

Northrop Grumman's Digital Transformation

Recommendations to NDIA for
2022 Systems Engineering Division Planning



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Digital Transformation

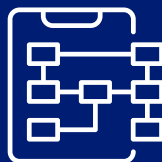
Enabling a digital ecosystem to rapidly deliver capability and achieve mission success



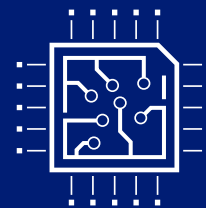
**Programs &
Products**



**Business &
Operations**



**Technology
Enablers**

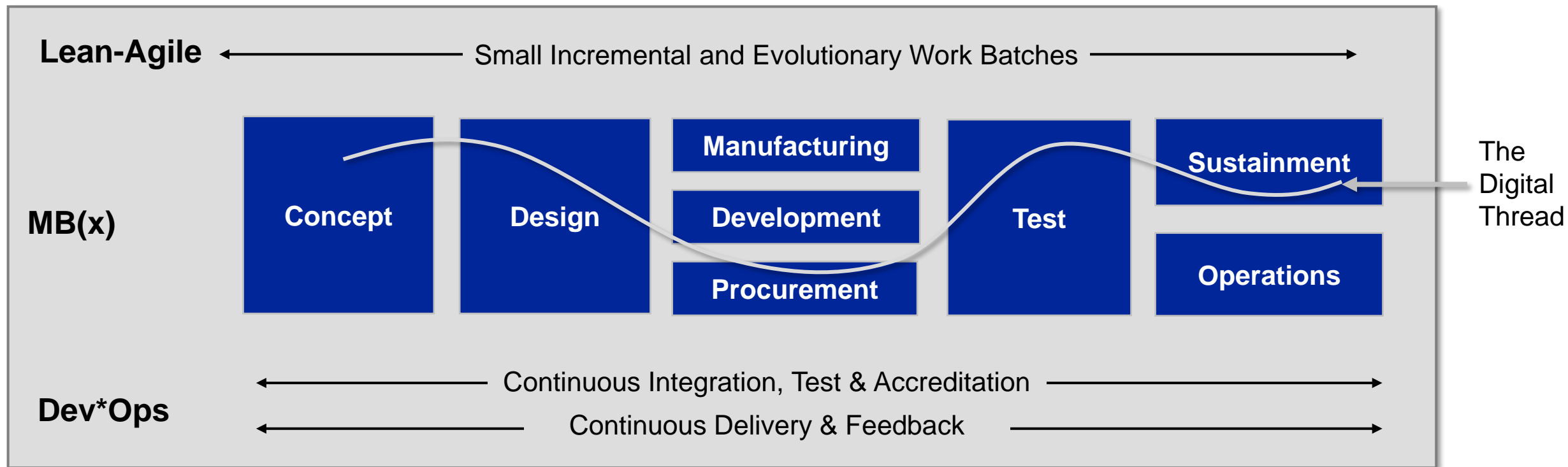


**Culture &
People**



Digital Transformation

Digital Thread Automates & Connects Data Flow Across Traditional Functional Approaches



✔ **Reduces Hand-off Errors**

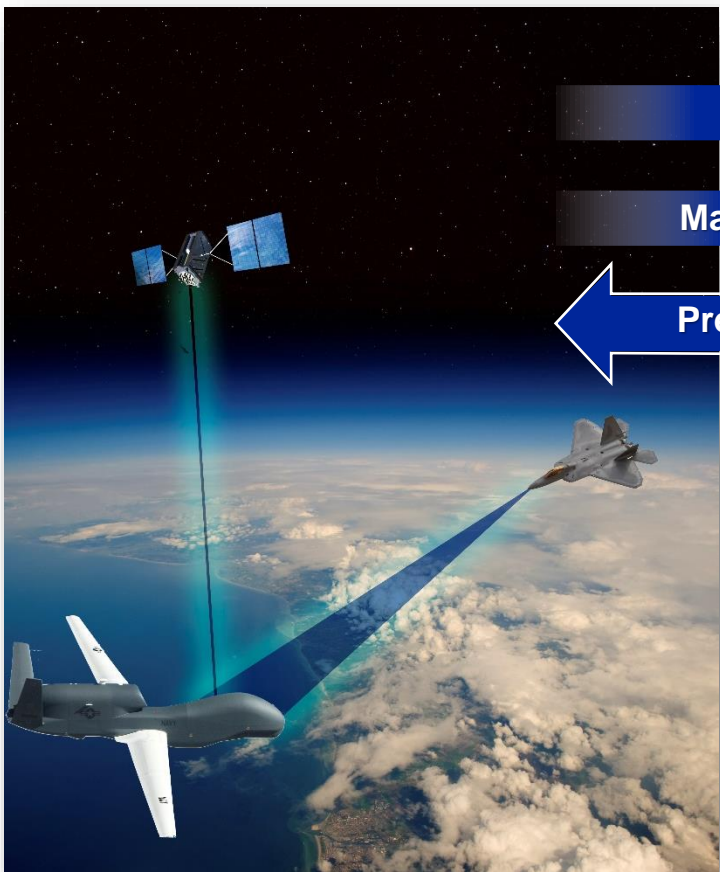
✔ **Enables Incremental Verification**

✔ **Finds Issues Sooner**

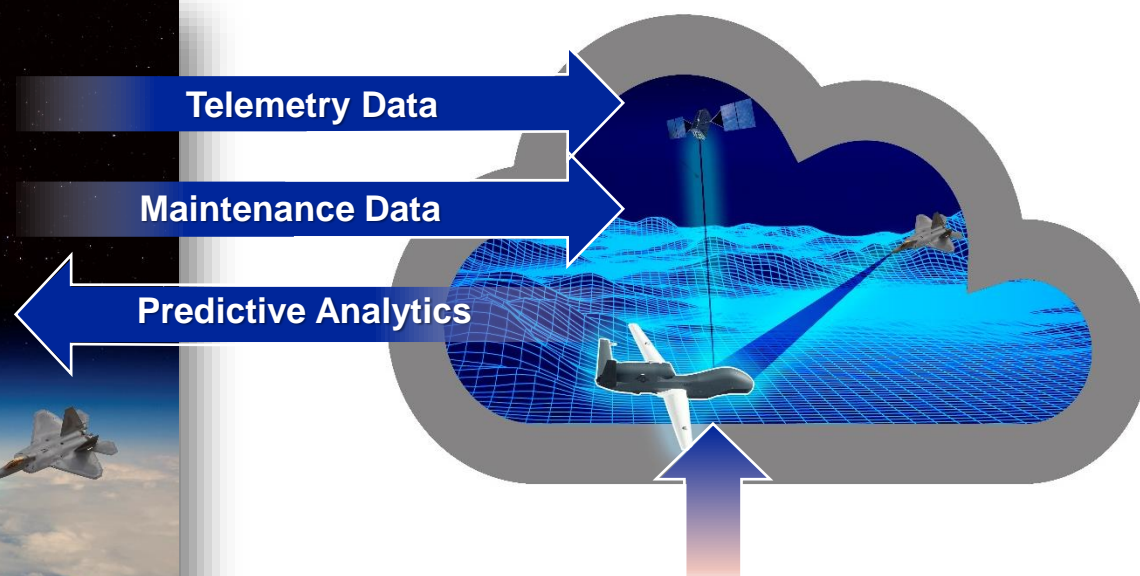
✔ **Reduces Rework**

Digital Twin

Physical Asset



Digital Twin



- Requirements Model
- Architectural Models
- Performance Models
- Threat Models
- Environmental Models
- Cost Models
- Hardware Emulators
- CAD Models
- Mission Simulation
- Operational Software

Benefits

- Facilitates early discovery of performance issues
- Enables product line optimization
- Supports personnel efficiency
- Rapidly evaluates system performance in ever-changing environments

A digital twin is a virtual representation of a physical system using real-time data to predict behaviors and performance over the lifecycle of the system.

Dev*Ops Challenges

Need for speed, but “Type D” embedded systems presents DevOps process challenges

Continuous Integration

$$T_K = (\text{Dev})(\text{Ops})$$

2 weeks - 1 month

Continuous ATO

$$T_{K+1} = (\text{Dev})(\text{Sec})(\text{Ops}) \leftarrow \text{“Security” culture and policy evolved; baked into automated pipeline}$$

+ hours

Continuous Airworthiness

$$T_{K+2} = (\text{Dev})(\text{Sec})(\text{AW})(\text{Ops})$$

+ months

Continuous Test

$$T_{K+3} = (\text{Dev})(\text{Sec})(\text{AW})(\text{DT/OT})(\text{Ops})$$

+ years

Continuous Weapons

$$T_{K+4} = (\text{Dev})(\text{Sec})(\text{AW})(\text{DT/OT})(\text{Seek Eagle})(\text{Ops})$$

+ months

Continuous Nuclear

$$T_{K+6} = (\text{Nuc})(\text{Ops})$$

+ months

...

$$T_{K+n} = \text{Dev*Ops}$$

DIB SWAP (3 May 2019)

“...not all software is the same”

Type A: COTS

Type B: Customized Software

Type C: COTS HW/Operating Systems

Type D: Custom Software/Hardware

Must consider and evolve these elements as well to enable more automated pipeline!

Keys to Success

1. Evolve Culture and Policy
2. Early Stakeholder Involvement
3. Automated vs. Manual Processes

Digital Transformation Challenges/Recommendations

Key Challenges That Government and Industry Must Jointly Resolve

- Enable and allow integration of models and data across multiple security environments
- Improve and enhance interoperability standards & strategy throughout value chain
- Ensure adequate protection of Proprietary Data in a cloud environment
- Increase in speed of delivery and approval for foundational tools and infrastructure
- Reach sufficient verification trust in models to allow reduction in physical tests
- Transition of certification offices to take full advantage of digital products
- Address how acquisition values digital engineering and digital twins in an offering



We will collectively achieve our visions through partnership & open dialogue

NORTHROP
GRUMMAN

The logo graphic consists of a thick black horizontal line extending from the end of the word "NORTHROP" to the right, and a thick black vertical line extending downwards from the end of the word "GRUMMAN" to the right, forming an L-shaped corner.