

NASA's Digital Transformation Strategy

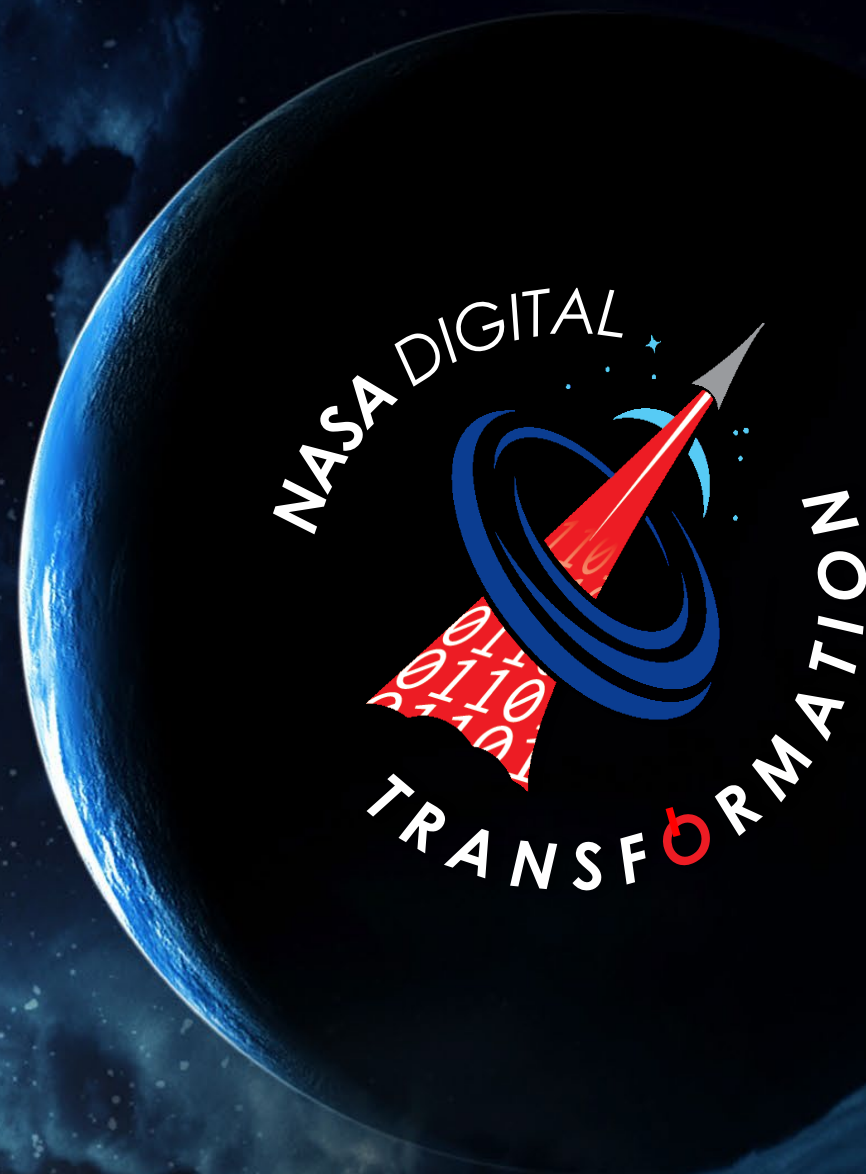
NASA TM 20220018538



Jill Marlowe

Digital Transformation Officer

February 22, 2023



REACH
— NEW —
HEIGHTS

BENEFIT
— ALL —
HUMANKIND

REVEAL
— THE —
UNKNOWN

Enduring **Bold Mission...**





...now in a **Changing World**

- Increasingly bold & complex missions
- Increasingly partnered
- Increasingly fast
- Increasingly affordable
- Increasingly transparent
- Increasingly inclusive

NASA must transform

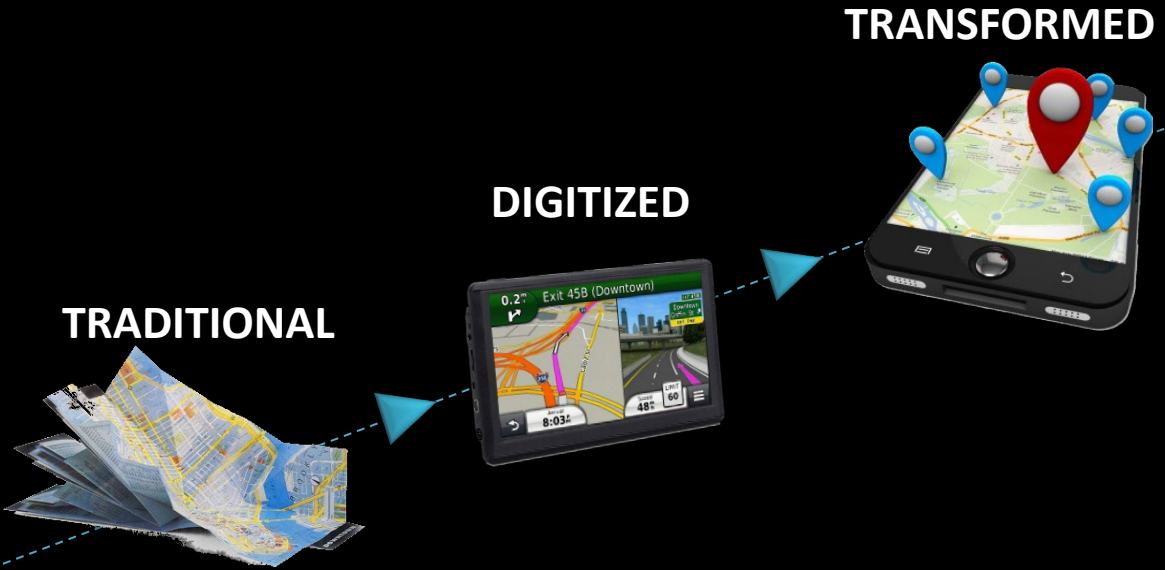


Digital Transformation

[dij-i-tl trans-fer-mey-shuhn] noun:

Employing digital technologies to change a process, product, or capability so dramatically that it's unrecognizable compared to its traditional form.

DT ≠ IT
DT = transformation focused
IT = technology focused



From Maps to Apps...
Digital Transformation has already changed our world



WHY digitally transform NASA?

3 Future State Goals



NASA must transform...

Expanding Partnership Landscape

the way
we
WORK

Sondra's **digital assistant** alerts her to a newly published **partner data set** related to her science research. She kicks off a **bot** to transfer & clean the data and integrate it into her **model**. Using **analytics** to rapidly **cross-check** the results, she discovers a potential breakthrough

Evolving Employee Expectations

the experience
of our
WORKFORCE

Caryn is excited to have joined a 1-day **collaboration jam** session where she **connected** with new teammates from across **NASA** to **quickly learn and apply AI/ML tools** on an elusive space suit challenge. She loved **helping the mission** and can't wait to **share her new ideas** with her financial peers.

Increasing Budget Constraints

the agility
of our
WORKPLACE

George pauses **digital manufacturing** of an urgent job after a **critical IoT sensor alert**. He imports the **data history** into the **lab digital twin model** and **rapidly forecasts** the job can safely continue, avoiding delays.

WHERE must we focus?

4 Transformation Targets



Enable agile multi-center/partner engineering teams to solve frontier problems

Transform Engineering



Multiply science & technology breakthroughs by leveraging diverse global minds/advances

Optimize & synchronize our work environment to increase efficiencies & effectiveness

Transform Operations



Accelerate risk-informed, evidence-based, self-consistent decision making

HOW will we get there?

5 Digital Levers



For any/each Transformation Target...



Establish Interoperable Architectures

Define value streams & associated organizational conops within the domain:

- Update policies, standards & guidelines that define domain digital processes & governance
- Define framework for **interoperable platforms/systems** to integrate domains and processes



Transform Critical Processes

Streamline critical workstreams within the domain:

- Eliminate, Optimize, Automate workflows to address process bottlenecks & redundancies
- Evolve from paper-centric to **integrated data/model-centric approaches**
- Maximize **shared services & role-based access** to enable geographically agnostic Future of Work



Maximize the Impact of our Data

Expand data search, access, interoperability, re-use and analysis:

- Baseline **data inventory/repositories** & name **data stewards** → integrate into **data architecture**
- Establish **data governance**, including data classifications/sensitivities & role-based access
- Enable **data fusion** as well as **data analytics & AI/ML** capabilities to mine insights



Adopt Common Tools

Reduce domain tool sprawl / chaos by driving to shared capabilities by tier:

- Tier 1 – **agency-wide common tools** (w/ deviation by exception)
- Tier 2 – functional interoperable **community core shared tools**
- Tier 3 – **local unique one-off** and/or home-grown tools (with justification)



Strengthen Inclusive³ Teaming

Eliminate barriers to strengthen inclusive teaming:

- Digitally-Inclusive: Establish threshold level of **digital understanding, literacy & skills**
- Geographically-Inclusive: Enable **immersive collaboration** for on- and off-site team members
- Organizationally-Inclusive: Provide **seamless data access across multi-center/partner** teams

... we can accelerate change by systematically facilitating & coordinating organizational plans to **harness Digital Levers**

WHICH digital technologies will we use next?

6 Technology Foundations



DT will catalyze investigation and adoption of the next key digital technologies that we can & should leverage to transform our work, workforce & workplace

Artificial Intelligence / Machine Learning (AI/ML):

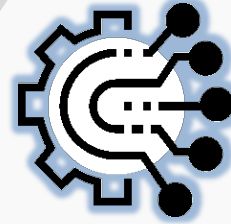
Harness machine capabilities to augment human intelligence in an era of big data

Zero Trust Architecture:

Enable dynamic internal/external collaboration wherever teams need to work, leveraging secure infrastructure, identity, network & data architecture

WORK

IA



Intelligent Automation (IA):

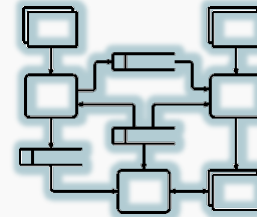
Eliminate, optimize & automate processes into synchronized workflows across enterprise platforms to maximize our efficiency and effectiveness to enable bolder missions faster

Model-Based Anything (MBx):

Employ digital models including digital twins across any/all functional domains to enable our people to address increasing complexity, scope, speed, uncertainty & changes



AI/ML



MBx

ZTA



IoT



XR

Extended Reality:

Enhance agile internal/external teaming via seamless, immersive, secure visualization & collaboration

WORKPLACE

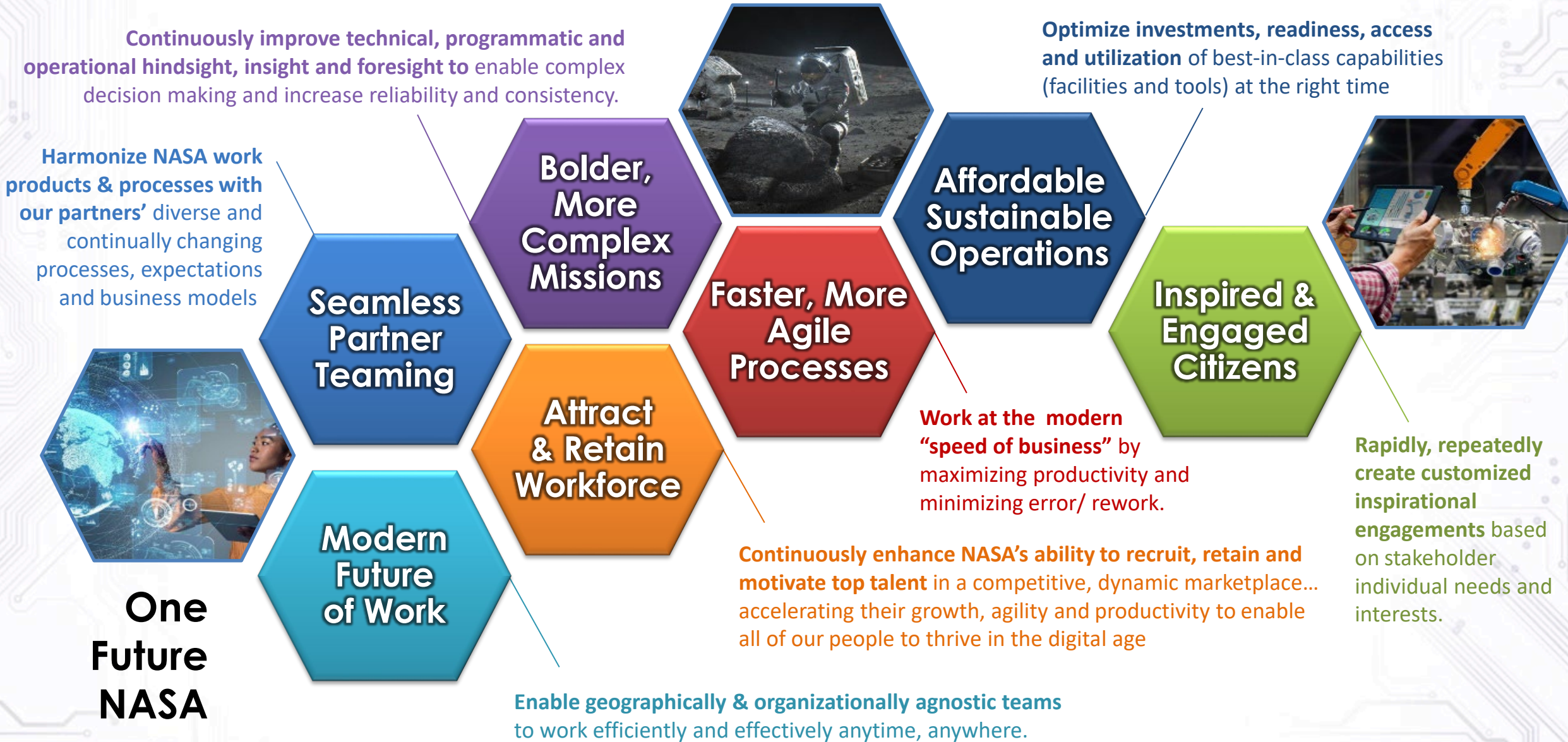
Internet of Things:

Integrate wireless, networked sensors & controls at scale to enable real-time hindsight, insight & foresight of smart assets

WORKFORCE

WHAT does a digitally transformed NASA look like?

7+ Mission Outcomes



NASA's DT Strategic Framework



3 FUTURE STATE GOALS



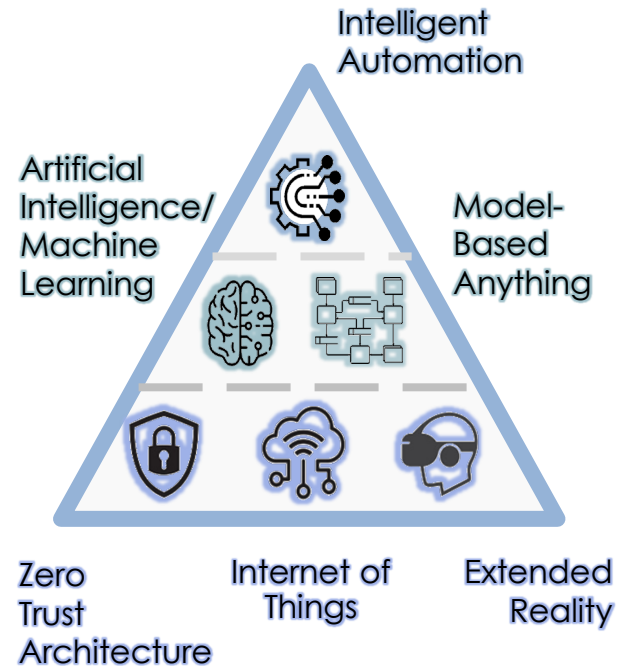
4 TRANSFORMATION TARGETS



5 DIGITAL LEVERS



6 TECHNOLOGY FOUNDATIONS



7+ MISSION OUTCOMES



One Future NASA

Implementation in a Federated Culture



Ignite Transformation

Facilitate **Tx Target Community-owned Roadmaps** & near-term priority actions to align DT intent & goals across NASA

Connect Plans

Coordinate like **Organizational DT Plans** that respond to the DT Strategic Framework to synchronize DT intents

Integrate Solutions

Assess **DT Forecast** of proposed Org DT Plans vs. Roadmaps / priorities and identify gaps & opportunities and inform investment decisions by DT and organizations

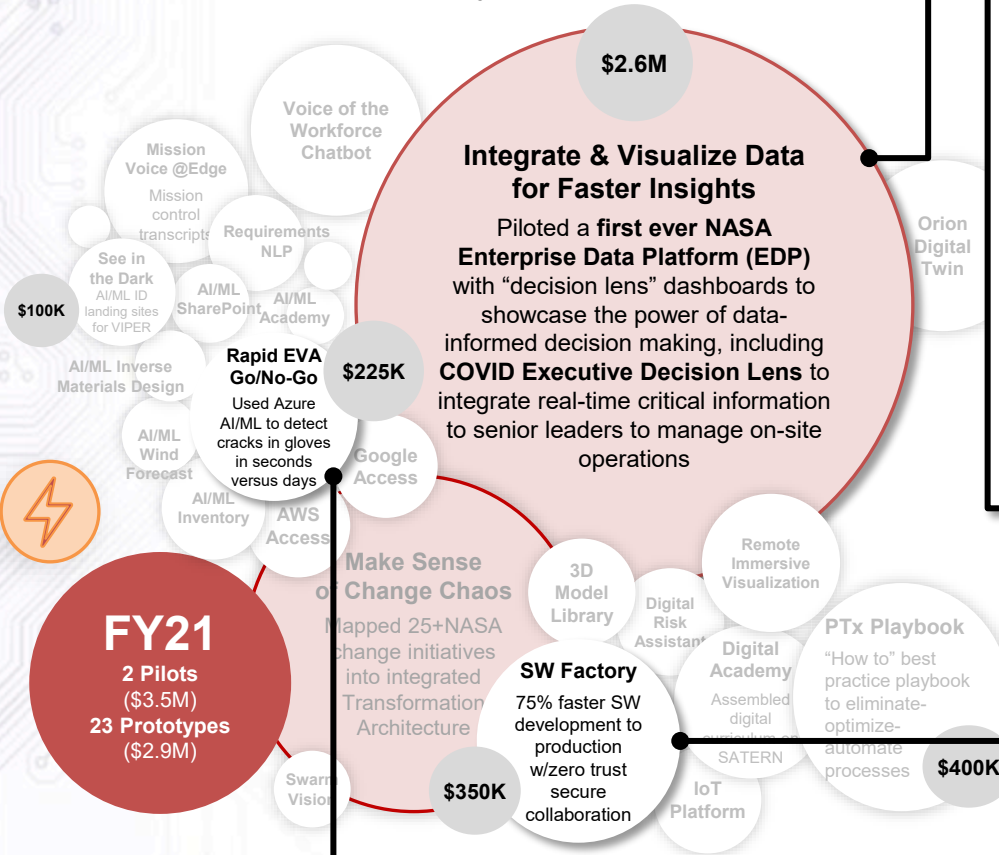
Facilitate Adoption

Measure **DT Progress** on Org DT Plans vs. Roadmaps; celebrate & share wins and elevate & address cross-cutting barriers via **DT Catalyst Projects**

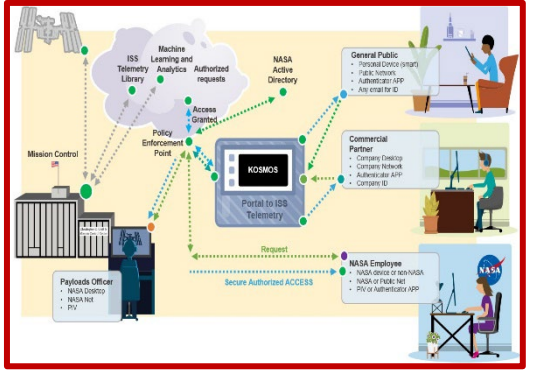
Enterprise DT Portfolio – FY21

Mostly bottoms-up “early win” demos within single organizations

DT’s role has evolved from **Igniter** to Connector, and now to Integrator and Facilitator to enable NASA’s Transformation Journey.

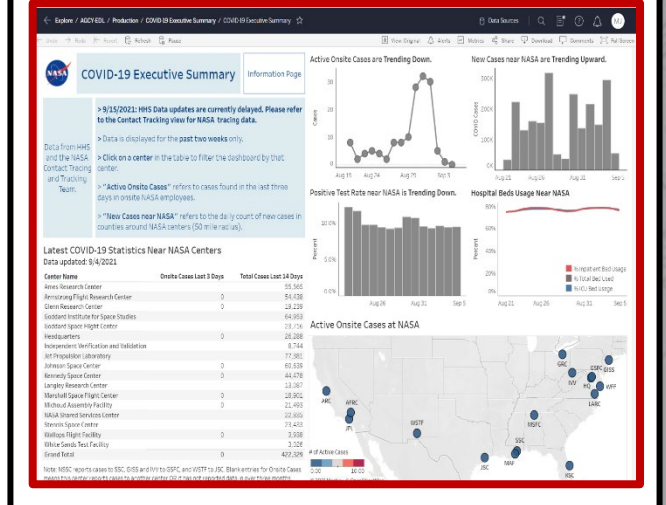


(June 2022) Utilizing the advanced capabilities of **APPDAT cloud computing platform** coupled with **Zero Trust** approach, enabled



Partnership with Google, cloud AI models and the JSC Mission Control Center, developed a machine learning model that **predicts the loss of KU Band signal on the ISS with a 4 orbit lead time**, providing rapid ops insights

(Dec. 2020) Using pilot **Enterprise Data Platform (EDP)**, created **COVID Executive Decision Lens dashboard** to dynamically integrate & visualize real-time national & regional HHS COVID case rate and hospitalization data coupled with NASA Center case rates to **improve insights and speed decisions for on-site operations** /protocols across Centers



(Dec. 2021) ISS demo of an **AI/ML prototype Astronaut glove inspection model** that performed diagnostics & generated a **GO/NO-GO recommendation in 45 seconds** on the glove condition, a process that normally is performed by a group of people taking multiple days.

GETTING STARTED →

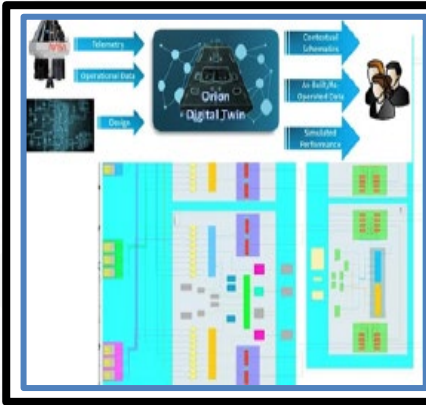
Where We Seeded Early Wins and Sparked Change

Enterprise DT Portfolio – FY22

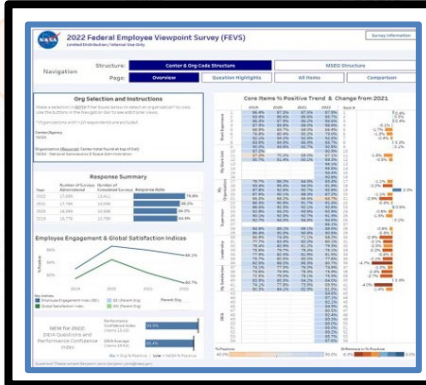
Mostly multi-org coalitions teaming to pursue shared solutions to common challenges



DT's role has evolved from Igniter to **Connector**, and now to Integrator and Facilitator to enable NASA's Transformation Journey.



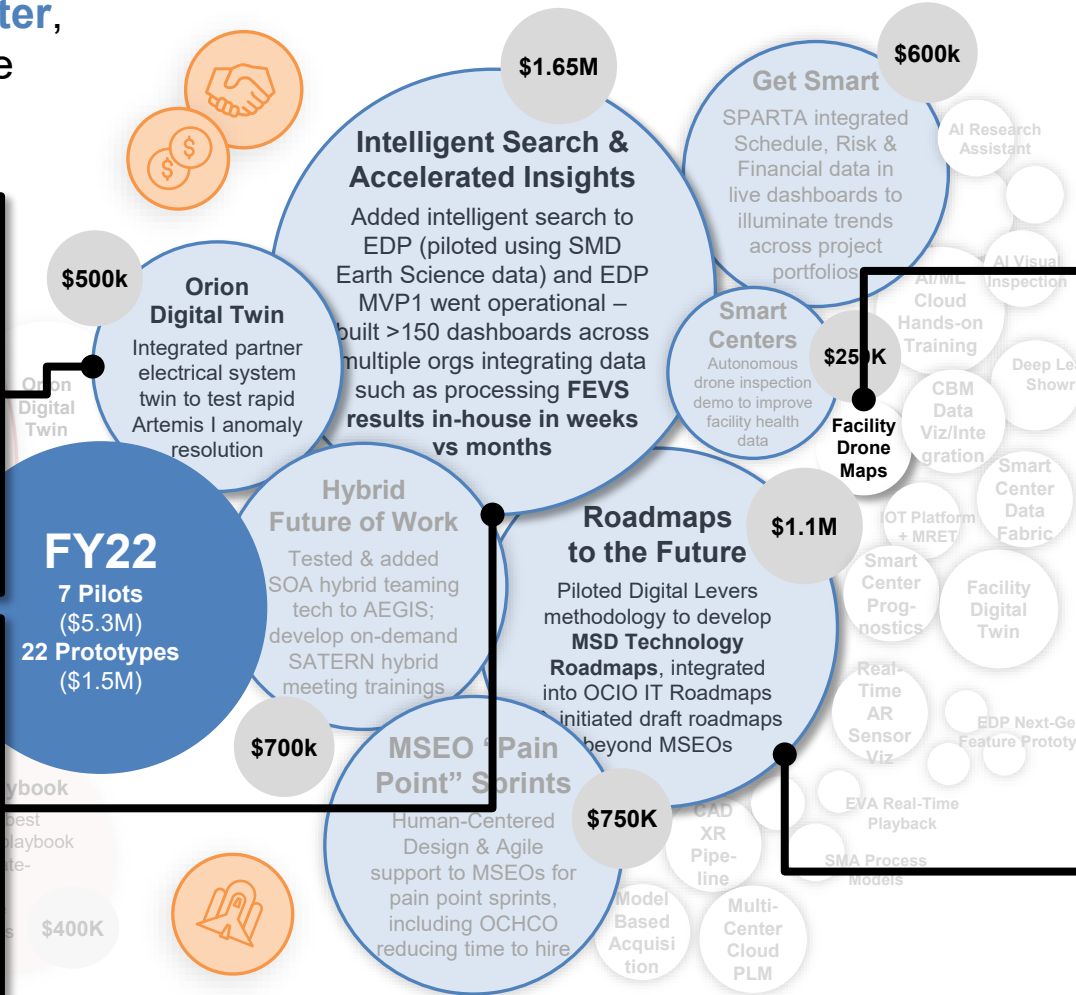
(Dec. 2022) Created **Orion Electrical Power system Digital Twin** that integrated NASA/partner models from requirements to as-deployed design, enabling **faster than real-time prognostics** with ability to ingest Artemis I telemetry flight data for validation & anomaly resolution.



(Aug. 2022) Delivered **Federal Employee Viewpoint Survey graphical reports & trend analyses** using EDP in **2 weeks vs. several months** analytics, providing better, more accurate insights and intuitive tools to explore results and improve org action plans.

GETTING STARTED

Where We Seeded Early Wins and Sparked Change



JOINING FORCES

Where We Built Coalitions to Attack Select Challenges



(Oct. 2022) Demonstrated multiple **autonomous drone facility inspections** that would have been difficult, dangerous & expensive with people; IR/ image data integrated into Smart Center data fabric for IoT sensor fusion.

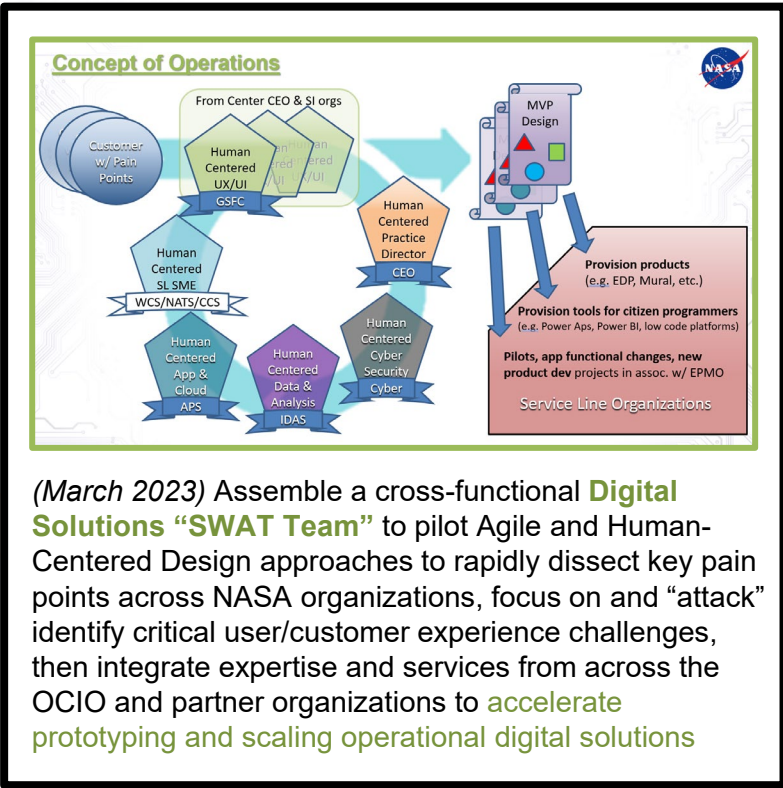
MSD Technology Strategy Goals			
Current Pain Points	Application based / Duplicative capabilities / Lack of time for creative work	Manual, routine or transaction based work / Lack of time for creative work	Data not standardized, not accessible for use across MSEA / Data calls are labor intensive
Goals	Approved Capabilities, Platform & Services / Leverage OCS approved platform and services when possible / Integrated Application Request Process / Increase request report requirements for cross cutting capabilities / Reduce/Elaborate Application Readiness / Among capabilities to future state	Intelligent Automation / Capable, process and regulatory fit / Leverage Citizen Development / Provide toolmaking for employees to automate tasks / Data Accessibility / Data Accuracy / Data Integrity	Data Standards / Develop standards for consistency across, real and synthetic data / Consolidated Catalog / Leverage what appropriate for business functions / Streamlined Learning / Center access to learn how to use existing IT capabilities / Simplified Analytics / Center to access analytics and visualization capabilities

(Nov. 2022) Advised on **MSD Technology Plans** using Digital Levers methodology; provided Agile support to **rapidly synthesize MSEO needs to inform OCIO Technology Roadmaps** for service lines.

Enterprise DT Portfolio – FY23

Fewer top-down strategic investments focused on immediate benefits

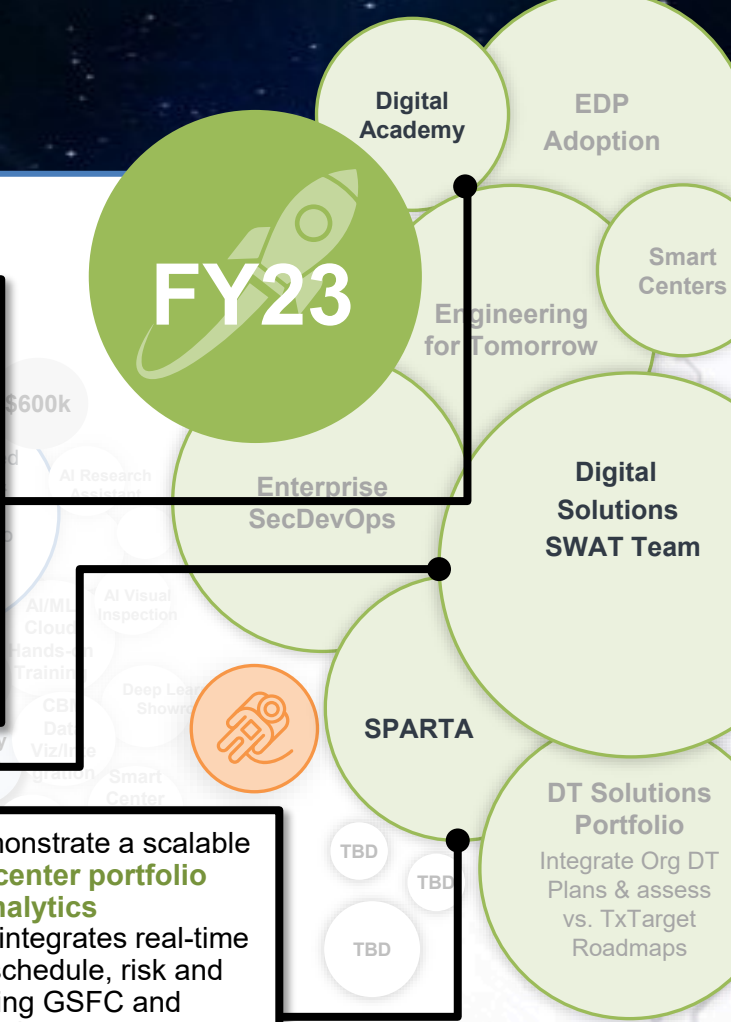
DT's role has evolved from Igniter to Connector, and now to **Integrator** and **Facilitator** to enable NASA's Transformation Journey.



(Nov. 2023) Build out data literacy offerings on **SATERN Digital Academy** by leveraging existing digital literacy curricula from other Agencies to provide in-depth trainings to develop job-based digital competences as well as common enterprise-wide digital literacy practices.

(Feb. 2023) Demonstrate a scalable **SPARTA multi-center portfolio management analytics dashboard** that integrates real-time mission profile, schedule, risk and financial data using GSFC and LaRC science projects to assess potential for **increased speed, better insights and earlier risk detection** from real-time evidence-based decision making using common data structures across projects.

Risk Center	Project	Risk Score	Consequence Avg	Likelihood Avg	Risk Count
GSFC	MSR-CCRS	9.32	2.83	2.15	170
	PACE	6.94	2.42	1.80	220
	RGT	6.22	2.35	1.66	311
	SETH	3.06	2.00	1.00	1
	SMAP	4.41	1.53	1.37	54
	SSMO	8.51	2.89	1.84	416
	SWFO	9.18	2.63	2.22	90



GETTING STARTED

JOINING FORCES

BUILDING MOMENTUM

Where We Seeded Early Wins and Sparked Change

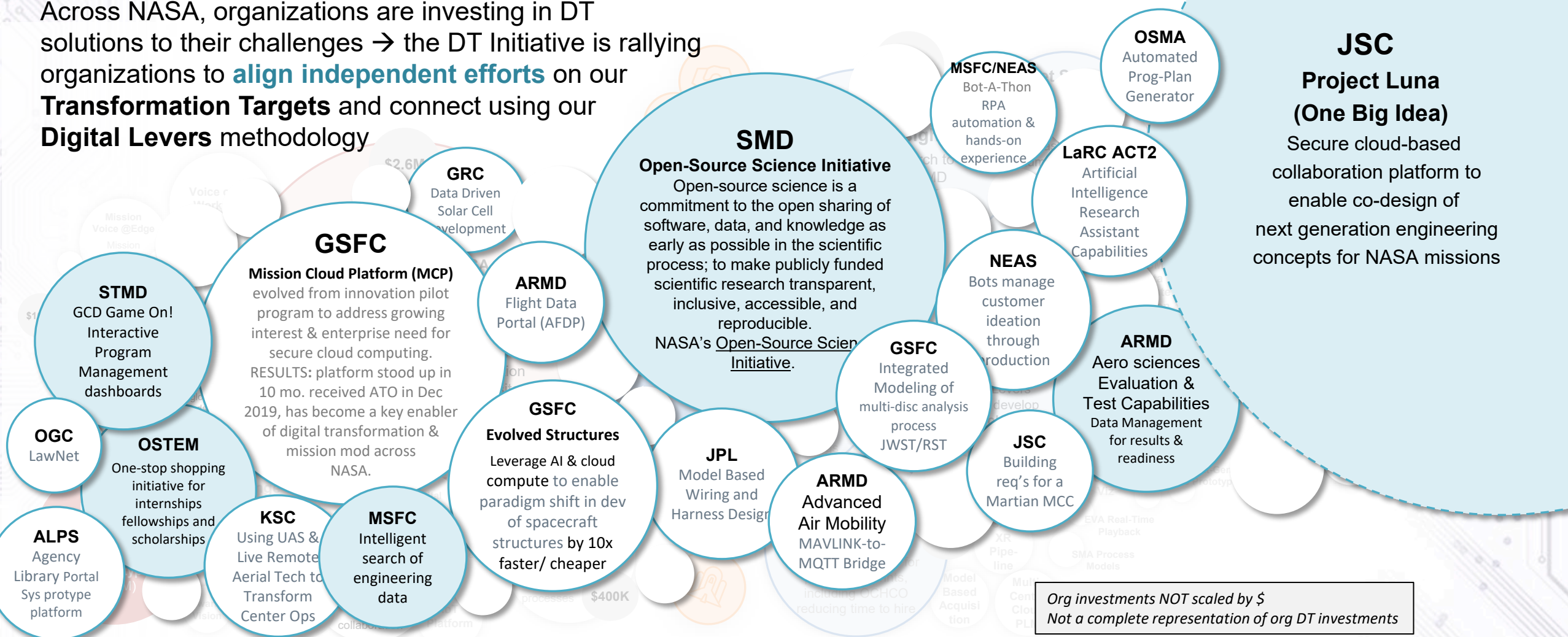
Where We Built Coalitions to Attack Select Challenges

Where We Must Focus for Key Results

Focusing Org DT Investments

Align to Transformation Targets, Connect via Digital Levers

Across NASA, organizations are investing in DT solutions to their challenges → the DT Initiative is rallying organizations to **align independent efforts** on our **Transformation Targets** and connect using our **Digital Levers** methodology



GETTING STARTED

JOINING FORCES

BUILDING MOMENTUM

Where We Seeded Early Wins and Sparked Change

Where We Built Coalitions to Attack Select Challenges

Where We Must Focus for Key Results

REACH

NEW

HEIGHTS



REVEAL

THE

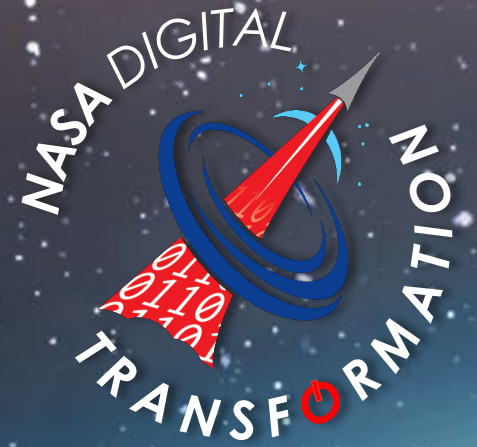
UNKNOWN



BENEFIT

ALL

HUMANKIND



Questions?



BACKUP

DT Myths

“Enterprise DT” is a strategic initiative that aims to be a catalyst to accelerate NASA’s transformation by harnessing digital advances



What DT is not...	What DT is...
Digitization – standardizing IT platforms/tools and/or automating what we are doing now to do it faster/cheaper in the future	Transformation – about driving change... challenging ourselves to deliver new value in a changing world (leveraging digital advances)
Program – discrete set of IT modernization goals/projects with centrally managed hard schedules, resources and milestones	Journey – recognizing our “value” will be a moving target as expectations evolve with technology advances
Separate Team – specific named individuals, separate from the rest of the org, charged with DT deliverables	Pervasive Mindset – cultural focus on the changing value we must deliver and being agile in (new) ways to achieve it
NASA Flavor-of-the-Month – an internal strategic initiative with a catchy bumper sticker that will last only as long as the senior leader champion who sponsored it	Global Movement – Gartner 2020 survey among 100 Fortune 500 CIOs found that 77.3% prioritized digital transformation for their 2021 budgets <i>over any other business activity</i>
More Work – additional taskers over and above all the traditional work we are already doing today	Working Differently – relentless, objective action to reinvent work by eliminating/optimizing/automating (new) value-streams
Cost Center – just another competitor for limited resources today	Investment – a deliberate choice to create/seize a new future
One-off Experiments – a bunch of isolated technology tests/demos that are super cool but have minimal operational impact	Campaign – systematic exploration, maturation and infusion of new approaches that harness technology to deliver new value
Eliminating Jobs – having bots take jobs away from people	Creating Opportunities – freeing people to do things bots can’t
OCIO-only – label for just the OCIO-led IT modernization/services	NASA-wide – integrates org transformation plans & enabling tech
Optional – discretionary effort that we do as time/budget allows	Inevitable – required for us to be relevant in a digital world