Advisory Board: R&M Engineering in the Era of Big Data

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Office of the Under Secretary of Defense for Research & Engineering

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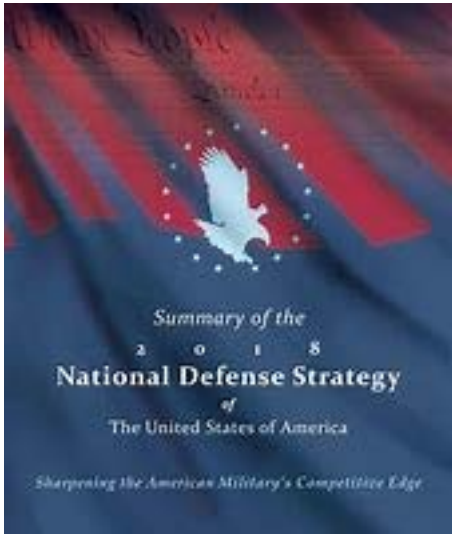
National Defense Strategy and Digital Engineering Strategy

National Defense Strategy

"A **more lethal force**, **strong alliances and partnerships**, American **technological innovation**, and a **culture of performance** will generate decisive and sustained U.S. military advantages." **– National Defense Strategy**



We need to:

- Bridge the invention-operations divide as the primary technology transition enabler
- Identify and support relevant, high pay-off, cost-effective cross-component technology efforts
- Plan and prioritize research and development of advanced capabilities

Digital Engineering Strategy

Objective:

- Guide the planning, development, and implementation of digital engineering across the services and agencies

Expected Impact:

- Increase technical cohesion and awareness of system in lifecycle activities
- Reform the Department's business practices for greater performance and agility

R&M Data

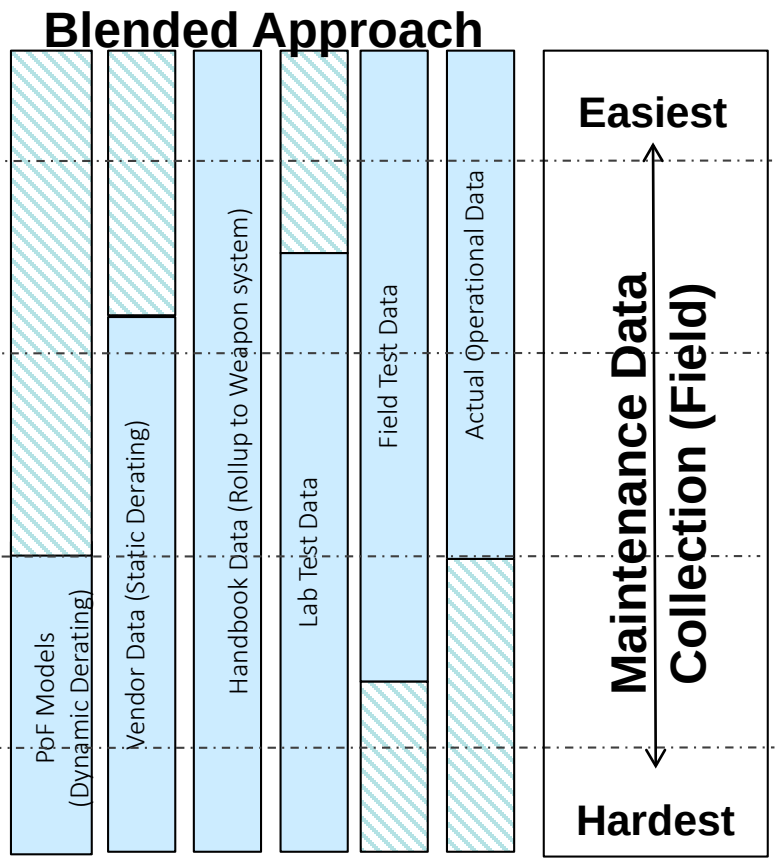
Weapon Systems
- Aircraft
- Land Vehicles
- Comm Systems

A-Kit
- Racks
- Cables

Subsystems (Box)
- LRU
- WRA

Circuit Card Assemblies
- SRU
- SRA

Components
- Integrated Circuits
- Transistors
- Gaskets

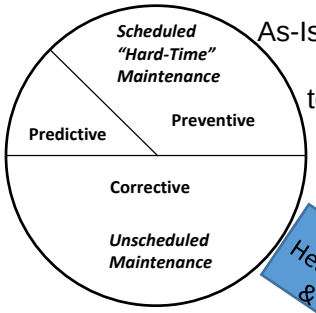


Data Available

Data **Typically** Not Available

Big Data: Moving from Reactive to Proactive to Predictive

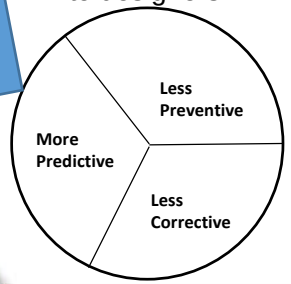
- Continuous design improvements with a digital twin
- Decreased corrective maintenance (unscheduled) and Can Not Duplicate rates (No Fault Founds)
- Increased predictive maintenance (scheduled)



As-Is: Limited to No Feedback to designers

Enabled through Health Management & Digital Twins

To-Be: Full to Partial Feedback to designers



Access and Quality of Data Remain a Challenge

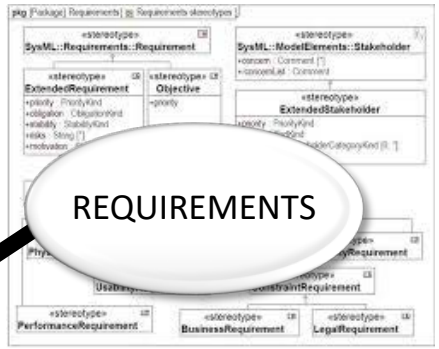
R&M in the Era of Big Data

Establish a Digital Ecosystem to Ensure Long-Lasting Benefits

WORKFLOW
- Storage
- Tools
- Compute

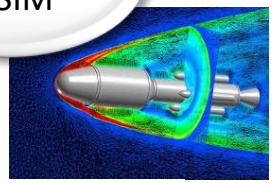
ACCESS
- DoD
- Classification
- Accessible to stakeholders

REQUIREMENTS



DESIGN & ANALYSIS
- Tools
- Software Development

MODEL & SIM



FUN3D

TEST & EVAL
- Data Collect
- ASoT Available

OPERATIONS
- Health Management
- Maintenance Data
- Condition-Based Maintenance+

INNOVATE

- Data Mining
- Machine Learning

Big Data Opportunities and Challenges

Data Challenges

- Authoritative Source of Truth and Data Quality
- Contracting (i.e. access, digital data, tailoring)
- Intellectual Property and Data Rights
- Lifecycle Data Needs, Availability, and Implications (Design, Test, Sustainment)

Infrastructure Challenges

- Access Control
- Cloud Configuration
- Cybersecurity and Information Protection
- Data Migration

Big Data Opportunities:

- Continuous design improvements with a digital twin
- Decreased repair costs
- Early identification of risks and mitigation plans
- Identification of changes, anomalies, and trends
- Improved fault detection, isolation, and reduced no fault founds
- Improved readiness with advanced analytics
- More effective decision making and problem solving
- Optimize and extend component lifetime
- Process Optimization

Advanced Analytics to Solve Complex R&M Engineering Problems

Common Architecture Challenges

- Compatible and interoperable tools
- Data Standards and Formats
- Ease of Sharing and Collaboration
- Taxonomies and Definitions

Culture Transformation Challenges

- Conduct of Design Reviews
- Interaction between Government and Industry
- Workforce Development Needs

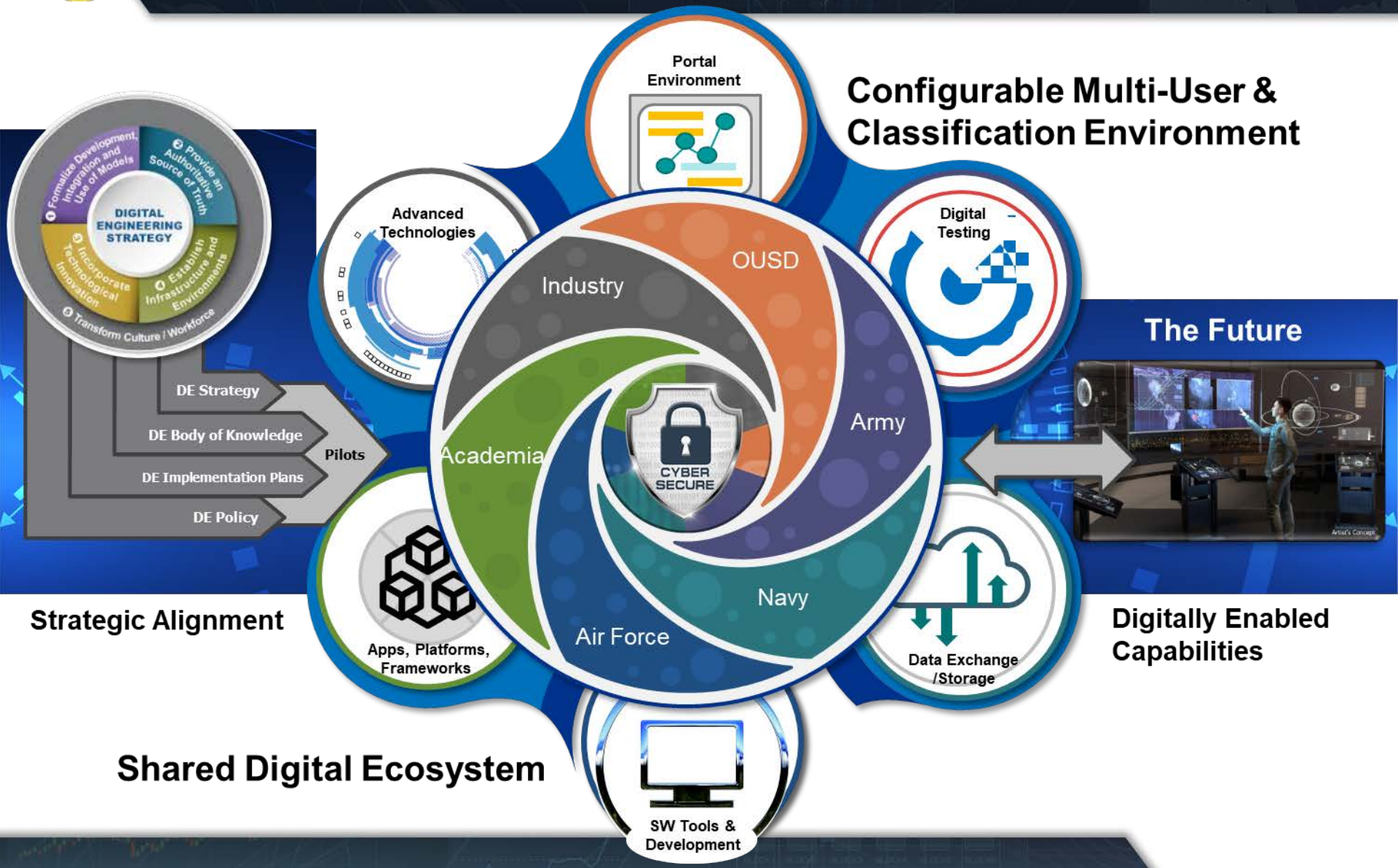
BACK-UP MATERIAL

Digital Strategy Goals and Challenges

Digital Engineering (DE) Vision:
Modernizes how the Department conceives, builds, tests, fields, and sustains our national defense systems.

	1	2	3	4	5
GOALS	Formalize the development, integration, and use of models to inform enterprise and program decision making	Provide an enduring, authoritative source of truth	Incorporate technological innovation to improve the engineering practice	Establish a supporting infrastructure and environments to perform activities, collaborate, and communicate across stakeholders	Transform the culture and workforce to adopt and support digital engineering across the lifecycle
CHALLENGES	Model Integration	Authoritative Data	End-To-End Solution	IP and Security Protection	Workforce Skills/ Training
	Model Curation	Governance	Engineer Practice Innovation	IT Infrastructure	Policy/ Guidance Standards
	Model Credibility	Digital Artifacts		Methods/Tools/ Processes	Metrics

Digital Engineering Core Capabilities



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