Enterprise Systems-of-Systems Model for Digital Thread Enabled Acquisition

Sponsor: DASD(SE)

By
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SoSECIE Webinar Series
April 30, 2019

www.sercuarc.org
Agenda

SERC Project RT-182 Digital Thread Enabled Acquisition

Introduction

• Methodology: Multi-level Sociotechnical Modeling & Enterprise Systems Analysis

• Systemigrams

• Outcomes & Next Steps
This research was conducted to evaluate the impacts of DE on current DoD acquisition enterprise processes. The following questions guided the research:

- What changes are likely to emerge from the transition to DE processes, methods, and tools?
- What are the enablers and barriers to such innovation in the DoD acquisition enterprise?
- What stakeholders will be affected and how will they likely embrace or oppose change?
- How might stakeholders be incentivized to embrace innovation and how will this be measured?
- What are the leading and long-term indicators of change?
- How might the value of such changes be predicted and measured?
Enterprise System-of-Systems Model, Digital-Engineering Transformation


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Agenda

SERC Project RT-182
Digital Thread Enabled Acquisition

- Introduction
- Methodology: Multi-level Sociotechnical Modeling & Enterprise Systems Analysis
  - Systemigrams
- Outcomes & Next Steps
Enterprise SoS Process

Multi-Level Models

Descriptive Models


It’s a rather interesting phenomenon. Every time I press this lever, that post-graduate student breathes a sigh of relief.

Graphic: smumn.edu/facpages/dobucknam/rat_cartoon.jpg
Full Process & Project Scope

1. Context Analysis
   - Background Research
   - Interviews

2. Central Questions of Interest

3. Identify System Structure & Phenomena
   - Systemecimgram Narratives & Diagrams

4. Visualize Relationships
   - Systemigram Narratives & Diagrams

5. Identify Areas of Exploration
   - Innovation System Analysis
   - Key stakeholders
   - Critical enablers & barriers to change

6. Identify Data Sets to Parameterize
   - What are the measurement areas that will drive change?
   - What measures are collected versus what should be collected

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In Practice: Enterprise Systemigrams

A qualitative stakeholder-driven process to produce quantitative goals
SoS Perspectives

Four

No Three
Stakeholder Interviews & Research

• 15 Project Visits Completed, 25 People Interviewed
  ― DASD/SE
  ― Aerospace Corp
  ― JHU APL
  ― SAF/AQ
  ― Army PM-Aviation
  ― Army Future Vertical Lift Program Office
  ― Ground-Based Strategic Deterrent Program Office
  ― SPAWAR San Diego
  ― TARDEC
  ― J8 JCIDS office
  ― DOT&E
  ― NASA-Langley
  ― NASA-Marshall
  ― JPL

• Also:
  ― ~50 documents reviewed
  ― 6 facilitated meetings with DASD/SE team
Interview Process

**Actors**

**The Present:**
What cannot be sustained in the future we seek

**The Future:**
What characteristics of the system we aspire to create

**The Transformation:**
The zone of innovation, signals of the future in the present

**Resources**

**Human Resources and Training Opportunities:**
Trained people who can put science, technology, and innovation to work for problem solving

**Institutional and Infrastructure Resources:**
Organizations or functions that provide the structure and collective knowledge needed to innovate

**Collaboration & Communication Resources:**
Connections among parts of the system that diffuse knowledge and enable learning

**Knowledge Resources:**
Information embedded in research, indigenous knowledge, intellectual property, etc.
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Webinar - April 30, 2019

Storytelling and Narrative

*storytelling and mapping tools to describe the future as a conceptual model*

Individual Narratives & Statements

Anecdote Database

Meaningful Course of Action
## Context Analysis (Selected Phrases)

<table>
<thead>
<tr>
<th><strong>Domain</strong></th>
<th><strong>Enabling Environment</strong></th>
<th><strong>Key Actors &amp; Resources</strong></th>
<th><strong>Interactions/Activities</strong></th>
<th><strong>Outcomes/Outputs</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operational Context</strong></td>
<td>• Increasing complexity</td>
<td>•</td>
<td>• Curate models across domains, fidelity, phases and the lifecycle</td>
<td><strong>Goal 1: Formalize the development, integration and use of models to inform enterprise and program decision making</strong></td>
</tr>
<tr>
<td><strong>DoD DE Strategy</strong></td>
<td></td>
<td>• Manufacturing 4.0 drivers</td>
<td></td>
<td><strong>Goal 2: Provide an enduring authoritative source of truth (AST)</strong></td>
</tr>
<tr>
<td><strong>Global innovation in DE</strong></td>
<td></td>
<td>•</td>
<td></td>
<td><strong>Goal 4: Establish a supporting infrastructure and environment</strong></td>
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<td><strong>Manufacturing 4.0 drivers</strong></td>
<td></td>
<td>• INCOSE and other</td>
<td></td>
<td><strong>Goal 3: Incorporate technical innovations to improve the engineering practice</strong></td>
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<td><strong>Global innovation in DE</strong></td>
<td></td>
<td>• professional organizations</td>
<td>• Digital program documents</td>
<td><strong>Goal 5: Transform Culture and Workforce</strong></td>
</tr>
<tr>
<td><strong>DoC DE Strategy</strong></td>
<td></td>
<td>•</td>
<td>• Enterprise owns the ontology and data layer for analytical approaches</td>
<td>easier to ingest new processes and incorporate acquisition expertise into the tools</td>
</tr>
<tr>
<td><strong>Global innovation in DE</strong></td>
<td></td>
<td>•</td>
<td>• Libraries of reusable models</td>
<td>make the B-team and C-team players perform more at the A-Team level</td>
</tr>
<tr>
<td><strong>Develop, mature, and use IT infrastructures</strong></td>
<td></td>
<td>•</td>
<td>• Pay once for data, reuse everywhere</td>
<td><strong>Goal 4: Establish a supporting infrastructure and environment</strong></td>
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<tr>
<td><strong>Define and govern authoritative source of truth</strong></td>
<td></td>
<td>•</td>
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</tr>
<tr>
<td><strong>Lexicon, taxonomies, ontologies</strong></td>
<td></td>
<td>• Communities: Standards, guides</td>
<td>• Digital twin that injects data back into the models</td>
<td>opportunities that can be gained from deeper information in the AST</td>
</tr>
<tr>
<td><strong>Paperless system and technical information</strong></td>
<td></td>
<td>•</td>
<td>• System data accessible from a single portal</td>
<td>make the process more efficient and reduce rework</td>
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<td><strong>Paperless system and technical information</strong></td>
<td></td>
<td>• Communicators/ matchmakers</td>
<td>• Eliminate human process of finding and using data</td>
<td>capture and maintain lessons learned</td>
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<td><strong>Better informed Decision makers</strong></td>
<td></td>
<td>• Model governance/version control mgmt.</td>
<td>• Everything needed is on desktop, what’s been done before is there to reuse</td>
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<td>• Leadership &amp; messaging</td>
<td>• Enhance collaboration</td>
<td>make the B-team and C-team players perform more at the A-Team level</td>
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<td><strong>Usability of DE methods &amp; tools</strong></td>
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<td>• Older vs younger workforce</td>
<td>• Humans can focus on creative work and machines can take care of mundane tasks</td>
<td><strong>Goal 5: Transform Culture and Workforce</strong></td>
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<td><strong>Organizational and cultural resistance</strong></td>
<td></td>
<td>• Human capital - skills</td>
<td>• Understand incremental value of all trades, done dynamically</td>
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<td></td>
<td>• A-Teams &amp; B/C-Teams - performance</td>
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### Diagram:

1. **Structured text**
2. **3. Structured text**
3. **4. Systemigram(s) Design**
4. **4a. Formal system concept**
5. **4b. Other systems thinking**
Workforce and Culture

Much of the discussions around digital thread and digital engineering focuses on the technological and modeling aspects. While those are integral to the changing dynamics and processes, often overlooked is the human role and associated changes, and how it will shift and might change over time, as the broader system seeks to become more agile.

Most stakeholders and experts do agree there is a cultural change at play, along with needs for the workforce to adapt and change with the broader trends at play as well. There are divergences in perspective. In regards to what this might look like, the change in the “old guard” to “new guard”, whether or not there are workforce capabilities and the “talent” will look like.

DE is a cultural change in and of itself. There are the new tools which bring in digital natives and will be a merger of new technology and existing experience. As such, the workforce shift will be substantial. There will be big struggles to learn new ways. The goal is having the models to feed the decision processes, which requires training of modelers and a new breed of decision makers. However, it’s a challenge to get a large group of people to change. Culture change is not done without resistance or done overnight. There is an extraordinary advantage to maintain the status quo and temptation to “do it like how we did last time”. Culture change is organizationally dependent and unchangeable.

One of the bigger points of diversion amongst stakeholders is whether or not there is a workforce in place to grapple with the changes at play, and if so, whether there are capabilities to address the changes. On the one hand, DE is done today often times without the realization that is being applied. People who do models do it without thinking about it. However, there lacks the process and culture to bring together the emerging digital natives with grizzled veterans and their domain knowledge.

On the other hand, there is the belief that much of the workforce is an aged workforce that looks back at the way things were done rather than looking to the future. The younger group coming in also has shortfalls. The younger workforce is more skilled in a single discipline rather than a broad perspective. There needs to be an effort to better train the younger workforce to oversee multiple different domains to provide a more robust understanding of digital environment. However, bureaucracy and paperwork make it hard to train due to time constraints.

Additionally, there is not enough money or time to train older workforce to train them how to use new tools as well.

This squeeze on resources also impacts the focus on SE, as discipline workforces are less and less SE focused and system implications. Labor is expensive and systems are expensive to implement. There are no expectations to think about larger system aspects from the onset. Hiring managers are worried about finding MBSE workers, but there should be more of an effort place finding systems engineers.
Agenda

• Introduction

• Methodology: Multi-level Sociotechnical Modeling & Enterprise Systems Analysis

  Systemigram; Authoritative Source of Truth

• Outcomes & Next Steps
Increasing System Complexity drives the inability to sustain. System Characteristics (Size, Connectedness, Safety, Security, Reliability) have existing standards, which are a feature of today's systems. Other Programs need to provide initial source of needs access to. The System-of-Systems Analysis defines driving strategy from the DoD Policy. To provide, which governs, the Government Program/Enterprises provide the Authoritative Source of Truth (Common Data Baselines like FMECA, Model Libraries, Central Data Repository). It leads to the inability to sustain strategy. Program Office Staff (Program Managers, Procurement, Developers) works with Tech Data Procurement (Who produce, who need, who enforces) for System Updates of enabling, Innovation, Competition, and Warfighter. Domain Specific Federated Data Set defines interoperability, enabling Future Systems Engineers to manage, extract, and use data. Central Data Storage (Single Portal, Computing System, Cloud Server) provides data & model availability instantly on the AI-enabled Big Data Tools, helping manage scale and complexity and ensure endurance. Everything is on the desktop when needed for finding & using data. Design escapes/defects are improved by better managing agility. Between trust and agility, knowledge translation supports. For the realm of the possible, managing the spurs helps with innovation. To sustain, government-owned digital models are needed. Hardware & software models support interoperability, enabling knowledge translation. Version control governs data & model evolution.
**Authoritative Source of Truth**

- **System Complexity** drives increasing System Characteristics: Size, Connectedness, Safety, Security, Reliability.
- Configuration Management leads to inability to sustain.
- Government Program/Enterprises has existing systems.
- Roadmap strategy from other systems.
- DoD Policy provides a driving starting place.
- IT Savvy Workforce supports system engineering.
- Central Data Storage resides in single portal.
- Authoritative Source of Truth (SOS) provides access to common data baselines (like FMECA).
- Digital Models are validated by Warfighter for trust.
- Everything is on the desktop when needed.
- Future Systems Engineers manage data.
- agility improves between improving and eliminating/controlling design escapes/defects.
- Domain Specific Federated Data Set makes up the initial source of need.
- Ontology & Data Standards need access to.
- weapsys system acquisition concept, development, production, sustainment.
- Other Programs needs provide.
- Structure and complexity must manage.
- Process/Resource must ensure scale and complexity.
- Central Data Repository provides central data storage.
- Data & Model Availability helps manage AI-enabled big data tools.
- Government Owned and Contractor Owned digital models.
- Finding & Using Data for knowledge translation.
- Trust enables warfighter agility.
- Evolves into future systems engineers.
• Introduction

• Methodology: Multi-level Sociotechnical Modeling & Enterprise Systems Analysis

• Context Background: DE Transformation

Systemigram; Workforce and Culture

• Outcomes & Next Steps
Workforce and Culture

Program Office Workforce
- Program Management
- Business/Financial Management
- Procurement
- Engineering
- Prod./Quality Assurance
- Test & Eval

Engineering Workforce
- Manufacturing
- Software Engineering
- Hardware Engineering
- System Engineering
- Test & Eval

Communication
- Across disciplines
- Across roles
- With stakeholders

Digital Tools
- Provide effective visualization
- Customize user experience
- Different uses of similar tools
- Support collaboration

Transform Workforce and Culture
- Message:
  - Create better informed requirements
  - Make better informed decisions
  - Ability to assert competencies
  - Do the same things faster
  - Communicate better
  - More work flexibility
  - Reduce risk

Leadership
- Must support investment
- Must produce
- Must persist to

Tool Vendors
- Must incentivize
- Must invest in
- Must provide

Central Data Storage
- Single Portal
- Computing System
- Cloud Server

Digital Collaboration Platforms
- Needed to
- For
- Use

Everything is on the Desktop when Needed

Finding & Using Data

Agility

Struggle with formal cross-disciplinary
Program Collaboration
- Lack formal

Leading to improved
Bridge the modelers to acquirers gap

Digital Engineering
- To create the necessary
- Requiring reprioritization of the

Younger Engineers
- More receptive to
- Link together
- Knowledge Transfer
- Broadens perspectives with
- Will be set by
- Causes
- Attrition

Aging Workforce
- Rely too much on
- Heroes*

Disciplinary Roles
- Performed by
- Concern
- Provide

MBSE
- Ability to model across
- Less receptive to
- Digital Models

System Complexities
- Driving change in
- System

System Complexity
- Limits delegation to
- Will lead to more technical
- Will reduce

Domain
- Actors
- Structure
- Processes/Resources

Legend

Must be about
- Has mature
- Is no silver bullet for good

MBSE
- Uses

Seeing increasing
- Driving change in
- Uses
Workforce and Culture

Actors
- Systems Engineering
- Domain
- Structure
- Processes/Resources

Legend
- Workforce and Culture
- Is no silver bullet for good
- Must be about seeing increasing uses
- Must be mature
- Has mature
- Perform by
- Concern
- Less receptive to
- Broader perspectives
- Provide
- More receptive to
- Link together
- union
- Will reduce
- “Heroes”
- Will be set by
- Tools
- Central Data Storage
- System Complexity
- Disciplinary Roles
- Processes/Resources
- Has mature
- Concern
- More receptive to
- Ability to model across
- Less receptive to
- Performing
- Concern

Legend
- DE Initiatives
- Shared knowledge/ Authoritative Source of Truth
- Guidedbook Chapter on MBSE
- Communities of Practice/Interest
- Innovation spaces & projects
- Strategic vector/Commander’s intent
- Must support investment in
- Must produce
- Must persist to
- Must provide
- Messaging
- Create better informed requirements
- Make better informed decisions
- Ability to assert competencies
- Do the same things faster
- Communicate better
- More work flexibility
- Reduce risk
- Everything is on the Desktop when needed
- Central Data Storage
- Single Portal
- Computing System
- Cloud Server
- Needed to
- Transform Workforce and Culture
- More “A” Players
- Improving
- Agility
- Program Collaboration
- Lack formal
- Program Office Workforce
- Program Management
- Business/Financial Management
- Procurement
- Engineering
- Prod/Quality Assurance
- Test & Eval
- Communication
- Across disciplines
- Across roles
- With stakeholders
- Bridge the modelers to acquirers gap
- Struggle with formal cross-disciplinary
- Program Collaboration
- Lack formal
- Digital Collaboration Platforms
- Digital Tools
- Provide effective visualization
- Customize user experience
- Different uses of similar tools
- Support collaboration
- Modern Engineers
- Older Engineers
- Knowledge Transfer
- Pace of Adoption
- Will reduce
- Will be set by
- Leadership
- Tool Vendors
- Digital Engineering
- System Engineering
- Disciplinary Roles
- Digital Models
- MBSE
- Systems Engineering
- Program Office Workforce
- Program Management
- Business/Financial Management
- Procurement
- Engineering
- Prod/Quality Assurance
- Test & Eval
- Engineering Workforce
- Manufacturing
- Software Engineering
- Hardware Engineering
- System Engineering
- Test & Eval
- Engineering Workforce
- Manufacturing
- Software Engineering
- Hardware Engineering
- System Engineering
- Test & Eval
- Program Office Workforce
- Program Management
- Business/Financial Management
- Procurement
- Engineering
- Prod/Quality Assurance
- Test & Eval
- Engineering Workforce
- Manufacturing
- Software Engineering
- Hardware Engineering
- System Engineering
- Test & Eval
Workforce & Culture

- Most stakeholders and experts do agree there is a cultural change at play
- Divergence in perspective in regards to what this might look like
  - Change in the “old guard” to “new guard”, whether or not there are workforce capabilities and the “talent” will look like
- Substantial workforce shift: new tools which bring in digital natives and will be a merger of new technology and existing experience
  - Are there capabilities and resources to address the changes?
  - Tensions between the old and new guard
- Evolution of Systems Engineering and System Modeling roles & methods
- Digital collaboration and access to truth data is a key enabler
- Commitment of leadership is essential
  - Investment, common messaging, safe places to experiment
- What innovations will drive the future DE desktop environment?
• Introduction

• Methodology: Multi-level Sociotechnical Modeling & Enterprise Systems Analysis

• Context Background: DE Transformation

Systemigram; Inform Enterprise and Program Decision Making

• Outcomes & Next Steps
Inform Enterprise and Program Decision Making

- **SME knowledge** feeds into an authoritative source of truth, represented by digital data, models, and simulations.
- **Capability Assessment** links to government concerns, defining context and right fidelity for enterprise architecture.
- **Operational Planning & Force Structure** uses digital requirements to produce the CDD, which starts the system development process.
- **Good Cross-Program Functional Models** support system development needs and inform decision making.
- **More Robust AoAs** and process to get to the capability assessment needs for the future.
- **Quality Control** provides lessons learned for decision makers.
- **Domain** and actors are involved in processes/resource capture.
- **Simulation Operations at Scale** involves different models representing the same capabilities at different scales.
- **Program Manager Concerns** include system level trades & analyses, design changes, and design escapes for cost and schedule optimization.
- **System Engineering** involves digital model for human understanding, producing digital program history to eliminate/reduce/control.
- **Decision Making** is informed by digital program history and lessons learned.
- **Satisfy Capabilities, not Requirements** makes systems engineering more efficient.
- **Make Systems Engineering more Efficient** through simulation, prototyping, and domain-specific models.
- **Domain specific models** inform operational planning & force structure for better understanding of operational requirements.
- **Early Stage Program Development** involves system level trades & analyses, design changes, and design escapes for cost optimization.
- **Digital Thread** involves early stage program development and early engagement in acquisition.
- **Simulation Operations at Scale** involves different models representing the same capabilities at different scales.
• Introduction

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Systemigram; Other Insights

• Outcomes & Next Steps
Technical Innovations to Improve Engineering Practice

Superior Engineering Capabilities

- Agile
- Scalable
- Cost effective
- Assuring mission success
- Superior System Creation/Definition Capabilities

More Comprehensive Models
- Digital Twin

Data Repositories
- Materials DB
- Weather DB

Engineering decision making

Visualization Capabilities
- Tradespace
- Data Viz
- VR/AR

Exploration Capabilities
- Tradespace Exploration
- Optimization

Uncertainty Characterization
- Quantification
- Validation
- Calibration

HPC Infrastructure
- Energy Efficient
- Scalable

Simulation Algorithms
- Human-in-the-loop
- Multidisciplinary
- Real-Time

Reasoning Algorithms
- Model Checking
- Consistency & Completeness Checking
- Formal Verification

Data Technologies
- Machine Learning
- Data Analytics
- IoT

Ontology Engineering

Knowledge Repositories
- Unstructured
- Structured

Models form Patterns

Decision Makers

Language Architects

SMEs

Communities of Practice

Ontology Engineering

Se Modeling languages
- Formal/ Unambiguous
- Intuitive
- Layered

Superior Modeling Capabilities

Superior System Creation/Definition Capabilities

Superior Interpretation Capabilities

The Cloud

Implemented in

Simulation Algorithms

Generate data for

More Comprehensive Models

Digital Twin

Authoritative Source of Truth

Superior Communication Capabilities

System Complexity

Agile Adversary

Effective technical innovation

Superior weapons systems

maintain advantage over

Effective technical innovation

makes SE more efficient

Superior Engineering Capabilities

requires

results in

ur scales with

Superior Engineering Capabilities

requires

implemented in

Federated Model Repository

implemented in

Digital Collaboration

Acquisition Stakeholders

Program Office

Contractors

Supply Chain

Domain

Actors

Structure

Processes/Resources

Legend

Superior Engineering Capabilities

- Agile
- Scalable
- Cost effective
- Assuring mission success
- Superior System Creation/Definition Capabilities

More Comprehensive Models
- Digital Twin

Data Repositories
- Materials DB
- Weather DB

Engineering decision making

Visualization Capabilities
- Tradespace
- Data Viz
- VR/AR

Exploration Capabilities
- Tradespace Exploration
- Optimization

Uncertainty Characterization
- Quantification
- Validation
- Calibration

HPC Infrastructure
- Energy Efficient
- Scalable

Simulation Algorithms
- Human-in-the-loop
- Multidisciplinary
- Real-Time

Reasoning Algorithms
- Model Checking
- Consistency & Completeness Checking
- Formal Verification

Data Technologies
- Machine Learning
- Data Analytics
- IoT

Ontology Engineering

Knowledge Repositories
- Unstructured
- Structured

Models form Patterns

Decision Makers

Language Architects

SMEs

Communities of Practice

Ontology Engineering

Se Modeling languages
- Formal/ Unambiguous
- Intuitive
- Layered

Superior Modeling Capabilities

Superior System Creation/Definition Capabilities

Superior Interpretation Capabilities

The Cloud

Implemented in

Simulation Algorithms

Generate data for

More Comprehensive Models

Digital Twin

Authoritative Source of Truth

Superior Communication Capabilities

System Complexity

Agile Adversary

Effective technical innovation

Superior weapons systems

maintain advantage over

Effective technical innovation

makes SE more efficient

Superior Engineering Capabilities

requires

results in

ur scales with

Superior Engineering Capabilities

requires

implemented in

Federated Model Repository

implemented in

Digital Collaboration

Acquisition Stakeholders

Program Office

Contractors

Supply Chain

Domain

Actors

Structure

Processes/Resources

Legend
Digital Engineering Infrastructure

Today's Infrastructure

Facing

Must Eliminate

Upcoming Systems

Greater Scale

Greater Complexity

Need to Move Beyond

Current Resources

MS Office Tools

Data Repositories like the Wild West

Configuration Management

Building

DE Capability

MBSE Tools

Processes

MBSE language

Parametric Tools

Enable Return to

Transition to

Comprehensive, Effective Configuration Management

Transition to

Spec Doc Writers

To

System Level Trades and Analysis

Enables

Support

Rigorous Systems Engineering

Focus on

System Development

Augmented Reality Simulation

Training

Operations

Foster

Collaboration across Disciplines and Locations

Collaboration across Disciplines and Locations

Outcomes

Enables

Enables

Tomorrow's Digital Engineering

Legend

Domain

Actors

Structure

Processes/Resources

Interoperable

Complete Package

Integrated Tools

Databases

Interoperable

System of Systems

Necessitates

Manual Processes

Finding Data

Using Data

60 days to get data off test range

Manage Data

Real Time Quick Look

Search for Relevant Data

Buy Data from Others

Automated Data Extraction

Available on

The Cloud

Available on

Different Levels

Threats

Living Digital Twin

Interconnected

Libraries of Information

Different Levels

System Development

__in the Loop

Augmented Reality Simulation

Training

Operations

Focu
Digital Information Exchange

Presented at inaugural DEIXWG meeting, INCOSE IS 2017

Change the nature of AoAs

Change how we curate data and models

Change Reqs process

Change what Systems Engineers do
Agenda

• Introduction

• Methodology: Multi-level Sociotechnical Modeling & Enterprise Systems Analysis

• Systemigrams

Outcomes & Next Steps
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• Created holistic model of DoD Acquisition Enterprise change as DE is gradually adopted

• Good agreement across stakeholders on the nature of the strategy

• Descriptive modeling process reveals scope of change

• Testing insights in multiple forums using Systemigrams

• Base models informing other activities:
  — Digital Engineering Working Group (DEWG)
  — Digital Engineering Information Exchange Working Group (DEIXWG)
Next Phase – DE Metrics

- Theme: “A Program Office Guide to Successful DE Transition”
- Work with several DoD program offices, contractors, and tool providers
- Identify measures of success, and define multi-level measurement models
  - Near- and long-term change indicators
- Identify potential innovation game-changers
  - Define enablers and barriers to innovation
  - Define cross-sector innovation opportunities
Future Research Needs

• **Model Curation and Certitude.** Must develop a rigorous approach to verify, validate, and accredit the models that are incorporated into the Authoritative Source of Truth, particularly quality and range of valid use.

• **Metadata standards for the Authoritative Source of Truth.** Extend SET work on ontologies and metadata/metamodell libraries and tools.

• **Human Capital.** This will be a significant shift in the workplace, leading to an “IT/Data Savvy” workforce. Training programs must evolve with the strategy.

• **Bringing in the first and last phases.** Need to engage and define how the capabilities assessment and development, operational, and test functions adopt and benefit from DE.

• **Evolution of Benefits of DE.** A sustained program that encourages exploring the art of the possible and understanding of the unique use cases that will evolve should be pursued.
Questions?

Thank you!