NASA INFORMATION TECHNOLOGY
ANNUAL REPORT

2021

Office of the Chief Information Officer

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2021 was another year of challenges as we all navigated the ongoing COVID-19 pandemic while also keeping the NASA mission moving forward. The team within the Office of the Chief Information Officer (OCIO) proved it could come together as a community to deliver consistently high-quality services while implementing improvements and innovations to benefit all employees at NASA. Information technology and the people behind it are integral to supporting NASA's mission. I am pleased to share the accomplishments we have made across our "One IT" community through the 2021 NASA Information Technology Annual Report.

To help provide NASA with secure, modern, and reliable IT services, OCIO pressed ahead on our transformation journey. The OCIO Transformation is a redesign of the agency's IT operating model to more directly enable NASA to achieve mission success and ensure that the OCIO is an organization where our people grow, learn, and thrive. Notable changes to the IT Operating Model include, but are not limited to, the OCIO's organization structure, governance boards and processes, NASA's IT acquisition strategy and IT contract management, optimizations to business and budget management, and new approaches to improving customer experiences.

OCIO people also served as catalysts for NASA's Enterprise Digital Transformation (DT) by connecting, integrating, and facilitating solutions to accelerate the transformation of NASA's work, workforce, and workplace. Digital transformation will increasingly change the way NASA operates, enabling agency missions to be completed more efficiently and effectively.

The OCIO Team is thankful for the partnership of Center and Mission leadership. Together, we continue to make strides in improving NASA's cybersecurity as we implement the foundations of a zero-trust architecture. The agency is staying ahead of cyber threats by using emerging technologies to detect and mitigate cyber threats to space and ground systems, implementing consistent cybersecurity controls, and deploying remote incident response tools for incident response and forensics.

Our collaboration tools continue to enable NASA employees to work securely no matter where they are, helping to shape the Future of Work at NASA. Some of the key technologies that supported our highly-distributed NASA workforce included: enhancements to Microsoft O365 and MS Teams; tools such as NASA Box for improved file sharing; providing a strong, secure, and resilient agency Virtual Private Network (VPN); development of COVID-19 contact tracing application and dashboard to aid NASA leaders; and growing an enterprise robotic process automation (RPA) service to automate enterprise and center-level processes.

The OCIO team is focused on continuing to deliver the advanced capabilities the people of NASA need and we're always interested in your ideas and feedback on how we can serve you better. Thanks for taking the time to check out this report and for being a valued partner.

With gratitude,

Jeff Seaton, Chief Information Officer

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

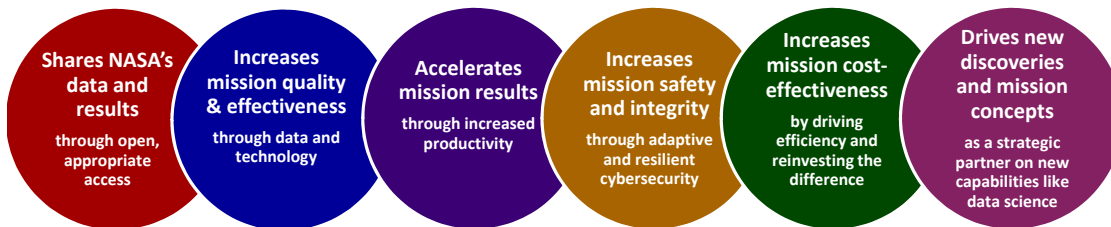Manage IT as a strategic resource to securely unleash the power of data.

IT Mission

Enable the secure use of data to accomplish NASA's Mission.

IT Values

Being a trusted partner is earned through Customer Driven (Responsive, Making IT Easy), Continuous Learning (Insight Driven), and Accountable (Transparent) behaviors.

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.

Shares NASA's data and results
through open, appropriate access

Increases mission quality & effectiveness
through data and technology

Accelerates mission results
through increased productivity

Increases mission safety and integrity
through adaptive and resilient cybersecurity

Increases mission cost-effectiveness
by driving efficiency and reinvesting the difference

Drives new discoveries and mission concepts
as a strategic partner on new capabilities like data science

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.

OCIO Transformation

- On September 21, 2021, the OCIO presented its final Mission Support Future Architecture Program (MAP) Key Decision Point briefing to the Mission Support Council and received approval to graduate from MAP. This milestone marks more than two years of careful and complex planning the transformation of the IT Operating Model to enable NASA's mission success.

- The formal organizational restructuring and start of the Pilot Phase began on October 24, 2021 after months of preparation. Key leadership positions were identified and established, critical skills and personnel were realigned, and Workplace and Collaboration Services became the first Service Line to transition.

Enabling a Shift to Enterprise

- Voice services transformation to soft phones across NASA will enable an enterprise-wide call manager that is more flexible and has more configuration options, enhanced security, and greater portability for voice forwarding and voicemail. Nearly 90% of NASA has been transitioned to VoIP (Voice over Internet Protocol) telephones.

- The new intent and incidental use forms for the Real Estate Agreement Systems (REAMS) were implemented to automate and standardize a manual process. By processing Real Estate Agreements and forms automatically in REAMS, NASA will save hundreds of labor hours for each contract that is routed through the system.

Digital Future

- In FY21, the agency launched the Enterprise Digital Transformation (DT) strategic initiative as a transformation catalyst by harnessing digital solutions across NASA to accelerate the modernization and transformation of our work, workforce, and work-place. DT will ultimately enable: a workplace with more efficient, effective, digitally optimized, and integrated processes using digital workflows with integrated data and models; more time and talent to be spent on research, analysis, and discovery instead of repetitive tasks; being part of a more connected, diverse, and digitally savvy workforce who work in hybrid on/off-site teams, geographically distributed across the nation (even world!); and the potential to take on exciting new kinds of work opportunities as roles emerge with NASA transforming to catalyze a new era of aerospace.

- To deploy software-defined access (SDA) to NASA's networks, SDA infrastructure components were installed and configured at sites across the agency, the design for virtual networks was established, and migrations to the SDA infrastructure are underway. SDA streamlines and automates the decisions and manual configurations needed for network security policies and reduces the need for reactionary patching and updates.

- To standardize the way centers communicate information out to the NASA workforce, the intranet site template and governance were completed, and all centers were consolidated onto a single intranet platform, OneNASA. In this new platform, the initial set of InsideNASA sites (23), Human Exploration & Operations Mission Directorate, and Digital Transformation sites (9) were completed. Several OCIO organizations, including some supporting programs, have also transitioned to the OneNASA platform.

- Headquarters' Information Technology & Communications Division developed the Anti-Harassment Application for the Office of Diversity and Equal Opportunity (ODEO) to process and monitor cases brought by alleged victims of harassment who wish to report the alleged harassment. This app was launched in April 2021.

Part of the Team

- Johnson's CIO Mission Readiness Team supports the multimedia requirements for International Space Station (ISS) Manned Missions, including ISS Expeditions 65 and 66, as well as SpaceX Crew 1 Landing, Crew 2, and Crew 3, while also providing support to the ISS around the clock.

- At Kennedy Space Center, the local CIO office provided landing splashdown imagery with visible and infrared cameras in gyro-stabilized systems for the Commercial Crew Program. Gyro-stabilization allows for tight shots of the capsules and parachutes in flight while infrared captures nighttime landings. This imagery is used for documentation, engineering, and public affairs.

- OCIO supported multiple video feeds for Space Launch System (SLS) Green Run tests via the Enhanced Video Content Delivery Network (EVCDN). It broadcasted the SLS Hot Fire Test via Multi-Channel Digital Television (MCDTV)/NASA-TV and transported more than two terabytes of real-time telemetry data to the Huntsville Operations Support Center (HOSC) for engineering analysis.

Critical Alliances and Enhancing Partnerships

- In partnership with the US Space Force (USSF), Ames Research Center began a five-year agreement for civil servant spectrum management expertise, including regular consultation on Space Force spectrum projects and USSF Spectrum Summits.

- Armstrong Flight Research Center's AFRC Weather page launched on September 20, 2021. The updated weather page provides new functionality for viewing weather stations on the lakebed and additional capabilities for reading and displaying data from multiple types of weather stations. The AFRC Weather page supports on-site monitoring of weather conditions and forecasting, centerwide safety monitoring, and flight operations and planning.

- Contributing to NASA's work with Unmanned Aircraft System (UAS) flights are IT teams across the agency. Ames coordinates with the National Telecommunications and Information Administration to operate and test unmanned aerial vehicles on Space Port America Range, White Sands, New Mexico. Kennedy provided aerial imagery from UAS, including aerial surveys and inspections of the Kennedy Solar Farm, antenna farm, and launch pad systems like lightning protection, Mobile Launcher, flame trench, and launch pad terrain mapping.

Technical Excellence

- Progress was made on the installation of 20,000 feet of fiberoptic cable across 3.5 miles of protected marshland for launch operations at Wallops Flight Facility (WFF). The upgraded fiber will support next-generation mission requirements, including faster data transfer rates, 4K/8K video, and future capabilities over the next 30 years.

- NASA's Mission Cloud Platform (MCP) accelerates mission cloud migration and adoption throughout NASA by offering a scalable and consolidated mission cloud service. MCP allows over 100 projects to leverage scalable on-demand resources, eliminate wasted capacity and cost of static data centers, improve cost-estimating via models, and increase security with common controls and patching.

- The OCIO partnered with NASA missions to design the NASCOM Mission Next Generation Voice (MNGV) system. MNGV will use an Internet Protocol (IP) network for voice communications, which is more flexible and secure than previous technologies.

Responding to COVID-19

- To combat COVID-19 transmission on site, the OCIO developed COVID-19 contact tracing dashboards and capabilities. NASA Chief Health and Medical Officer Dr. J.D. Polk gave an overview of contract tracing.

- The Executive Decision Lens (EDL) uses interactive visualizations to present COVID-19 information, including metrics informing decisions for onsite work, tracking NASA COVID case counts and vaccinations, and telework and leave workforce metrics. The EDL combines data from human capital, IT, and external public health sources to securely inform management decisions.

- To respond to the challenges of refreshing mobile and computer equipment in a remote work environment, NASA's end user support teams have support technicians onsite following safety protocols and at-home options with virtual guidance. In 2021, the computer refresh process was shorted to one hour.

- The OCIO ensured that NASA's workforce had access to IT capabilities needed for wide scale telework. In the past year, a wide variety of productivity-enhancing Teams features were implemented, such as Tasks, Pinned Posts, Hand Raising, Live Captions, Chat Visibility, Transcription, and Whiteboard.

- In March 2021, Zoom Webinar for NASA was launched for hosting large, external, public-facing webinars and virtual events of up to 20,000 attendees, such as scientific symposia, lectures, town halls, webinars, and presentations.

- MURAL, a virtual whiteboard tool that enables teams to work together to share information, brainstorm, and collaborate in a highly visual way, was deployed in June 2021. This tool integrates into meetings, has flexible features to help teams work together and visualize ideas, and allows for external partner participation.

- Funding through the Coronavirus Aid, Relief, and Economic Security Act (CARES) Act strengthened IT support for NASA's operations during the pandemic. Several applications were implemented and enhanced, enabling agencywide telework, including Microsoft Office 365 services, NASA's Contact Tracing and Tracking (CTT) application, data visualization, Salesforce low code applications platform, and accessible collaboration across the agency and its partners.

A New Way of Working

- The OCIO's end user support team developed a Return to Site Guide to help NASA employees prepare their equipment and workstations before returning on site and share support resources and best practices when working back in the office.

- As NASA leadership plans for the eventual lifting of on-site capacity limits and more people conducting onsite work, a new capability integrates Microsoft Teams meetings with ViTS videoconferences. This capability allows ViTS rooms to participate in Microsoft Teams meetings to bridge attendance between in-person meetings located at NASA Centers with participants working remotely via Teams and partners external to NASA.

- The OCIO's Applications Division trained 70% of their staff in the Scaled Agile Framework for Lean enterprises (SAFe) and launched initial Agile Release Training to align business value and outcomes to OCIO-provided services. SAFe allows the OCIO to visualize its work and deliver value faster to stakeholders and customers.

- In 2021, 20 Robotic Processing Automations (RPA) were run, saving an estimated 12,500 hours per year, while preparing the cloud environment, tools, and security posture for wide adoption of Intelligent Automation.

Enterprise Protection

- Deployed the Remote Incident Response Tool to Ames and other NASA centers, allowing IT security staff to perform remote incident response with a single tool across all operating systems, in contrast to the varying methods otherwise needed. IT security staff can work remotely, reducing health and safety risks during the pandemic, and incident response is more productive and error free with a single, consistent method.

- In April 2021, the Enterprise Information and Communications Technology (ICT) Supply Chain Risk Management (SCRM) service transitioned the Agency from its legacy Request for Investigation (RFI) process to the CATSCAN (Covered Article and Technology Supply Chain Assessment Needed) Process. This extensive and multi-layered implementation effort includes new toolsets, process updates, and training. CATSCAN Process improves the customer experience and increases opportunities for innovation as the security around NASA's supply chain and infrastructure is strengthened.

- The ICT SCRM Knowledge Center was launched in March 2021 to deliver timely communication to the ICT SCRM community. The site enables stakeholders to keep their fingers on the pulse of ICT SCRM activities, relevant resources, and notable supply chain-related news. Since its launch, the site has had a thousand views and counting.

- Enhanced reliability and security of IT assets and capabilities through Network Asset Control (NAC) enforcement, eliminating cybersecurity vulnerabilities by removing unauthorized software, and Application Control security policies on all IT firewalls. NAC allows the Agency to understand who, how, and what is authorized to access our network infrastructure.

- NASA maintained the highest rating for the FISMA Risk Management Assessment ("Managing Risk") for 13 consecutive quarters since Q3 FY 2018.

Cyber from the Start

- Based on survey feedback, developed FY 2022's annual cybersecurity training course for a remote telework environment using less bandwidth without sacrificing interactivity. New features include a test-out pretest per module, 508-compliant interactives (versus text-only), and a cumulative quiz at the end of each module.

- In 2021, the Cybersecurity Integration Teams studied top cybersecurity issues, producing comprehensive reports with 11 total recommendations and action plans to address cybersecurity policy gaps and develop a model to deploy cyber expertise to missions.

Protecting Data

- NASA successfully transitioned to the newly mandated Governmentwide initiative for marking sensitive information, replacing the "Sensitive but Unclassified (SBU)" marking system. The goal of the new Controlled Unclassified Information (CUI) program is to standardize, across the Federal Government, how sensitive information is marked, handled, and shared, while ensuring the information remains appropriately protected.

- As of July 2021, NASA met eight of ten of cybersecurity CAP goal targets on Performance.gov, exceeding its FY 2021 target of 70%. NASA achieved this performance by meeting the Data Protection CAP Goal target and progressed implementation of continuous diagnostics and mitigation (CDM) cybersecurity capabilities across the agency. CDM sensors enable identification of assets on the network and vulnerabilities to remediate.

- By August 2021, NASA completed 100% installation of CDM sensors on the Agency's corporate systems, 98% on JPL's (Jet Propulsion Laboratory's) corporate systems, 96% on the Agency's mission systems, 81% on JPL's mission systems, and 100% on the NASA Communications System (NASCOM).

Data Access & Analytics

- NASA's Enterprise Data Platform (EDP) completed multiple critical project reviews and was approved to begin testing the EDP with data. The EDP is scheduled to go live on April 19, 2022 with expanded access expected for mid-June 2022.

- The OCIO continued to develop business applications and the Enterprise Data Platform (EDP) with Tableau and Power Business Intelligence (BI) software for data integration, intelligent automation of business processes, and the management of Internet of Things (IoT).

- In FY 2021, the EDP helped to develop 75 Tableau data dashboards across centers, organizations, and mission directorates. A "Tableau Bootcamp" trained NASA personnel on the visualization software and "data doctor hours" were available for individualized trainings.

- NASA has cataloged 81K datasets on *data.nasa.gov* and over 800 datasets in internal data catalogs. In FY 2022, the Data Stewards Working Group will be established under the Chief Data Officer.

- In August 2021, the OCIO deployed the HoloLens 2, an augmented reality device and service using sensors, advanced optics, and holographic processing. Holograms can be used to display information, blend with the real world, or even simulate a virtual world. This service provides opportunities for collaboration, remote teaching, reduction in travel, and integration with the Teams environment.

- In April 2021, Headquarters' ITCD migrated ODEO's Reasonable Accommodations Management System (RAMS) to a new platform, enhancing the system and reducing technical issues. This system is used to track and monitor requests for reasonable accommodation and support increased participation of individuals with disabilities.

- The Applications Program expanded use of low-code app platforms, including the onboarding of these apps using Salesforce: the NASA STEM Gateway Community of Practice, STMD Flight Opportunities and Small Spacecraft Technology, and Goddard's Mission Cloud Platform (MCP) Dashboard.

Information Strategy

- The Digital Transformation Strategic Initiative was launched to aggressively harness digital advances to accelerate and unify our collective efforts to transform NASA. Here are just a few examples of these activities:

  - The Hyper-effective nOise Removal U-net Software (HORUS) Machine Learning-powered Lunar Feature Detection algorithm processed 5,968 raw Lunar Reconnaissance Orbiter images of the lunar south pole and created more than 4,000 high-resolution, low-noise images for improved landing site and other mission planning.

  - The Enterprise Data Platform pilot was developed to inventory, tag, and integrate data along with offering basic enterprise-level analytics. 34 new EDP analytic proof-of-concept solutions were also created.

  - The Process Transformation (PTx) Playbook designed to develop a repeatable process for critically rearchitecting our processes by eliminating unnecessary steps, optimizing the work that needs to be done, and automating transactional work wherever possible. PTx Playbook was beta-tested by the Office of the Chief Financial Officer and the Mission Support Transformation Office has been identified as the next organization to use the Playbook.

- In FY 2021, NASA's Scientific and Technical Information Program published 9,251 new records to the STI Repository, the NASA Technical Reports Server (NTRS). Of the new records published to NTRS, 8,360 (90%) were disseminated as publicly available. The remaining 891 were limited to users provisioned for access to registered content. This data is used extensively in the Science community to further advance scientific discoveries.

Partners in Excellence

- Following Office of Management and Budget approval, the OCIO conducted its first-ever agencywide survey to baseline the OCIO's customer experience measurement, connecting with 2,000 random NASA civil servants and contractors. Customer experience advancements will be driven by better understanding customer needs and providing targeted service improvements.

- The Data Center Networking (DCN) capability enables customers using data centers located at Johnson and Kennedy to seamlessly migrate virtual servers between the two locations, without the need to reconfigure the servers after migration. Workloads can be moved quickly, increasing efficiency and reducing downtime, while also avoiding disruptions from weather or infrastructure outages.

- In October 2021 all OCIO Programs and Service Lines migrated to one common OCIO brand for official Enterprise-level OCIO communications, standardizing under one brand and one voice. This will help ensure communication consistency across all our services, whether delivered at the agency or center level.

- Starting in September 2021, the OCIO Front Door Project kicked off activities to design and implement a better way for customers to access IT services and support, transitioning from siloed information hubs. The project will develop the NASA OCIO Intranet for effective self-service information via an intentional site architecture, a services directory to provide a listing of all approved IT products and services, a knowledge base that covers the most important issues to customers across major IT service areas, and a configuration management strategy for maintenance and governance.

- An enhanced Teams Roadmap is now available to ensure customers have the most up-to-date information regarding what new Microsoft Teams features are available at NASA and when. With the new roadmap, users can: access detailed instructions for using features that have been released, preview upcoming features Microsoft is getting ready to release, and determine which features Microsoft scheduled for release but later delayed.

- NASA expanded the Box external file sharing service, allowing the service to handle more sensitive data types. Box is NASA's tool for sharing files externally, replacing the less secure Large File Transfer service, which was decommissioned. Before, during, and after transition, the OCIO offered a series of trainings on the internal and external file sharing tools.

- NASA has updated its Office 365 (O365) security policy to allow the sharing and storing of Controlled Unclassified Information (CUI) (and the previous SBU) information – including several sensitive data types – without individual file encryption.

Operational Excellence

- As part of the OCIO Transformation initiative, Business Relationship Managers (BRMs) and Customer Relationship Managers (CRMs) are being established as the consistent customer interfaces to anything OCIO.

- NASA implemented a centralized IT procurement support capability, including procurement authorization and review, at Langley Research Center (LaRC). The capability was made available to all Centers for software and hardware purchases, regardless of procurement mechanism. The Agency progressed on standing up the Integrated IT Acquisition Management Office.

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