



Enterprise Digital Transformation

Ed McLarney, AIML Transformation Lead, NASA

What is Digital Transformation?



Digital Transformation has already **changed our world...**

Employing digital technologies (e.g., AI, mobile, cloud, data) to **change a process, product, or capability so dramatically** (e.g., real-time, intelligent, personalized, anywhere, anytime) that it's **unrecognizable compared to its traditional form**

TRADITIONAL



DIGITIZED



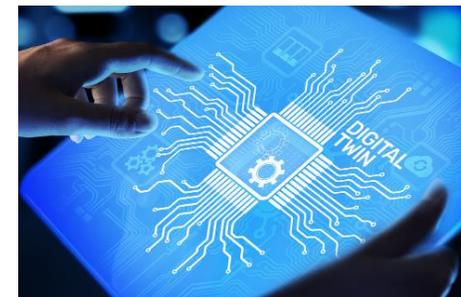
TRANSFORMED



... & technology discovery and convergence is accelerating change!



- Cloud Computing
- Mobile Access
- Automation and Robotics
- Big Data / Data Mining / Analytics
- Artificial Intelligence / Machine Learning
- Model-Based Systems Engineering
- Agile Software Development / DevOps / DevSecOps
- Internet of Things / Sensors
- Digitized Manufacturing (e.g., 3-D Printing)
- Augmented Reality / Virtual Reality
- Multidisciplinary Modeling and Simulation
- High Performance Computing
- Collaboration Platforms
- Social Media / Crowdsourcing
- Virtual Meetings
- **And more...**



Home & Work: Common Denominators



Similar challenges at both home and at work:

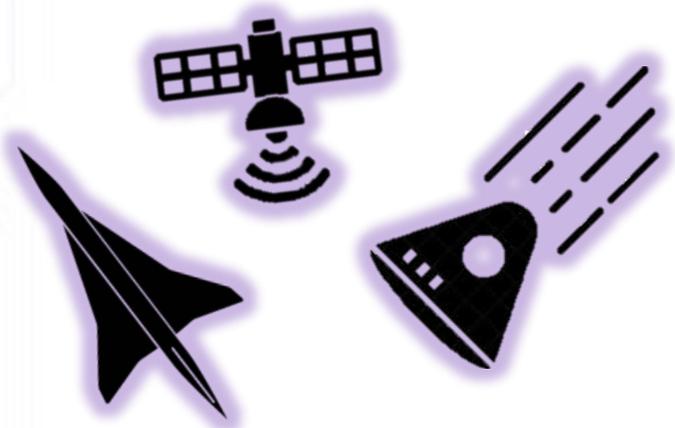
- More demands
- More complex & complicated
- More interactions
- Faster paced
- More frequent changes
- More budget pressures

The same kinds of **digital solutions** that are helping us navigate modern life at home will also transform our work world





WHY: Enterprise DT Goals



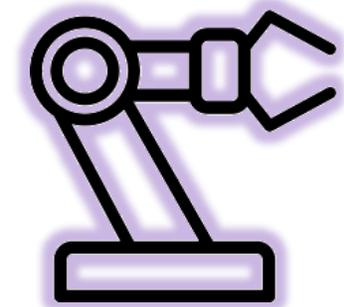
Transform NASA's Work

Deliver increasingly **complex missions** leveraging increasingly **complicated partnerships**, on **shorter timelines** to achieve **bolder outcomes** that **inspire** the world



Transform NASA's Workforce

Create a seamless, integrated, and inclusive **employee experience** that **energizes** our people by feeling **connected** to the NASA enterprise, continuously **grow**, and take **pride** in rapidly delivering **high-value work**



Transform NASA's Workplace

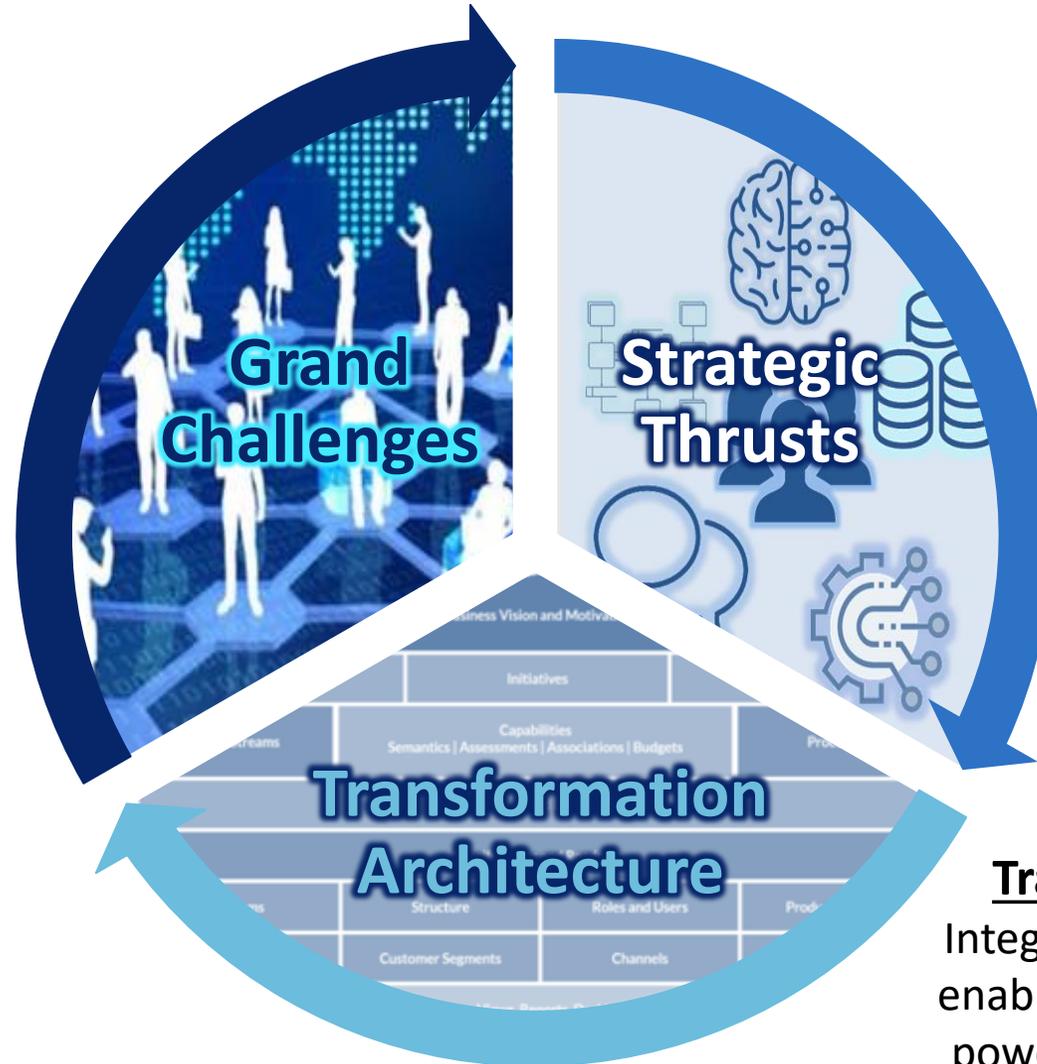
Optimize a 21st Century **cyber-physical work environment** that powers **flexible, adaptable, efficient, and effective** employee / partner **teaming**.



WHAT: Enterprise DT Essential Elements

Grand Challenges

“Real world”
transformation pathfinders
that serve as a lightning
rod to catalyze enterprise
DT adoption and
integration and deliver
tangible end-to-end
outcomes, using integrated
digital enablers



Strategic Thrusts

Catalysts for transformation →
key shared enterprise-level
digital enablers that orgs can
use to accelerate
transformation outcomes

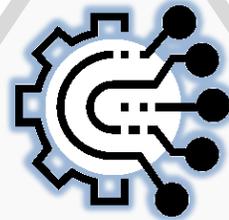
Transformation Architecture

Integration plan for how those digital
enablers can/should work together to
power our future transformed NASA



WHAT: Enterprise DT Thrusts

WORK



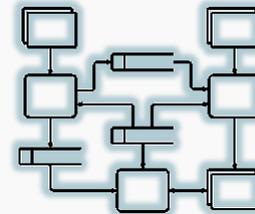
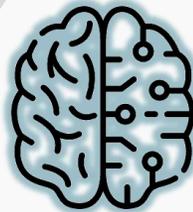
Process Transformation (PTx):

Transform our products and processes to maximize our efficiency and effectiveness to enable bolder missions faster

DT Outcomes Tier

Artificial Intelligence / Machine Learning (AI/ML):

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



Model Based Everything (MBx):

Employ digital models to enable our people to address increasing complexity, scope, speed, uncertainty & changes

DT Accelerants Tier

Data: Ensure the data we need is Findable, Accessible, Interoperable, and Reusable (FAIR) to power data-driven decision making



Culture & Workforce:

Foster digital savvy, enterprise connection, and growth mindsets

DT Foundations Tier

Collaboration:

Enable agile teaming via seamless, secure internal and external collaboration

WORKPLACE

WORKFORCE



WHERE: Enterprise DT Early Wins (selected)



Process Transformation

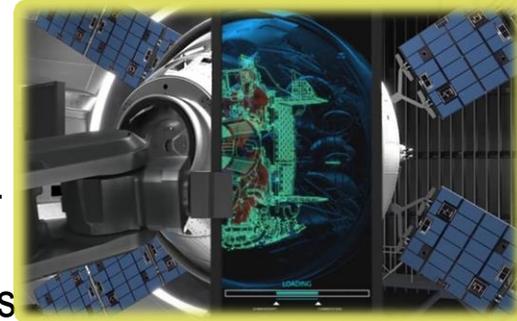
- **Process Transformation Playbook** – guidelines to make PTx easy and repeatable for all NASA orgs; test on initial use cases including Robotic Process Automation

AI/ML:

- **High priority (learning) use cases** – Natural Language Processing for Requirements Analysis, Inverse Design of Materials, **Extreme Weather Forecasting**

Model Based Everything (MBx):

- **Orion MBSE Digital Twin Pilot** – Test common models and standards Agency-wide for MBSE w/Orion



Data



- **Data-Driven Decision Lens** – Integrate NASA data into central analytics/viz platform to enable holistic, enterprise level executive data driven decision making; less rework; better risk forecast what-if analysis
- **Agency Data Analytics Platform** - Integrate/scale COTS analytics tools to power data-driven decision making

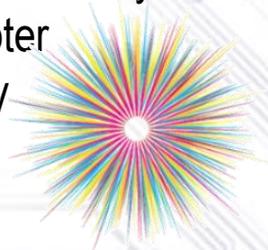


Collaboration

- **ITAR File Sharing** – ISS w/ESA prototype of 2-way secure sensitive file sharing for rapid external collab
- **Remote Immersive 3D Visualization** – Visualize engineering models via 3D headsets at remote locations

Culture & Workforce

- **SWARM Innovation** – Rapidly develop innovation skills and mechanisms in key early adopter community





NASA AI/ML Strategy – Elevator Pitch



Context:

- NASA is forming a Digital Transformation (DT) Strategy and Roadmap, led by the Office of Chief Technologist and Office of Chief Information Officer. This strategy includes AI/ML as one of six key strategic thrusts.
- NASA has a rich history of applying artificial intelligence (AI) to our hardest problems, such as autonomous behaviors in Mars rovers, deep analysis of space suit data, or image analysis to understand material strength. With the advent of powerful, plentiful, and affordable AI in business and industry, NASA is crafting a strategy to use AI as an accelerant for all NASA missions and business functions.

Strategy: As part of NASA's overall Digital Transformation, NASA's AI strategy includes:

- **Apply:** Solve relevant mission and mission support problems via AI / ML.
- **Teamwork:** Lead and synchronize NASA AI/ML via an open Agency AI / ML community.
- **Reskill:** Expand AI training, education, hiring, and retention across the workforce.
- **Tools:** Assess, recommend, and establish AI / ML platforms for NASA-wide adoption.
- **Data:** AI-enabled! Establish secure, authoritative access to the right data.
- **Outreach:** Make selected data and problems available for public / partner AI / ML work.
- **Adapt:** Leverage industry AI / ML work and adapt it to NASA use rather than reinventing.
- **Scale:** Plan to promote selected AI / ML capabilities from pilot to production operations.

The AI/ML team is from across the Agency with over 60 active members; additional contributors are always welcome.

Contact:

Ed McLarney (edward.l.mclarney@nasa.gov), Nikunj Oza (nikunj.c.oza@nasa.gov) or Herb Schilling (hschilling@nasa.gov)

AIML Intersection with Missions and Mission SPT (Examples, not Exhaustive)

Mission-Embedded

Command & Control Autonomy
For Moon / Mars Robots

Enable Scaled
Air Traffic Control

On-Board Analysis for
Science Sensors

Condition Based Maintenance
For Space Habitats

Autonomous Navigation
For UAS/UAM

Early Warning of Severe
Storms via ML Image Analysis

Mission Analysis

AI-Assisted Project
Management

AI-Enabled
Vehicle Design

Horizon Scanning via
AI Recommendation Engines

AIML + Traditional
Hybrid Analysis

ML-Enabled
Requirements Optimization

AI-Assisted System
Engineering

Mission Support

Bot Automation of
Repetitive Processes

Condition-Based Maintenance
For Facilities

ML IT Security
Monitoring

AI-Enabled HR Processes:
Resume Review, More

AI-enabled Lessons
Learned Recommendations

ML Assisted
Fraud Detection