in support of the OCIO Transformation Project and implemented a redesign of the agency's IT Operating Model. Notable changes to the IT Operating Model include, but are not limited to, the OCIO's organizational structure, governance boards and processes, the IT acquisition strategy and contract management, optimizations to resource and budget management, and new approaches to improving customer experiences.
- Kennedy Space Center's Voice Team has worked hard to manage mission voice system changes and upgrades that meet evolving customer requirements while obtaining cost efficiencies. The team performed a top to bottom inventory, identifying opportunities to substitute more expensive keysets with less expensive systems during a refresh and deletion of superfluous systems. Additionally, transitioning systems to less expensive facility power solutions, negotiating lower process, and avoiding unnecessary replacements resulted in more efficiencies. These methods were shared with other centers to expand efficiencies.




- The Johnson Space Center (JSC) OCIO led an effort at JSC to create the Dare Unite Explore (DUE) survey. DUE allowed JSC civil servants to voice their thoughts on the products, processes, and facilities of JSC. Using Python and Natural Language Processing (NLP), the JSC OCIO was able to process and provide valuable data in one day, transforming from a time-consuming, manual process. The JSC DUE initiative will shape the future of work, improve products and processes, and modernize facilities for the future.
- Consolidation efforts echo across NASA's centers, with official completion of the OneNASA Intranet Project consolidating 109 sites into one seamless internal intranet for all of NASA while still providing center-unique information to employees. The Imagery Digitization project at Armstrong Flight Research Center (AFRC) continues to successfully coordinate shipments between AFRC and JSC for digitization. AFRC's Imagery Digitization project saves the photographic history of AFRC from 1949 until the present for generations to come; more than 100K images have been digitized to date. Langley Research Center migrated more than 500,000 documents and over 4.0 Terabytes of data to more modern and secure tools that improve collaboration.

# Enabling Discovery and Understanding

## As a Strategic Partner on Capabilities like Data Science

As NASA explores the secrets of the universe, facilitating greater discovery and understanding is part of our core mission. Additionally, strategic partnerships are a hallmark of the OCIO's work, whether aligning center OCIOs, service lines, and agency-level offices; teaming with other mission support offices; or embedding within mission directorates. To improve the customer experience, Business Relationship Managers (BRMs) and Customer Relationship Managers (CRMs) were established as the consistent customer interfaces to anything OCIO. In support of the Artemis 1 launch, NASCOM worked closely with all organizations involved in the end-to-end telemetry dataflows to test and perform a root cause analysis on an anomaly discovered during preparations. Continue reading for additional ways the OCIO has enabled discovery and understanding:

- The Digital Transformation initiative drove several advanced prototypes of next-generation digital solutions to mission challenges, including the first US artificial intelligence/machine learning (AI/ML) demo on the International Space Station. This astronaut glove inspection generated a GO/NO-GO recommendation in 45 seconds instead of involving multiple people over several days. The cross-center team received a 2022 Space Flight Awareness Award for the space gloves project.
  - In support of the James Webb Space Telescope (JWST) launch activities, the Headquarters/Goddard Space Flight Center OCIO provided 24x7 cyber operations and international travel support for personnel involved in launch activities. When the first images arrived from JWST, the Web Services Office maintained the stability and performance of the NASA Image and Video Library, allowing for millions of viewers to see the very first images produced in real time. The site recorded 5 million hits and 13 million requests for media files.
  - Center teams also provide critical multimedia support for an array of NASA missions. The Stennis
- 
- Space Center Audio Visual services supported OCOMM by documenting Artemis mission propulsion testing, as well as video and still photography support during the Artemis rollout, Wet Dress Rehearsal, and flight test at Kennedy Space Center. AFRC provides still and motion imagery of test aircraft that are used for flight research and testing.
  - The JSC OCIO, along with the JSC Engineering Directorate, other centers, and industry/academia partners, created the Big Idea/Project Luna. This innovative proposal will build a flex hybrid space dedicated to NASA and industry collaboration, initially focused on exploration formulation initiatives. The collaboration between NASA's expertise and data and advancements from external partners will unlock a "space for all." This project is expected to begin in FY 2024.
  - OCIO's Cybersecurity and Privacy Division (CSPD) formalized the Cybersecurity Mission Integration Office, effectively resourcing cybersecurity mission engagement and partnership from a perspective of advocacy. CSPD also facilitated the Artemis Cyber Summit in partnership with the Artemis programs (Space Launch System, Exploration Ground Systems, Human Landing System, Gateway, Orion), fostering awareness of cyber challenges, providing knowledge of Artemis program architecture, and delivered training.



**NASA Mission:** *NASA explores the unknown in air and space, innovates for the benefit of humanity, and inspires the world through discovery.*



**OCIO Mission:** *OCIO delivers IT capabilities that meet NASA's diverse missions more efficiently, securely, and innovatively.*