Evolving MBSE to Enable the Digital Future

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Connecting People, Disciplines, Insights, and Ideas

Image credit: US Department of Transportation
A Modern Approach to the Challenge: What MBSE is All About

- Making system descriptive and analytical models explicit, coherent, and consistent
  - Evolution from low-fidelity representations in documents to higher-fidelity, richer representations
  - Improved granularity of knowledge capture for management, analysis, and learning
  - One architectural model connecting multiple analytical models
- Leveraging models for communication and analysis
- Developing a “single source of truth” for system design and specification
- Ensuring consistent design and specification (when done well)
- Providing an explicit system model to engineering teams

An evolution – not revolution in thinking and approach...
An evolution that offers transformative results
Seeing the Evolution of MBSE
Beyond Seeing the Big Picture: Setting the Big Picture

“One cannot understand a part of a system without at least a rudimentary understanding of the whole.”

“People can only be empowered if they have enough context to make good decisions.”

“Functioning in an interdependent environment requires that every team possess a holistic understanding of the interaction between all the moving parts.”
Aligning and Understanding through “Fit for Purpose” and “Single Source of Truth”

Reprinted from Department of Defense Architecture Framework (DoDAF) 2.0, May 2009
Engaging and Immersing through Life
Leveraging Architecture, Patterns, Composability for Health, Resilience, Security
Connecting Architecture and Analysis

“One model to coordinate them all”
Seeing the Bigger Picture

A Reality Check for Systems Engineers
Seeing the Mismatch between Modern Conditions and Classic Approaches

We tend to assume that technological advances will enable us to do what we have always done, only better. However these same technologies imbue our operating environment with escalating non-linearity, complexity, and unpredictability.

Attempts to control complex systems by using the kind of mechanical reductionist thinking … breaking everything down into component parts, or optimizing individual elements … tend to be pointless at best or destructive at worst.
Model Chains: Perception and Reality
"The amount of systems engineering required for a given project is fixed. You don’t get to choose how much SE you do. You simply get to choose when you do it (up front or during integration & test), how much positive impact it has, and how much it costs."
Systems Engineering the Digital Thread: Digitizing the Engineering Lifecycle

MBE Enhances Affordability, Shortens Delivery and Reduces Risk Across the Acquisition Life Cycle

NDIA Model-Based Engineering Final Report, February 2011
Engineering a Modern, Connected Approach: Data, Concept, Theory, Workflow, Workforce, and Trust

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Drawing Inspiration beyond Engineering

Semantic Science
Visualization
Life Sciences
Design Thinking and UX

Systems Science
Sociology
Computational Augmentation
IT Experts
Systems Literacy for All
The Journey Forward
Exceeding the Capabilities of Traditional (S)E: Capturing Knowledge, Responding to Change

System scale
Mission complexity
Project team complexity
Dynamic complexity

Image credit: Alisa Farr for Letter27. farrimages.com
Applying Our Practices to Ourselves and the Journey – Accidental, Integrated, or Engineered?

The systems perspective is essential to developing solutions for problems with a meaningful degree of complexity.

The interesting things are often found in the gaps – between disciplines, between technologies, between components.

Without the systems perspective, we cannot address the challenges of today and tomorrow effectively, efficiently, and free from unintended consequences.

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The Journey to the Digital Future

The path to optimizing systems engineering lies in suboptimizing systems engineering.

We fail more often because we solve the wrong problem than because we get the wrong solution to the right problem (Russell Ackoff)
Questions