Evolving MBSE to Enable the Digital Future

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Connecting People, Disciplines, Insights, and Ideas

Requirements Architecture Image credit: US Department of Transportation **SVitech**

Moving from Ambiguity to Digital Clarity: Communications, Semantics, Analysis



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 higherfidelity, 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: <u>Setting</u> 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"



Engaging and Immersing through Life





Connecting Architecture and Analysis



Seeing the Bigger Picture

A Reality Check for Systems Engineers



Seeing the Mismatch between Modern Conditions and Classic Approaches

ORK TIMES BESTSELLE TEAM TEAMS LES OF ENGAGEMENT FOR A COMPLEX WORLD GENERAL STANLEY McCHRYSTAL U.S. Army, Retired with Tantum Collins, David Silverman,

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





Remaining Grounded: Law of Conservation of SE

"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 Operations

LRIP

Engineering & Manufacturing

Technology

Development

Pre-Systems Acquisition L Program Manager

PDR er

Management Test

Configuration

Management

Integrated

System Design

Post PDR

Assessment

Systems Acquisition

Manufacturing

stics

Customer

System Capability & Manufacturing Process

Demonstration

Post CDR

Assessment

Operationa . Models

Production &

Deployment Full Rate Prod

& Development

Decision Review

customers

& Support

Life Cycle Sustainment

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

suppliers

Operational

Models

Syster Model

NDIA Model-Based Engineering Final Report, February 2011



Material

Solution

Analysis

Material Development

Decision

Systems

Hardware

Software

Engineering a Modern, Connected Approach: Data, Concept, Theory, Workflow, Workforce, and Trust





The Journey Forward



(MB)SE

Exceeding the Capabilities of Traditional (S)E: Capturing Knowledge, Responding to Change

System scale

Mission complexity

Project team complexity

Dynamic complexity



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Applying Our Practices to Ourselves and the Journey – Accidental, Integrated, or Engineered?



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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



