National Aeronautics and
Space Administration

2023

NASA
IT Annual Report

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Message from NASA's Chief Information Officer

Information Technology touches all our lives every day. At NASA, IT is intertwined with every mission, every launch, and every discovery. We depend heavily on our IT capabilities to keep complex missions and operations moving forward.

In 2023, the Office of the Chief Information Officer (OCIO) reached significant milestones and supported groundbreaking space, aeronautics, and science missions and initiatives. Our IT helped spread awareness and excitement about numerous NASA missions such as Artemis II and the return to the Moon, the SpaceX Falcon 9 Dragon Crew-6 launch, the return of the OSIRIS-REx sample, and the opening of the Earth Information Center, which makes Earth science and climate data more accessible to scientists, engineers, people around the world, and much more.

Sharing NASA's data and results is paramount. NASA's world-class research produces data that must be safely stored, yet made accessible to our scientists, education and industry collaborators, and international partners as well as the public. To do all this, it's critical the agency have modern, innovative, and collaborative technologies with integrated cybersecurity protections to help us accomplish our important work.

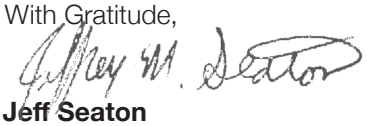
This year, the agency continued its multi-year transition to a Zero Trust Architecture to improve our cybersecurity posture and simplify our cyber processes for employees. This provides NASA employees and partners with timely, equitable data and resource access by consistently requiring IT user identity and device authentication and authorization. Through a massive, coordinated agencywide effort, NASA ensured that implementation of Multi Factor Authentication (MFA), Data-at-Rest encryption (DAR), and Data-in-Transit encryption (DIT) requirements increased across all NASA IT systems. The progress made in this effort provides a stronger protection against attacks and increases mission safety and resilience.

The behind-the-scenes cyber work made it possible for us to improve our entire web footprint. OCIO together with the Office of Communications and the Science Mission Directorate, advanced communications through the agency's web modernization project which included a redesign and redevelopment of NASA's three flagship agency-level platforms (nasa.gov, science.nasa.gov, and the OneNASA internal SharePoint). Visitors now have a better online experience and we have improved the way we communicate with external audiences.

Internally, our teams are solving customer problems, sustaining crucial services, and developing new, innovative, and reliable capabilities to help everyone do their work better. OCIO is committed to delivering the tools and technology NASA employees need to have a more productive and satisfying work environment.

I want to thank all the talented IT staff across the centers for their dedication and commitment to advancing our priorities. This annual report highlights some of our many accomplishments that reflects everyone's hard work. I am incredibly thankful for what we have achieved together so far, and I'm excited about the incredible journey that lies ahead in IT at NASA.

With Gratitude,



Jeff Seaton

NASA Chiel Information Officer

NASA's IT Strategic Plan

NASA's IT Strategic Plan outlines our vision for the strategic use of information and technology at NASA through fiscal year (FY) 2026. This plan provides a unified direction for mission alignment, roadmaps, investments, and accountability for NASA's IT community to help achieve NASA's Strategic Plan. We engaged NASA's mission directorates, mission support offices, and centers during formulation, as well as external stakeholders. The agency's resulting IT strategy focuses on achieving outcomes—the impacts and change NASA's missions need to be successful.

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.

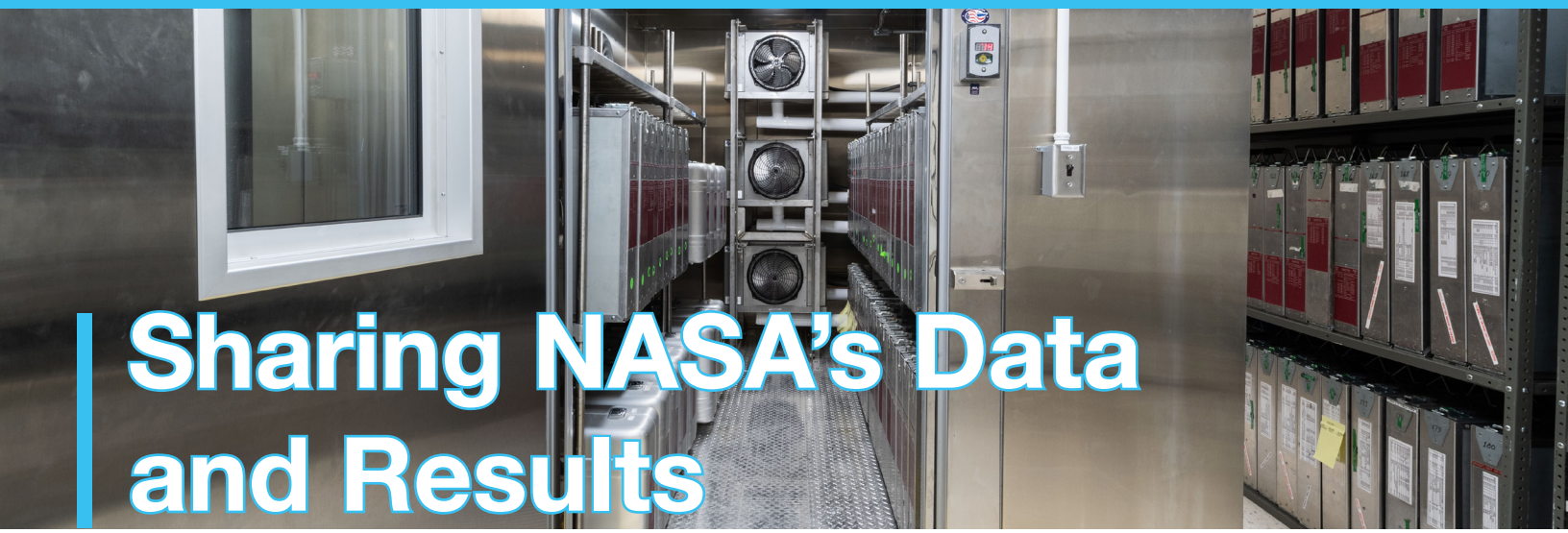
Progress toward the plan and related performance objectives helps NASA personnel improve agency outcomes by driving discoveries as a strategic partner, accelerating results through productivity, sharing NASA's data and results, and increasing quality, resiliency, and cost-effectiveness.

To achieve these outcomes, the strategic goals and objectives in the NASA IT Strategic Plan 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

Making a Difference in Numbers in 2023

- Intelligent Global Search indexes **130M objects** from current and historical projects.
- **70,000 of the 553,045 historical negatives** digitized from the Langley Photo Archives.
- ARMD Test Data Portal will host more than **1TB of data** from Quesst Mission tests.
- Increased NASA's implementation of multi-factor authentication (by **48%**), data-at-rest (by **46%**) and data-in-transit (by **36%**) encryptions.
- IT Service Management (ITSM) Strategy and Roadmap relays SM plans for next **4-5-years**.
- **386 interns** at Goddard and **110 interns** at Headquarters onboarded via new tool.
- **80% reduction** in time-to-resolution for incidents during MSFC pilot after integrating the Enterprise Network Operations Center (ENOC) and Security Operations Center (SOC).
- **74% increased** use of commercial cloud storage, **43PB to 75PB.**
- The Cybersecurity Improvements Portfolio baseline includes **8 Federal mandates, 111 requirements,** and **73 projects and initiatives.**
- **100% Wi-Fi coverage** at six locations and extending at all others after wireless surveys across 150 facilities at 14 locations.
- Proactively replaced **900 strands of fiber connections** at Wallops.
- Trained over **600 civil servants and contractors** in Generative AI capabilities and ethics, gathering **200 test use cases.**
- Migrated **158 switches, 545 wireless access points,** and **11K devices** to Langley's software defined network.
- SPARTA dashboards integrated **3.9M disparate data records** for **249 missions.**
- Johnson's Artemis II crew reveal had nearly **669K views** across YouTube, Twitter, Facebook, and Twitch.
- Contract optimization reduced number of **IT contracts by 50%.**
- **939 Digital Transformation projects** are active, planned, or proposed across NASA.
- **39 cybersecurity handbooks** converted for easy feedback, **21 public feedback form comments,** and **210 changes** made to handbooks.
- **40% fewer printers and multifunction devices** at Glenn after optimization.
- **35,880 cumulative person-hours** saved to date by intelligent automation.



Sharing NASA's Data and Results

NASA's world-class research produces data that must be safely stored, yet accessible to our scientists, education and industry collaborators, and international partners. Tens of thousands of these data sets are made available to the public via NASA's online data portals: data.nasa.gov, code.nasa.gov, api.nasa.gov, and developer.nasa.gov. In 2023 these, these portals were modernized, updating data and information, ensuring accessibility for all visitors through compliance with Section 508 of the Rehabilitation Act, enhancing data security, improving search capabilities, and bettering customer service with a new ticketing system to track issues and requests. Keep reading for additional stories about how NASA's IT organizations help our missions document, organize, and share critical research data:

- In partnership with the Office of Communications (OCOMM), Stennis Space Center's (SSC) OCIO broadcast and streamed the RS-25 engine test series, as well as test team interviews and interesting facts to TV, Facebook, and YouTube, enhancing video quality with digital 4K video and aerial drones. At NASA Headquarters, local, Network & Telecommunication Services (NaTS), and AEGIS teams installed network, technical components, and an interactive kiosk for the Earth Information Center: a dedicated space for the public, visitors, and decision-makers to understand NASA's research and reporting on Earth's climate change.

- The Armstrong Flight Research Center (AFRC) supported the development and implementation of the Aeronautics Research Mission Directorate's (ARMD) Test Data Portal (ATDP). The portal replaced end-of-life technology and centralizes ARMD flight test and research data for easy access by researchers across the agency, partners, and contractors. The ATDP also shares wind tunnel test data with the Enterprise Data Platform (EDP). Missions using the ATDP include the Quesst X-59 Low Boom Flight Demonstrator large data sets, and Aerosciences Evaluation and Test Capabilities and Glenn Research Center's (GRC) wind tunnel ground test data.

- Marshall Space Flight Center (MSFC) continues to refine its Intelligent Global Search (IGS), a simple web interface that surfaces data from a variety of sources, maintains access controls, and is assisted by natural language processing, artificial intelligence, and machine learning for more relevant results. IGS data includes more than 130M mission information objects. The Headquarters/ Goddard Space Flight Center (HQ/GSFC) OCIO developed a streamlined solution to migrate the Robert H. Goddard Award nominations into a SharePoint library, eliminating manual submissions and saving time for nominators and administrators. OCIO's cybersecurity policy team converted 39 handbooks from signed PDFs to increase accessibility for all users, allow for continuous feedback and more frequent updates, and be easily searchable. Since the conversion, there have been 21 comments and 210 changes.

- Preserving NASA's historical record is a critical function supported by OCIO teams. The Langley Research Center (LaRC) Photo Archives Team has been digitizing its physical collection of 553,045 priceless photo negatives that date back to 1921. The team digitized approximately 70,000 negatives this year, the most since the initiative began. AFRC and Johnson Space Center (JSC) continued a preservation project to save AFRC's photo history from 1949 to the present by digitizing and processing more than 160,000 images for metadata.

Increasing Mission Quality and Effectiveness

The future of mission data management lies in the cloud. The OCIO's Cloud and Computing Services (CCS) enables tremendous computing for services, including an 126% increase in cloud storage in 2021-2022 and an additional 74% in 2022-2023. Many missions are taking advantage of the commercial cloud space, including Surface Water Ocean Temperature (SWOT), which launched in December 2022 and is now processing, storing, and distributing all its information via the cloud. Other missions using the cloud are Human Health and Performance systems, Genelab, Science Discovery Engine, and Time-Domain Astrophysics Coordination Hub (TACH). NASA's Mission Cloud Platform (MCP) supported the Moon to Mars (M2M) Space Weather Analysis Office throughout Artemis I, as well as additional mission ground system testing. Here are additional stories of increasing mission quality and effectiveness this year:

- Modernized services are easier to access and increase efficiency. In 2023, 496 interns at NASA Headquarters and Goddard were onboarded with a new tool that streamlined IT equipment ordering and communication between OCIO and mentors. Workplace and Collaboration Services (WCS) implemented a global audio-conferencing service that is integrated within Microsoft Teams. AFRC consolidated SolidWorks servers from three to one, providing state-of-the-art features and tools which enable more sophisticated designs, simulations, and analytics while improving software performance, minimizing downtime, and increasing reliability.

- Delivering telecommunications and imagery services during high-profile mission activities, Kennedy Space Center's (KSC) Integrated Communications, Network and Tracking (ICAN)/Communication Data Processor (CDP) team successfully developed, certified, and operated the system for the Artemis I launch. During mission operations, the KSC team solved a launch system anomaly constraining the launch. Center OCIO offices, along with local leadership, are investigating and evaluating Wi-Fi coverage concerns and needs. Wireless surveys of 150 facilities were conducted and coverage is being expanded, leading to a better on-site wireless experience with higher throughput, stronger signal, and fewer dropouts. Goddard TV Operations aired over 15 launches, like the SpaceX Falcon 9 Dragon Crew-6 launch and Double Asteroid Redirection Test (DART).

- OCIO's Strategy and Architecture Office (SAO) developed an Agency Roadmap Manager (ARM) capability to collect planned strategic IT investment content across service lines, mission directorates, mission support offices, and centers. This holistic view allows for analysis against priorities, risks, and investments, providing senior leadership with visibility into disparate and overlapping business needs and enhanced investment decision making. An IT Service Management (ITSM) strategy and roadmap, laying out a 4–5-year strategic plan towards the ITSM target state, were completed by the Service Management Office (SMO).

- In partnership between SAO and the Enterprise Program/Project Management Office (EPMO), OCIO Performance Management was established to develop, align, and report on key strategic performance measures. By aligning Objectives and Key Results and a Balanced Scorecard to the NASA IT Strategic Plan, it ensures OCIO organizations can align and prioritize work that drives NASA's IT strategy. EPMO also enhanced the IT Governance Framework with three new service line boards and completed service improvements, including updating the ITMB Charter, using Teams Polling, readdressing decisions made at IT boards for awareness and impact, and a monthly roundup to all boards on decisions and impacts.

Accelerating Mission Results

To enable our missions to accelerate their results, the OCIO executes projects directly for missions, invests in platforms open to many, and makes administrative changes to streamline processes. One innovation of great interest to the agency is Generative AI. In 2023, the OCIO initiated a controlled and limited test of Generative (Gen) AI for leaders to consider an enterprise scale adoption. Large language model GenAI capabilities are gaining popularity because they rapidly generate high-quality images, audio, text, code, simulations, and videos. Restricted to non-sensitive data, over 600 users received NASA and vendor training on emerging cloud-based AI technologies and more than 200 use cases were gathered for testing. Keep reading for other ways the OCIO is accelerating mission results:

- AFRC's still and motion imagery teams use high-performance test aircraft to document project testing. In flight chase photography and videography gather data, monitor the safety of flights, and provide visual data on flight research ensuring mission results are validated, captured, and documented. A partnership between MSFC, JSC APPDAT, and MSFC Engineering Directorate application administrators delivered a cloud-based simulation of the Four-Bed CO2 Scrubber, one of the primary ways of removing carbon dioxide onboard the International Space Station. Using the scalable cloud allowed for more streamlined analysis and visualization than was possible with existing tools and does not require maintaining complex infrastructure. 576 feet of fiber were installed at Wallops Flight Facility (WFF) for the U.S. Navy's Protected Distribution System. Additional fiber was also repaired while ensuring national security was maintained.

- While some rely on individualized support, other teams are implementing capabilities to serve a broad range of programs. The KSC OCIO supports NASA's Digital Transformation (DT) Initiative through custom Internet of Things (IoT) design and consulting services and Model Based Systems Engineering (MBSE) development support, including hardware and software design, data logging and storage, and reporting.

- Expanding platform capabilities, Enterprise Data Platform 1.0 was delivered, facilitating a culture of data transparency, fair and equal access, and collaboration across organizations. Platform expansion will enable data storage, management, analysis, and visualization-improved decisions. The MCP team kicked-off project ATLAS to unify and extend secure, cloud-based capabilities into a single integrated offering, enabling missions, business operations, and partner collaborations on Earth and beyond.

- Administrative support also drives acceleration. JSC revamped its Export Control Program (ECP) processes to visualize the key strategic and tactical workflow steps, from center-to-agency, including foreign-national controls. These efforts identified bottlenecks, waste, and delays to increase EC output quality, create better outcomes for customers and teams doing the work, reduce lead time, and drive potential savings. In partnership with the Office of International and Interagency Relations (OIIR), the OCIO supported the Office of the Administrator's international travel, including loaner device tracking; managing badge, training, and certificate expirations; and other details for hassle-free IT when traveling. Within WFF and NASA Headquarters, IT teams modernized conference rooms with new technology to support hybrid meeting capabilities for the Future of Work (FoW) posture.

Increasing Mission Safety and Resilience

Critical to the success of NASA's missions is the safety and security of information, systems, and equipment. Achieving effective protections requires a partnership between the OCIO's cybersecurity apparatus, mission personnel, and the Federal Government. In 2023, EPMO established the Cybersecurity Improvements Portfolio (CIP) to manage the scope, cost, schedule, performance, and risk of projects to improve NASA's cybersecurity posture and deliver strategic OCIO objectives. The CIP baseline includes eight Federal mandates and their 111 requirements, establishing 73 projects and initiatives to meet mandates. One initiative is the multi-year network transition to a Zero Trust Architecture to provide employees and partners with secure data and resource access by consistently requiring identity and device authentication and authorization. Other resilience efforts included:

- The National Security Council (NSC) set cybersecurity requirements for Federal agencies. Through a massive agencywide effort, NASA increased implementation of Multi Factor Authentication (MFA), Data-at-Rest encryption (DAR), and Data-in-Transit encryption (DIT) by 48%, 46% and 36%, respectively, across IT systems. Systems unable to meet the requirements documented plans or made risk acceptance requests which included risk management mitigations. The Cybersecurity & Privacy Division (CSPD) provided detailed guidance and technical support, reviewed all documented plans and risk acceptances, and provided specific feedback to information system owners to help improve NASA's overall cybersecurity posture.
- NaTS's Software-Defined Architecture (SDA) project significantly increases the security posture of the network and ability to meet customer requirements based on the device risk. Langley was the first center to complete transition with Phase 1 of their SDA project. The team migrated 158 switches, 545 wireless access points, and approximately 11,000 unique devices to the SDA fabric. The lessons learned at LaRC are being used to improve transitions at other centers. WFF completed an SDA fabric migration to a zero-trust network environment, allowing users to move around campus without making a new IP reservation and redirecting guest devices to the guest network for greater security.
- Adding resilience to our systems increases the flexibility and longevity of our investments. GRC's OCIO leadership worked with the center to review GRC's system security plans (SSP) and align them to the requiring organizations. Customers have increased insight into, and awareness of, SSPs that affect their organizations as they accept risks or make mitigations based on mission value and requirements. Through a new user-friendly and automated cybersecurity scorecard, NASA Information System Owners (ISOs), Information System Security Officers (ISSOs), Authorizing Officials (AOs), and leadership can better identify where to improve the management of IT risk within their SSP.
- Led by the SMO, the OCIO partnered with the Office of the Chief Human Capital Officer (OCHCO), Office of STEM Engagement (OSTEM), and the Office of Protective Services (OPS) to address onboarding, badging, fingerprinting, and identity proofing COVID-19 waivers, worked to standardize processes, and integrated new responsibilities while supporting Fall 2022 and Spring 2023 intern onboarding. These efforts significantly improved the time to onboard new employees and improved NASA's cybersecurity posture for Return to Work and FoW efforts.

Increasing Mission Cost-Effectiveness

Effective missions rely on well-planned, managed, and administrated IT services, responsibly stewarding public investment. In Fiscal Year 2023, NASA received Congressional authorization to establish an IT Modernization Working Capital Fund (WCF) within the NASA WCF. The new WCF enables the OCIO to formulate and execute cost-effective, strategic modernization projects that appropriately consider risks, merits, and alternatives for IT modernization investments. The Enterprise ITSM project uses the WCF to support NASA's IT strategic goal for achieving operational excellence by implementing effective ITSM using a standardized framework for IT services that improves value to customers and enables NASA's missions. Creating value also includes evaluating for efficiencies, transitioning contracts when necessary, and expanding insights into investments:

- The DT Initiative created the first searchable inventory of agencywide DT efforts and solutions. They collected organizational DT plans, including transformation goals; their current, planned, and proposed investments; and alignment to the NASA DT Strategy. There are nearly 1,000 DT efforts across NASA, with about one third currently in execution. DT partnered with Application & Platform Services (APS) to create a dashboard for the inventory and SAO to marry DT and IT customer needs in the Agency Roadmap Manager. Another DT portfolio management dashboard for the Smart Projects and Reviews with Transformative Analytics project gives project teams and reviewers greater insights, as well as the abilities to rapidly identify risks and trends across centers, projects, and capabilities and implement mitigations to avoid major impacts. Using this dashboard, 78 partners are monitoring 3.9 million records across 249 missions.

- NASA conducted a yearlong review of each OCIO data center, assessing electrical and mechanical systems, servers, storage, staff, cloud adoption, etc. and found that most of the OCIO-operated data centers are underused, with many requiring considerable maintenance. The data collected will inform future divestment decisions and a single data center environment provides a consistent set of processes, procedures, and requirements. Divesting underused assets and continually migrating data to the cloud creates efficiencies and balances data center facilities with demand. About ten data centers have been migrated from center ownership into the AEGIS contract.

- AFRC completed their own data storage optimization, transitioning from an end-of-life system to one with faster data processing, better performance, lower energy consumption, potential savings, and increased reliability. NASA Headquarters migrated several services to the cloud, realizing savings with reduction in data centers and consolidated licenses.

- Following OCIO Transformation activities, organizations continue to consolidate services for efficiencies, customer service, and potential savings. Enterprise shifts include the Centralized Information Technology Request (CITR) application as a one-stop process and team to ensure that 100% of IT purchases comply with Federal and NASA cybersecurity policies and guidelines. Ames Research Center (ARC) moved from the local IT Help Desk to the Enterprise Service Desk for IT issue resolution with minimal transfers and follow ups. NASA Enterprise Automation Services successfully saved 35,880 cumulative person-hours to date with intelligent automation, heightening operational efficiency through rapid completion of repetitive tasks, reducing error rates, and continuous 24/7 availability.

Enabling Discovery and Understanding

NASA's Digital Transformation (DT) initiative strategically uses IT to enable discovery and understanding. In partnership with OCHCO, DT led the development of the Digital Academy on NASA's SATERN learning management system. Released this year, Digital Academy 2.0 makes it easier to quickly find training on digital topics, learning journeys by role, and Learning Labs for hands-on experiences. The personalized data literacy coursework ensures all employees have a threshold of data literacy, essential for quick and quality data-enabled decision making. In the first month, there were 350 Digital Academy visits and more than 50 course completions. Here are more stories of the OCIO enabling discovery and understanding:

- A joint effort between OCOMM, Science Mission Directorate (SMD), and OCIO redesigned and redeveloped three flagship platforms (nasa.gov, science.nasa.gov, and OneNASA) under the web modernization project. This aligns NASA with the website and digital service modernization provisions of the 21st Century Integrated Digital Experience Act. Launched in September 2023, nasa.gov and science.nasa.gov provide a consistent, integrated experience to visitors while ensuring all content is authoritative and up to date. Modernizing the technology of the main websites and streamlining public engagement with content online are critical first steps in making NASA's information more accessible, discoverable, and secure.

- A team from the SMD, Mission Cloud Platform (MCP), and Information, Data, and Analytics Services (IDAS) launched the beta sciencediscoveryengine.nasa.gov. Users can discover data, documents, tools, models, software, and code from the five SMD divisions, supporting SMD in the Federal Year of Open Science. In partnership with the Clearinghouse for the Open Research of the United States (CHORUS) publishing group, IDAS also streamlined and tripled public access to scientific publications through NASA's PubSpace, a single interface for the public to search peer-reviewed manuscripts from NASA, publishers, and a previous partnership with the National Institutes of Health.

- OneNASA, the internal web platform, was completed in 2022 to provide consistent and authoritative information to all employees and contractors via a searchable, secure, user-centered, customizable, and mobile-friendly platform. The Customer Engagement Office (CEO) leveraged this platform to modernize the OCIO's internal portal, redesigning the hub website, implementing the OCIO Staff Directory, and using intuitive navigation to make it easier for customers to find the IT services and support they need.

- The HQ/GSFC Information Science & Technology (IS&T) Colloquium Series shared DT and strategic IT innovation information, encouraging organizations to embrace digital technologies and transform operations. CSPD's Cybersecurity Mission Integration (CMI) hosted an "Ask-Me-Anything" event for 100 SMD members to answer frequently asked cybersecurity questions. The MCP Program Manager held more than 20 outreach events with the public, academia, industry, and NASA community to speak about evolving cloud technology and how NASA is using MCP to transform its mission capabilities. These events promote transparency, knowledge of public resources, benefits, and collaboration.

Front cover: NASA's Space Launch System (SLS) carrying the Orion spacecraft lifts off the Artemis I mission on 11/16/22. Photo: NASA/Chris Coleman, Kevin Davis.

P. 2 Banner: Overhead shot of the X-59 Quiet SuperSonic Technology (Quesst) aircraft assembly. Photo: Lockheed Martin/Garry Tice

P. 2 Inset: Artemis I launch team members at Firing Room consoles during launch attempt activities. Photo: NASA/Kim Shiflett

P. 3 Banner: Engineers in simulation training at KSC for the Polar Resources Ice Mining Experiment-1 (PRIME-1). Photo: NASA/Frank Michaux

P. 3 Inset: Visitors look through virtual reality goggles at NASA 2018 Earth Day exhibit in Washington, DC. Photo: NASA/Aubrey Gemignani

P. 4: Johnson Space Center's cold vault with the original Apollo, Skylab, Shuttle, and Station mission film. Photo: NASA

P. 5: "Cheer wall" of video greetings for the astronauts from NASA and partners during 2020's SpaceX Crew Dragon Demo-2 launch. Photo: NASA

P. 6: Armstrong OCIO in-flight chase photographer's selfie while inverted inside her chase plane. Photo: NASA/Carla Thomas

P. 7: NASA astronaut Bob Hines conducting research aboard the International Space Station (ISS). Photo: NASA

P. 8: DT's Smart Center dashboard fusing data from smart wireless sensors with autonomous drone facility inspections. Photo: NASA

P. 9: Guests at the Banana Creek viewing site watch the Artemis I launch at Kennedy Space Center. Photo: NASA/Keegan Barber

Back cover: Photo of Earth taken from the Apollo 13 spacecraft during its journey home on April 17, 1970. Photo: NASA

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