MBSE COCKPITS

GLOBAL PRODUCT DATA INTEROPERABILITY SUMMIT 2025

Jonathan Scott - Razorleaf

PRESENTER'S BIOGRAPHY

Jonathan Scott, Razorleaf

Jonathan Scott is a leading advocate for product digitalization, championing the adoption of digital thread and digital twin concepts across manufacturing industries. With extensive experience spanning commercial and government sectors, he assists clients in formulating and implementing product digitalization strategies using modeling, PLM, and MES technologies. Jonathan's primary focus lies in shaping the technical vision and strategy for digital thread initiatives within product organizations. His background in the nuclear and transportation industries, his training in mechanical and systems engineering, and his 25 years of experience in consulting enable him to share insights and recommend solutions to clients. By leveraging his expertise and understanding of industry dynamics, he encourages organizations to change how they work so they can achieve their goals.

Jonathan Scott holds a Bachelor of Science degree in Mechanical Engineering from the University of Virginia and a certificate in Model Based Systems Engineering from Caltech.

BLUF (BOTTOM LINE UP FRONT)

1. Summarize, analyze, simulate, and act
2. Data and processes in PLM, MES, QMS, ERP, SCM...
3. Digital Thread is hard, but the information is meaningful
4. “Enterprise AI” needs this data

REAL-WORLD SCENARIO: AGILE UXV MANUFACTURING

From the News:

China's Export Restrictions on Drone Parts Could Reshape Global Supply Chains

dronelife

News Products Industries Enthusiasts

China's Export Restrictions on Drone Parts Could Reshape Global Supply Chains

December 10, 2024 by Miriam McNabb — Leave a Comment

Limitations May Impact Ukraine, the U.S., and Europe as Drone Technology Evolves in Wartime

The Chinese government plans to implement stricter controls on the export of drone parts in early 2025. This shift is already affecting manufacturers and buyers across the globe. According to reports, Chinese companies have reduced or halted sales of batteries, motors, and flight controllers to the U.S., Europe, and Ukraine. These components are critical for drone operations and supply chains.

China's decision follows escalating tensions with the U.S., highlighted by sanctions against American drone companies like Skydio, BRINC Drones, and RapidFlight. (Skydio announced last month that they had been

Conflict Scenario:

- Global armed conflict will use many Unmanned <X> Vehicles (UxVs)
- Near-peers will continually escalate capabilities via SW+HW
- Winning will rely on delivering nimble capabilities to the conflict zone at scale

Today's Story:

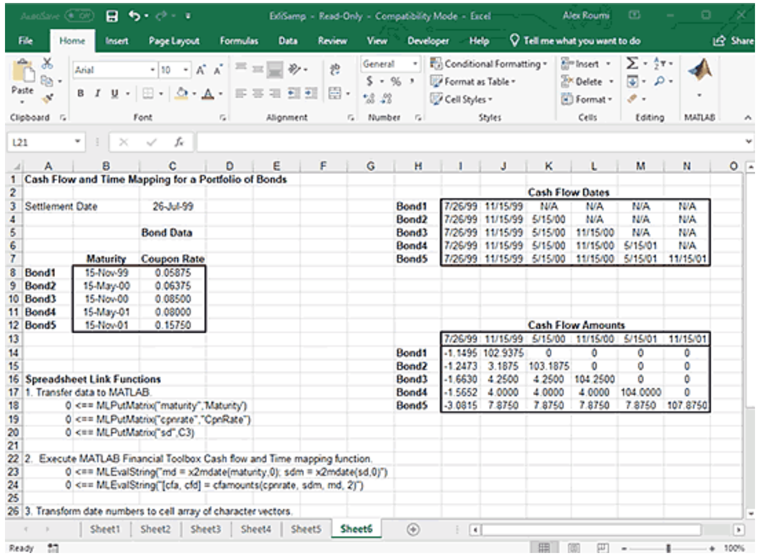
- How could MBSE cockpits for products, factories, and enterprises help?

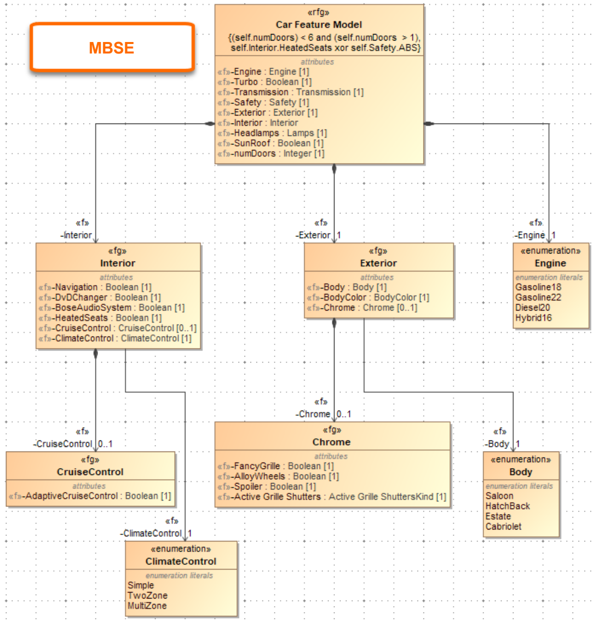
Look for →

EXAMPLE

- Details of cockpit usage

Visibility without agency





THE MBSE COCKPIT VISION

Product

ENTITIES:

Modules, Components, Behaviors

CHARACTERISTICS:

Weight, Material, Energy, Speed

EXAMPLE

- Requirements update
- Visualize impact by subsystem, use case

Factory

ENTITIES:

Lines, Work Cells, Processes

CHARACTERISTICS:

Cycle Time, Delivery, Cost, Scrap

EXAMPLE

- Line throughput change
- Visualize work cell impact
- Evaluate line rebalance

Enterprise

ENTITIES:

Suppliers, Logistics, Materials

CHARACTERISTICS:

Availability, Time, Distance, Cost, Risk

EXAMPLE

- Component shortage
- Visualize supplier impact
- Evaluate supplier redistribution

COUNTERARGUMENT

Risk	Too much information AND control in one place
Separation of Concerns	Analyzing information is different from simulating or taking action
Impracticality	There is no “one [tool] to rule them all”

MULTI-LEVEL ABSTRACTION POWER

Abstraction Enables Speed

EXAMPLE

High Abstraction:

- Simple power-to-weight product math model

Scope Controls Focus

EXAMPLE

Model Scope:

- SoS showing supply chain and 2 factories making a single product

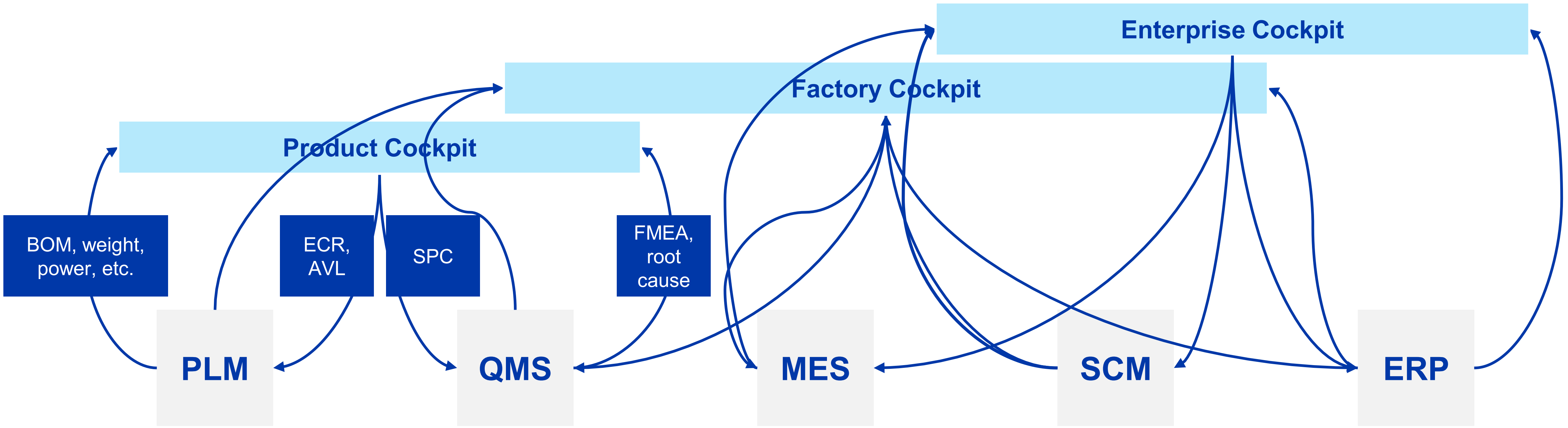
Levels/Layers Examples for Product, Factory, Enterprise

EXAMPLE

Layered Models:

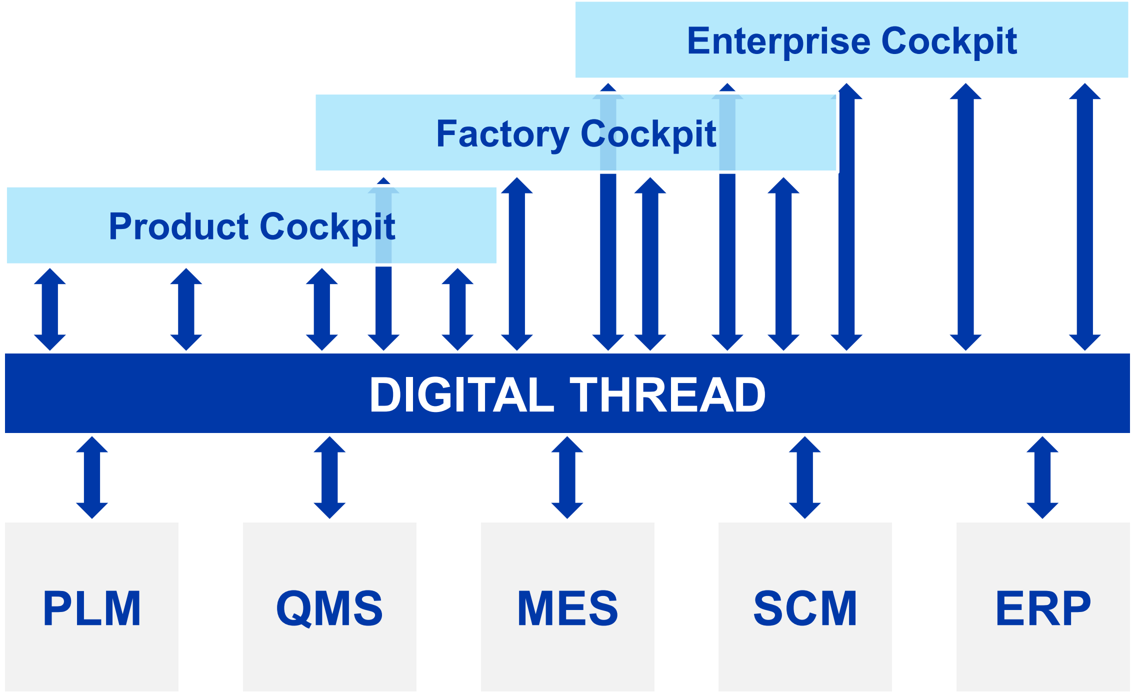
- Full factory model for bottlenecks at shipping/receiving
- Limited factory model for X product line

FROM PASSIVE DASHBOARD TO ACTIVE COCKPIT



- **Not full closed-loop with 2-way communications (1.5-way)**
  - **1-way: live data from source systems/tools into MBSE**
  - **0.5-way: proposals and simulations from MBSE back to source systems**
- **Proposed actions travel back through Digital Thread to ASOT (Authoritative Source of Truth)**

TECHNICAL INTEGRATION CHALLENGES



- Overlapping data in disconnected systems (PLM, QMS, MES, ERP…)
- Disparate and proprietary data models
- Heterogeneous logical security models
- Misaligned time-phasing
- Technological variety
- Security threats

Why MBSE cockpits transform operations

- **Eliminate tool-switching delays and inconsistencies**
- **Enable real-time scenario testing**
- **Support collaboration – across abstraction levels AND among stakeholders**
- **Push actions back to relevant ASOTs**

Analogy: NFL Surface Sideline Viewing System

What Am I Proposing?

- Build a digital thread to explicitly connect the right information together
- Expose the right information context in a model
- Use the model to analyze, propose, simulate, and drive action

Where Does AI Fit?

After training on valid MBSE models, AI can propose solutions alongside humans

Where Does AI *NOT* Fit?

- Making the MBSE model
- Making the digital thread

QUESTIONS

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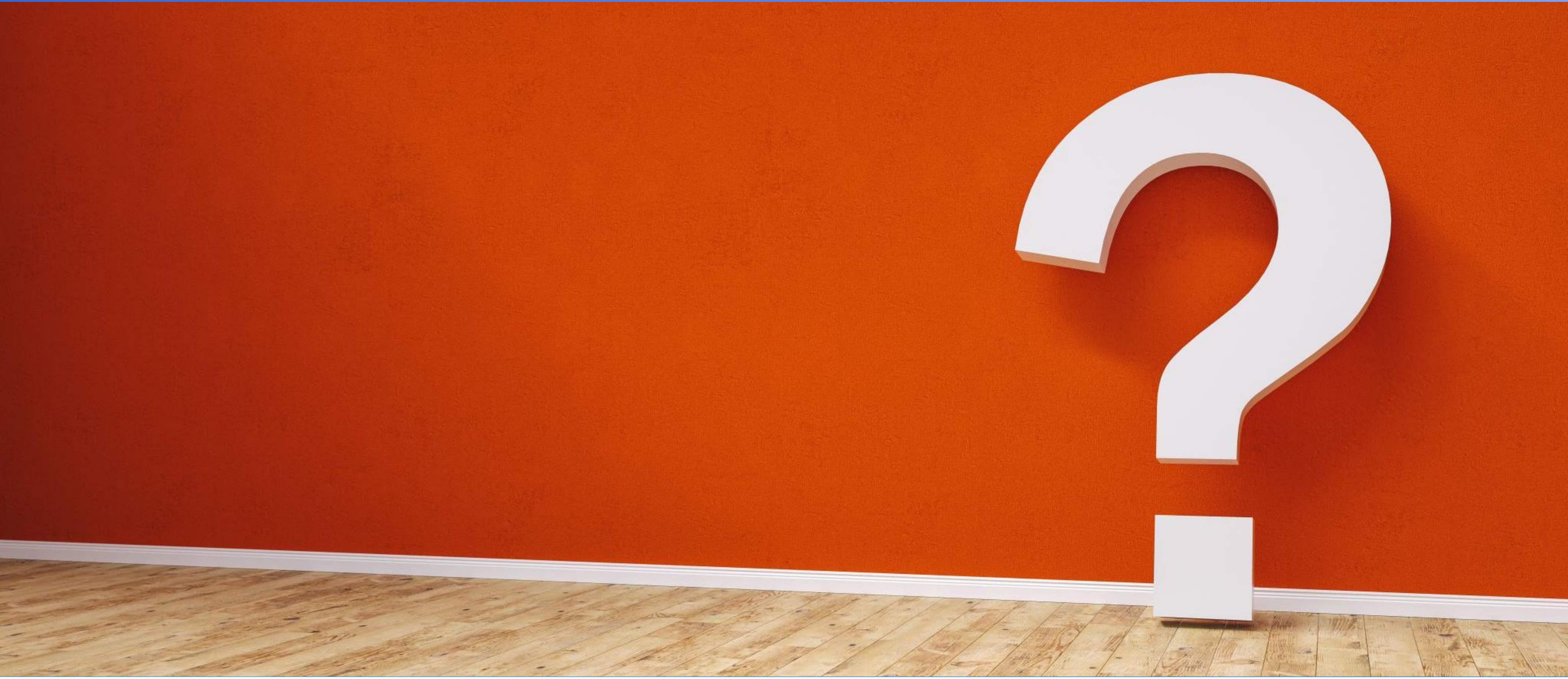

Integrating MBSE Tools with PLM, MES, and ERP Systems: The Missing Dimension of Your Digital Engineering Strategy

In today's fast-paced engineering environment, integrating Model-Based Systems Engineering (MBSE) tools with enterprise systems like Product Lifecycle Management (PLM), Manufacturing Execution Systems (MES), Enterprise Resource Planning (ERP) fills a critical gap in a cohesive digital engineering strategy. While MBSE offers a framework for modeling complex systems, its full potential is realized when aligned with manufacturing and business systems. Integrating these systems with MBSE ensures seamless data flow, linking engineering decisions to manufacturing and business goals.

This type of integration adds a missing viewpoint, and set of capabilities, between engineering, production, and operations, driving more efficient and agile programs. Modeling requirements, processes, systems, and environments align engineering efforts with customer needs, regulations, and business strategy, positioning companies for success in a changing marketplace.

This presentation by Razorleaf, an industry leader in integrating engineering systems, including PLM and MES, highlights the value of integrating MBSE tools as the heart of a digital engineering strategy. Weaving the capabilities of MBSE tools into daily digital engineering streams provide a very useful view of the system-of-systems and a watchful eye highlighting specific triggers, patterns, and change-driven impacts.