SERC TALKS

How Can Model Governance Aid Digital Engineering Execution?

with Dr. Heidi Davidz, ManTech International Corporation

- Today's session will be recorded.
- An archive of today's talk will be available at: www.sercuarc.org/serc-talks/ as well as on the SERC YouTube channel.
- Use the Q&A box to queue up questions, reserving the chat box for comments, and questions will be answered during the last 5-10 minutes of the session.
- If you are connected via the dial-in information only, please email questions or comments to SERCtalks@stevens.edu.
- Any issues? Use the chat feature for any technical difficulties or other comments, or email SERCtalks@stevens.edu.

CELEBRATING SYSTEMS ENGINEERING DIGITALIZATION

“Celebrating Systems Engineering Digitalization” Series Moderator

Tom McDermott

Chief Technology Officer,
Systems Engineering Research Center

How Can Model Governance Aid Digital Engineering Execution?

ManTech
Securing the Future

Dr. Heidi Davidz

Engineering Fellow, Intelligent Systems Engineering,
ManTech International Corporation

How Can Model Governance Aid Digital Engineering Execution?

Know what you have

Know why you have it

Know how it's controlled

What is Model Governance?

- Documented decisions, rights, and accountabilities
- for model related processes,
- executed according to an agreed upon set of rules
- which describe:
  - who can take
  - what actions with
  - what models,
  - when, under
  - what circumstances, using
  - what methods.

Transparent

Collaborative

Measurable

Adapted from Pak 2021

Why Governance?

"Digital Engineering (DE) is an integrated digital approach that uses authoritative sources of system data and models as a continuum across disciplines to support lifecycle activities from concept through disposal"

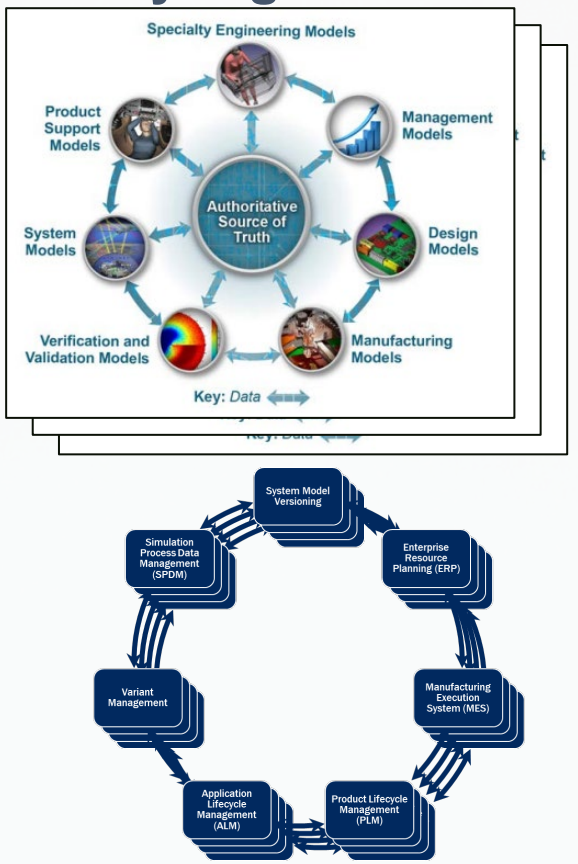
Adapted from DoD 2018

Use models

Different domains

Distributed data management

Many organizations



Reality

Governance across a digital thread must address a set of data management tools to ensure quality for decision making

Why Governance?

Organize the digital engineering ecosystem to execute efficiently and reduce the cost of confusion, churn, rework

- **Scope** – WHAT models/data are in the program DE ecosystem?
- **Roles** – WHO needs to interact with those models/data?
- **Purpose** - WHY are models/data needed for the mission?
- **Process** – HOW do WHAT actions happen WHEN?
- **Location** - WHERE do models/data reside in the infrastructure?

Governance vs. Management

Model Governance

Govern – Define and oversee the right things

Model Management

Manage – Do the right things

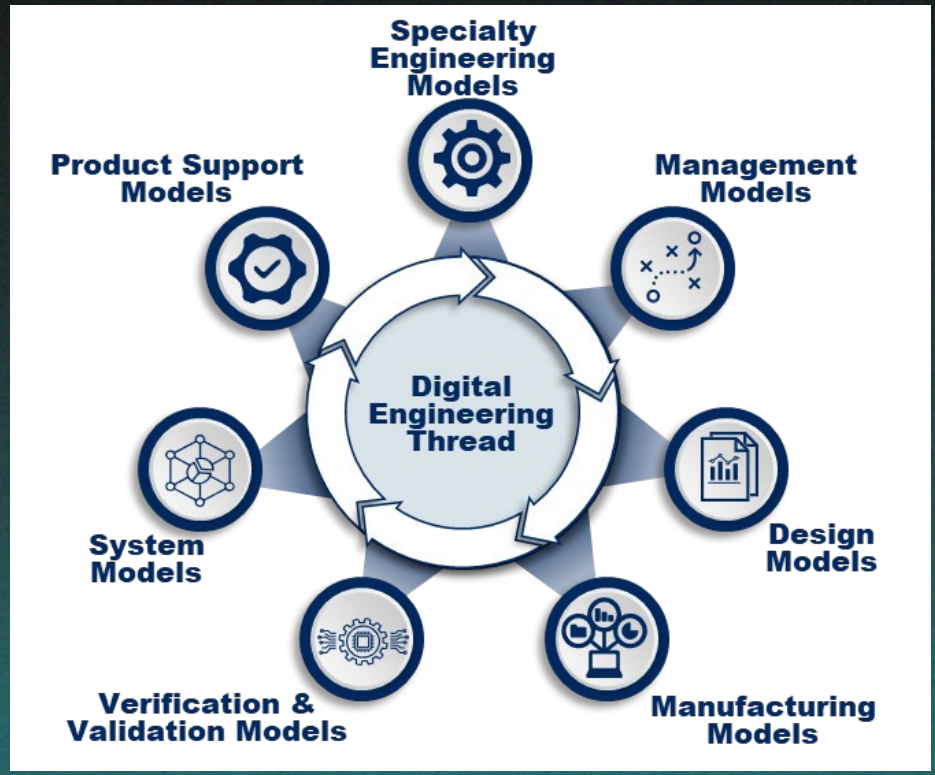
Model Governance ensures Model Management is happening

Adapted from Ladley 2020

Two Sides of the Same Coin

Solution Debt and DE

- Technical debt is the implied cost of additional rework caused by choosing a limited solution now
- Solution debt attempts a more comprehensive view across discipline and lifecycle, including data debt
- Evaluating solution debt includes: (1) impact, (2) fix cost, (3) contagion



DE Connects Data in Useful Ways, but Can "Super Spread" Debt Impact

Cost Justifies Governance

- Experian: The cost of bad data is 15% to 25% of revenue for most companies
- IBM: Businesses lost $3 trillion dollars per year due to bad data
- Gartner: Every year, poor data quality costs organizations an average $12.9 million

From Redman 2017, Grandperrin 2022, Taylor et al 2022

Cost of Data Debt Used to Justify Data Governance Programs

One Solution

Design, deploy, sustain an effective data and model governance program

ManTech Model Governance Guide

As Digital Engineering (DE) employs a digital thread with a broad range of interconnected models, it can be difficult to govern linked models across disciplines and contractual boundaries. This approach includes:

GUIDANCE – Model-based guidance with in-model work instructions,

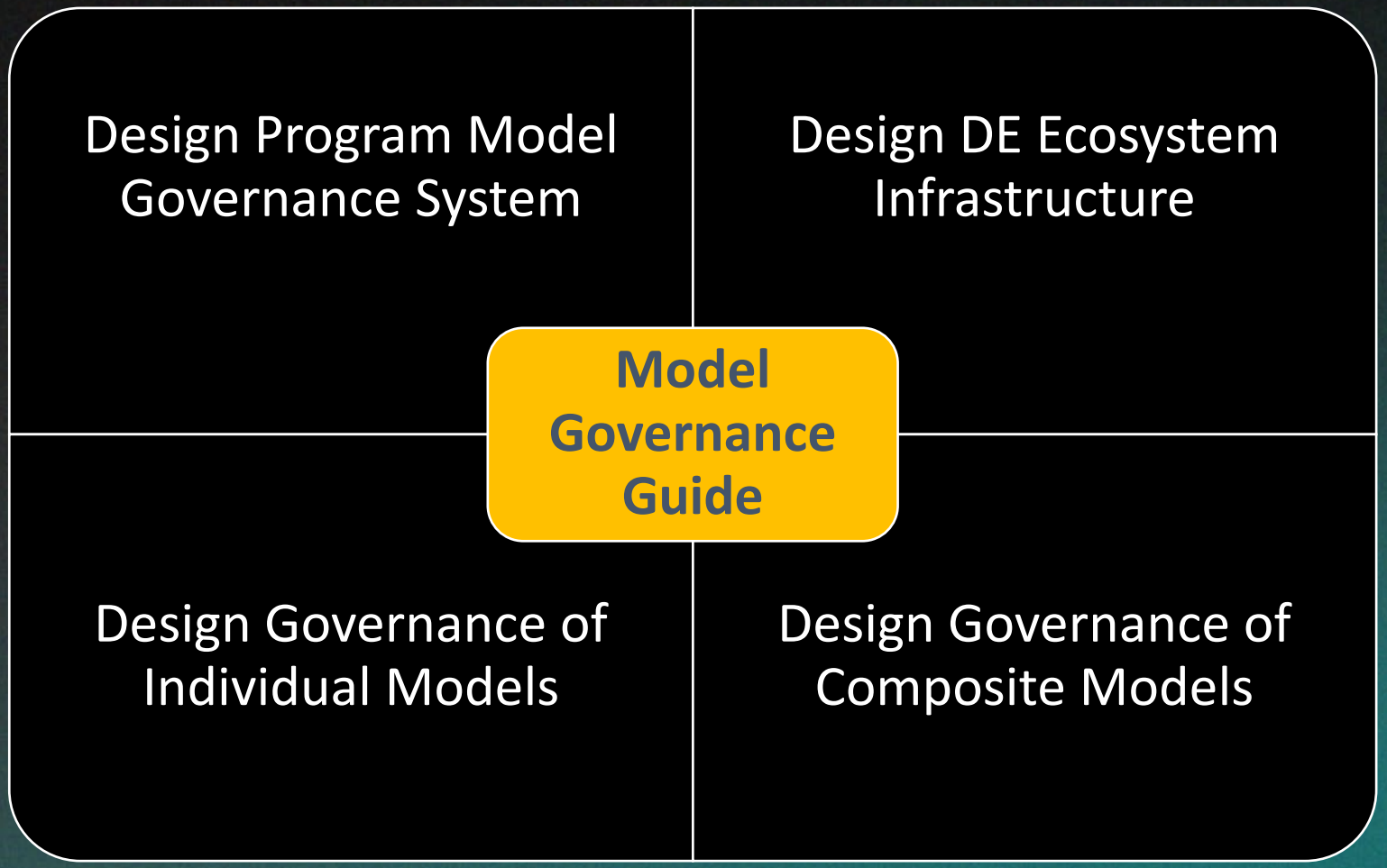
INTEGRATION – Integration of the overall model governance system, DE Ecosystem (DEE) infrastructure, individual models, and composite models,

PURPOSE – Traceability of model purpose and resolution of technical debt,

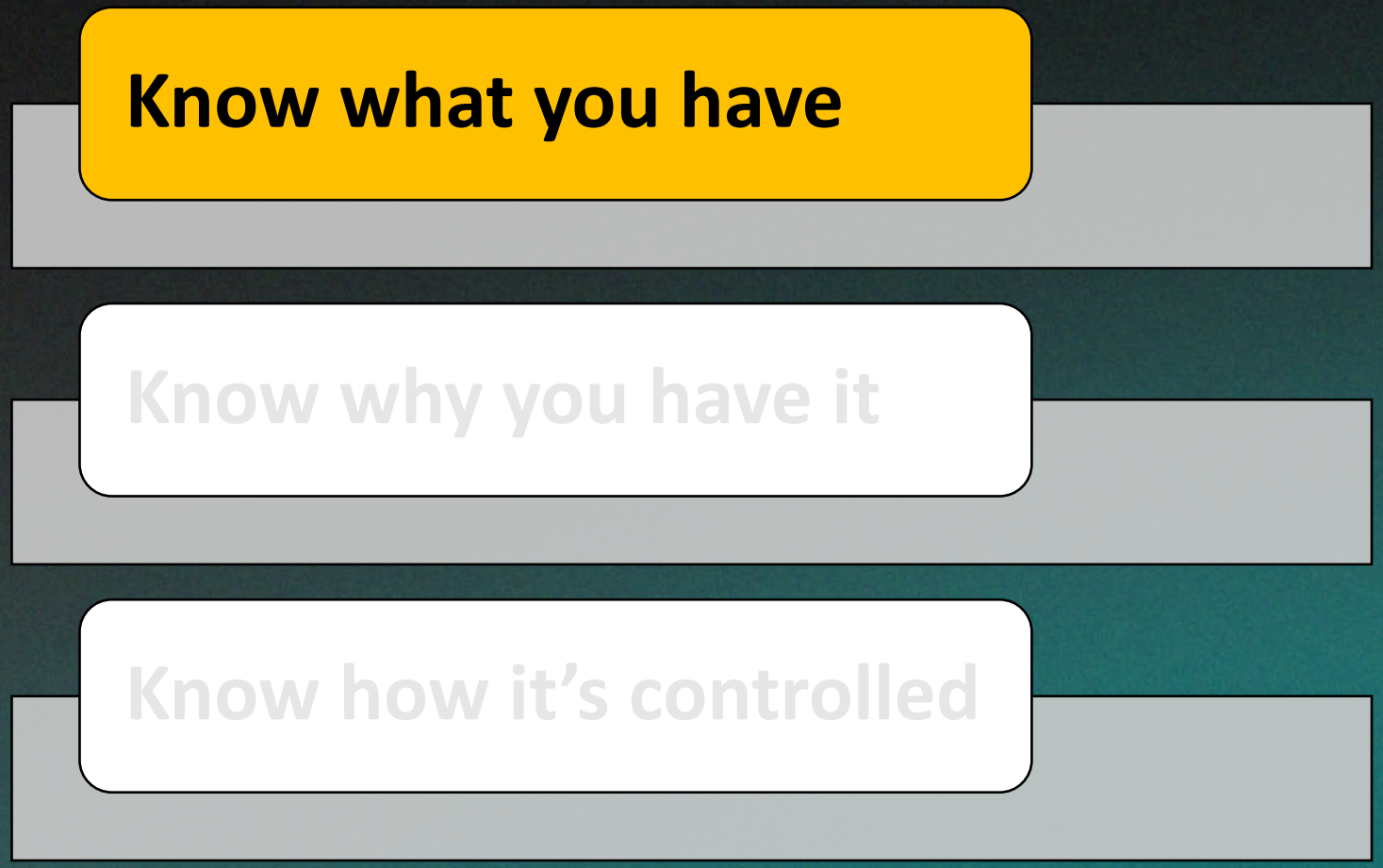
VALIDATION – Automated validation for insight on compliance,

FLEXIBILITY – Customization for flexibility and tailoring (flex-engineering®).

Design the Program DE Governance

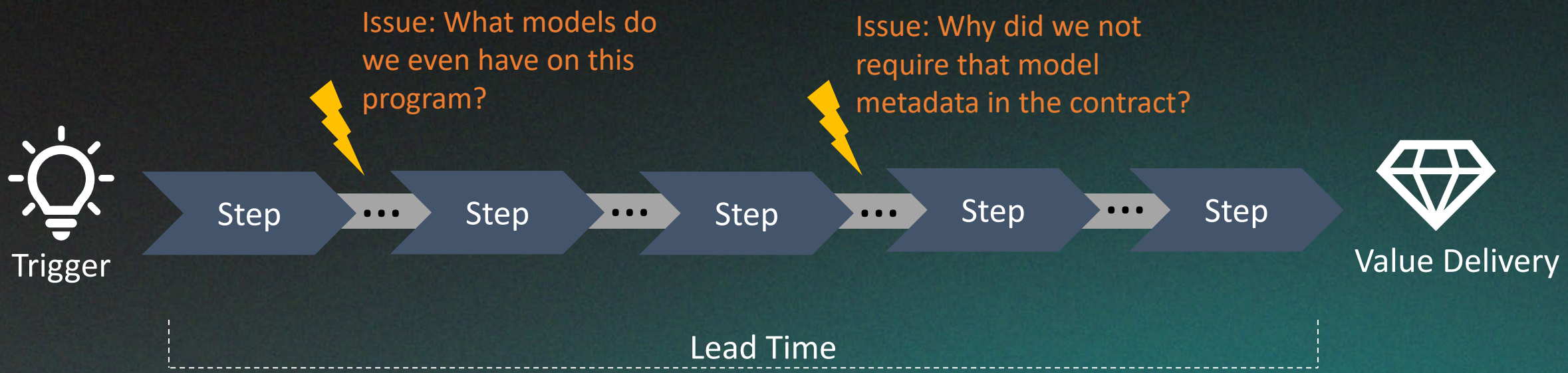


How Can Model Governance Aid Digital Engineering Execution?



Examples Interrupting Execution

Know What You Have



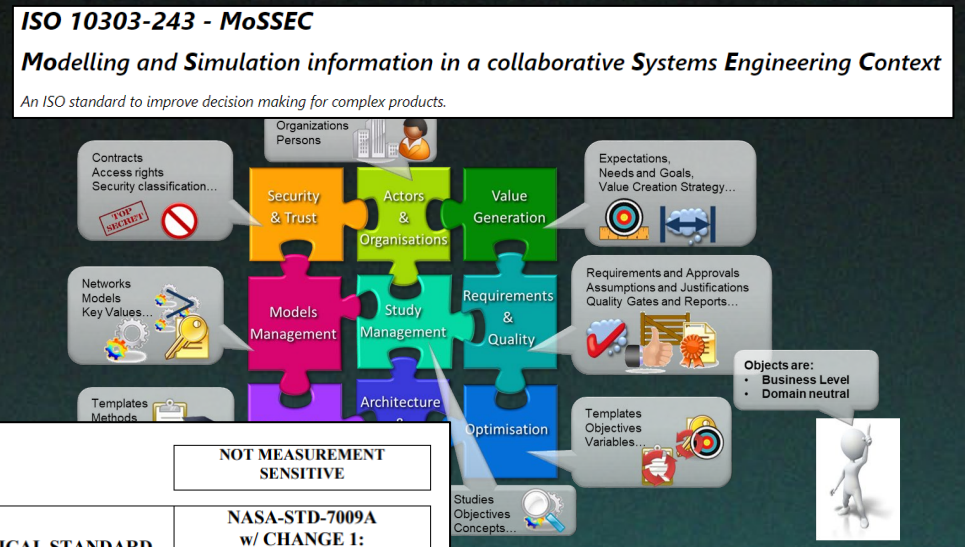
Know What You Have

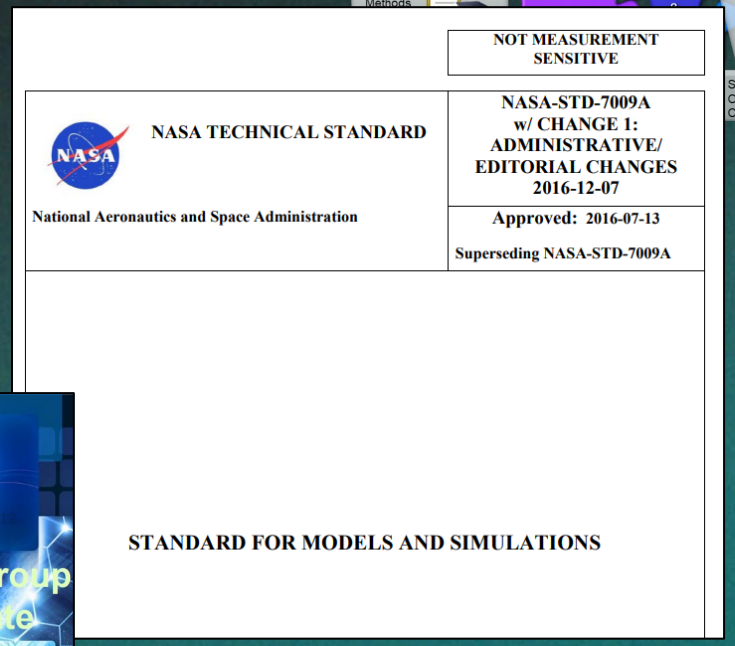
Examples, Not Exhaustive List

- Models
- Model metadata
- Connections between models
- Standards
- Model requirements
- Assumptions
- Risks
- Criticality of decision model is informing
- Model location
- DEE infrastructure
- Tools and applications
- Model location on infrastructure
- Contractual requirements
- Delivery timing
- Resources for modeling
- Training
- Other data types

Standards Inform Specific Approach

- Standards available to inform approach and metadata
- Various standards may apply
- Understand tool/application implementation of standards
- Continuing to evolve




NOT MEASUREMENT SENSITIVE

NASA TECHNICAL STANDARD

NASA-STD-7009A w/ CHANGE 1: ADMINISTRATIVE/ EDITORIAL CHANGES 2016-12-07

National Aeronautics and Space Administration

Approved: 2016-07-13

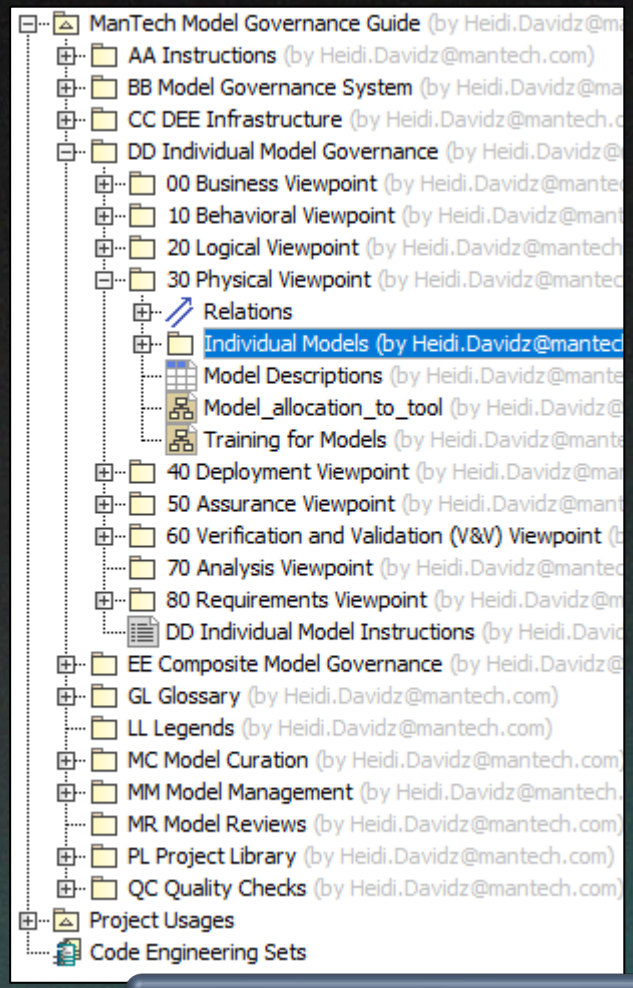
Superseding NASA-STD-7009A

STANDARD FOR MODELS AND SIMULATIONS

From OMG 2023, NASA 2023, MoSSEC 2023

Approved for Public Release

Models with Metadata of Choice

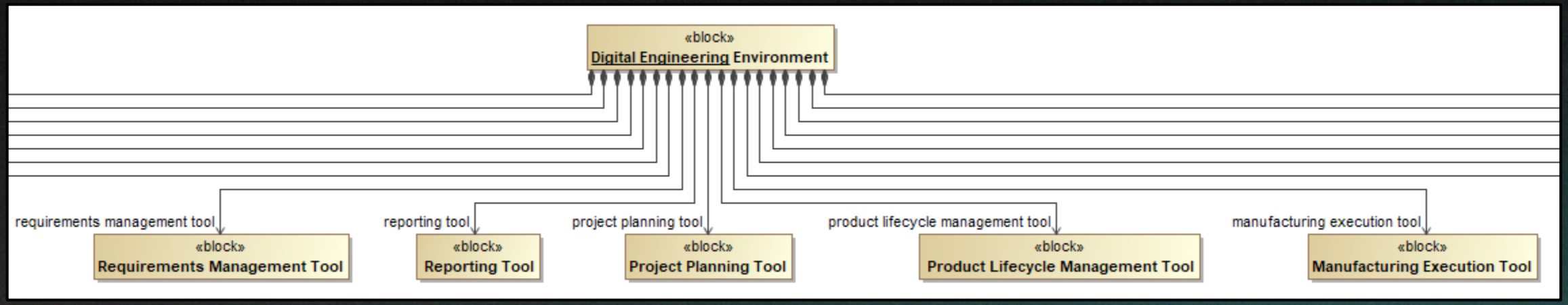


#	Name	Documentation	Associated Assumptions	Associated Risks
1	Composite Model DE	Example composite model.	Assumption AA	Risk R7 Risk R8
2	Composite Model EF	Example composite model.	Assumption AA Assumption BB Assumption CC	Risk R6
		Example composite model.	Assumption BB Assumption CC	Risk R5

#	Name	Documentation	Associated Assumptions	Associated Risks
1	Model A	This is the description of Model A...	Assumption B Assumption A	Risk R1
2	Model B	This is the description of Model B..	Assumption C	Risk R1
3	Model C	This is the description of Model C...	Assumption D	Risk R1
4	Model D	This is the description of Model D...	Assumption E Assumption F	Risk R2
5	Model E	This is the description of Model E...	Assumption D	Risk R3
6	Model F	This is the description of Model F...	Assumption E Assumption B Assumption C Assumption D	Risk R4

Add Metadata and Information of Interest to Model Governance Plan

DEE Infrastructure



Name	Documentation	Realizes	Associations
Cameo Enterprise Architecture	Dassault Cameo is a model-based systems engineering tool.	Architecture Tool Verification Management T	Teamwork Cloud FlexNet Publisher Cameo Collaborator AWS AppStream
Matlab	Matlab is an analytical tool.	Analytical Tool	Computer A AWS AppStream
ModelCenter	ModelCenter is a tool which enables trades and multi-disciplinary optimization.	Analytical Tool Trades and Optimization T	FlexNet Embedded AWS AppStream

Include DEE Infrastructure Details and Relationship to Models

How Can Model Governance Aid Digital Engineering Execution?

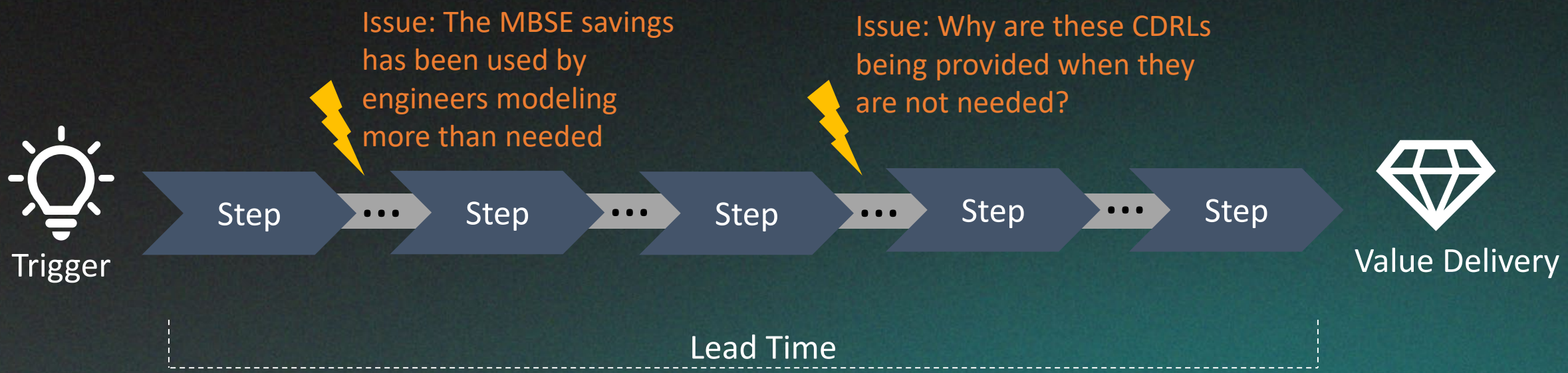
Know what you have

Know why you have it

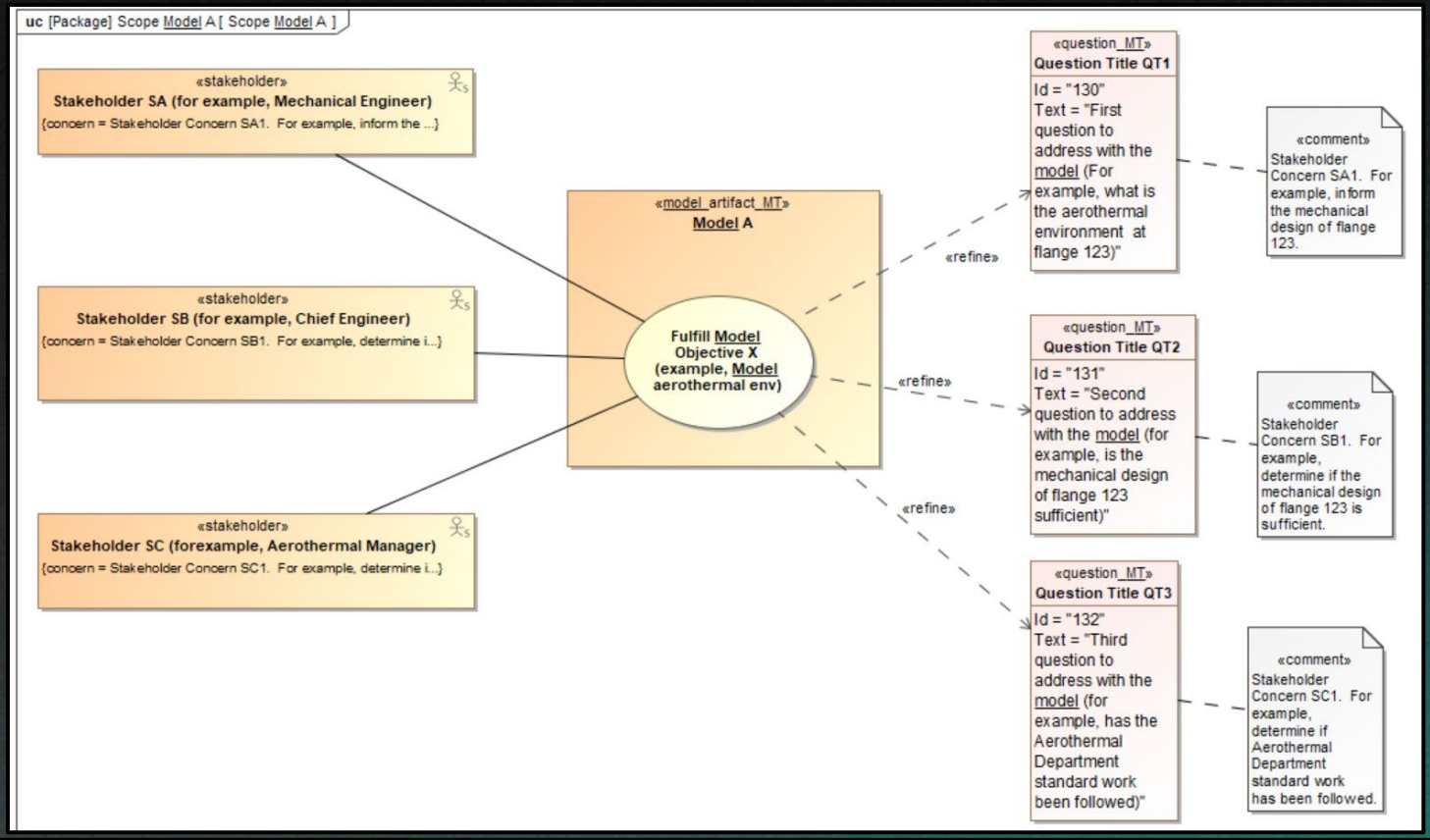
Know how it's controlled

Examples Interrupting Execution

Know Why You Have It



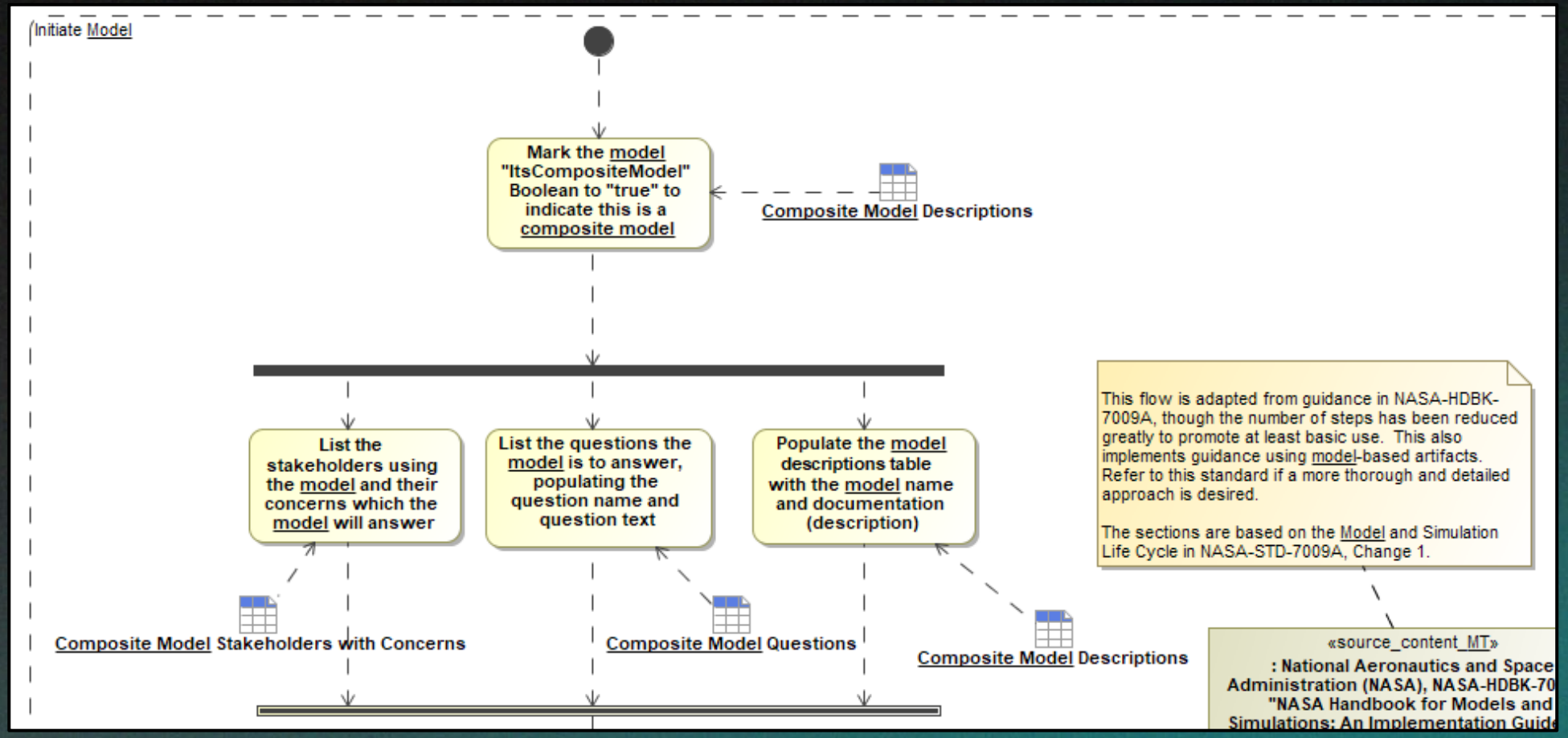
Individual Models



#	Name	Documentation	Associated Assumptions	Associated Risks	Traced to Standards	Use Cases	Questions2	Satisfies	Allocated To	Location
1	Model A	This is the description of Model A...	Assumption B Assumption A	Risk R1	Standard 1 (for example, I Best Practice 3 (for examp Standard 2 (for example, (	Fulfill Model Objective X (e	Question Title QT1 Question Title QT2 Question Title QT3	23 Modeling Questions MGSG-116 Risk MGSG-2 Model Name	ansys : ANSYS	AWS AppStream

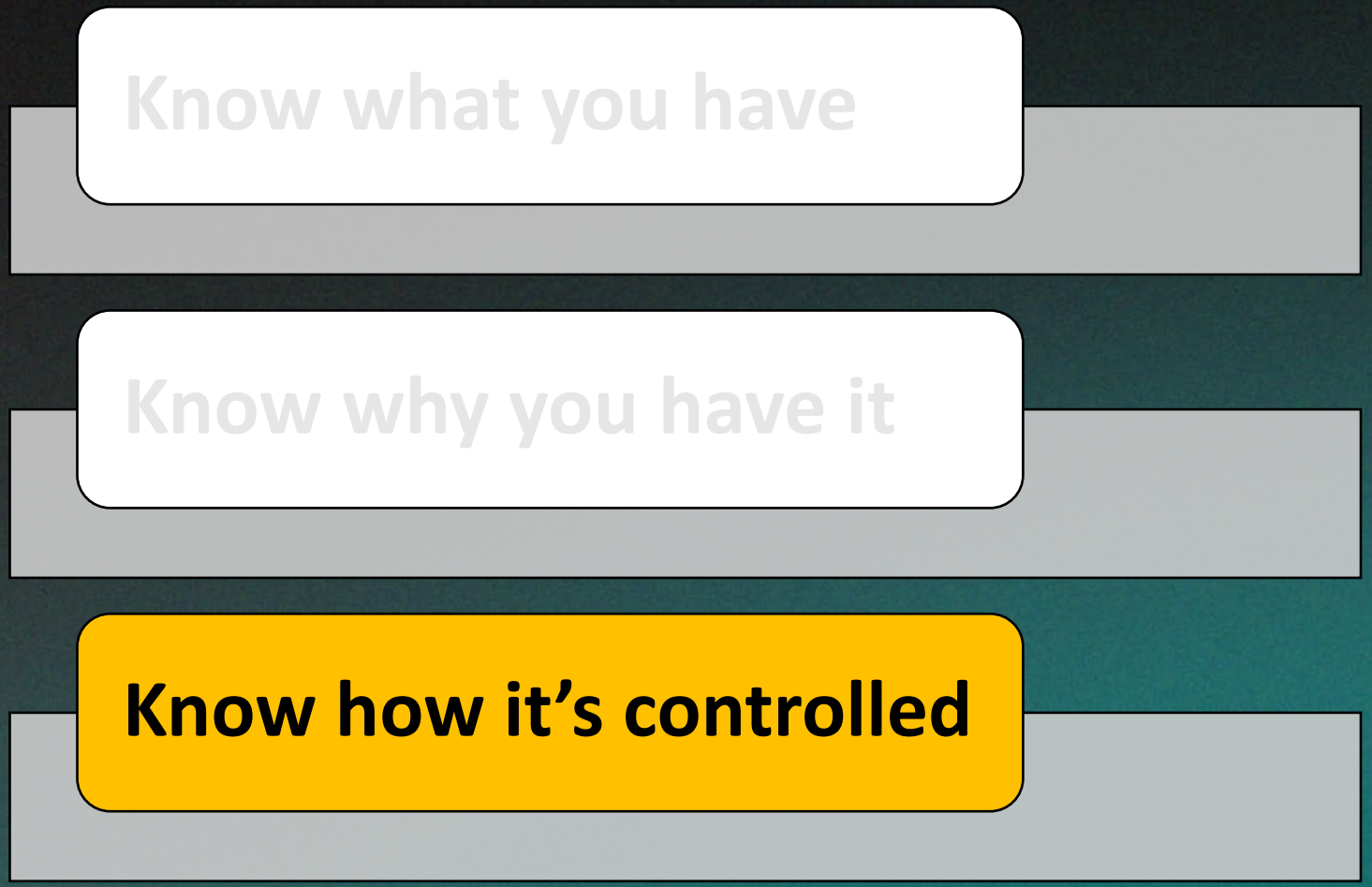
Scoping and Traceability for Models to Address Stakeholder Needs

Composite Models



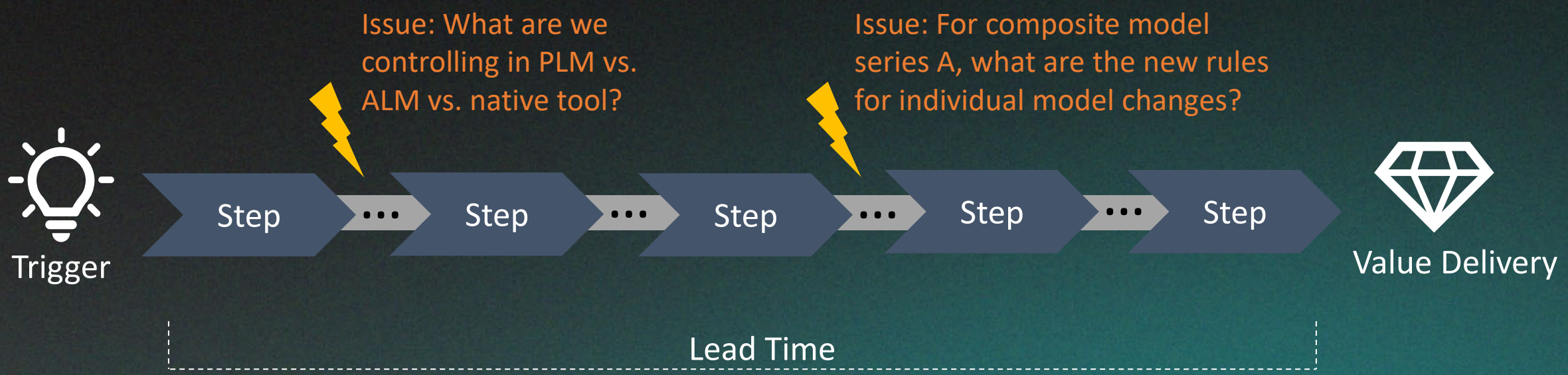
Define Composite Model Characteristics to Track Linked Model Needs

How Can Model Governance Aid Digital Engineering Execution?



Examples Interrupting Execution

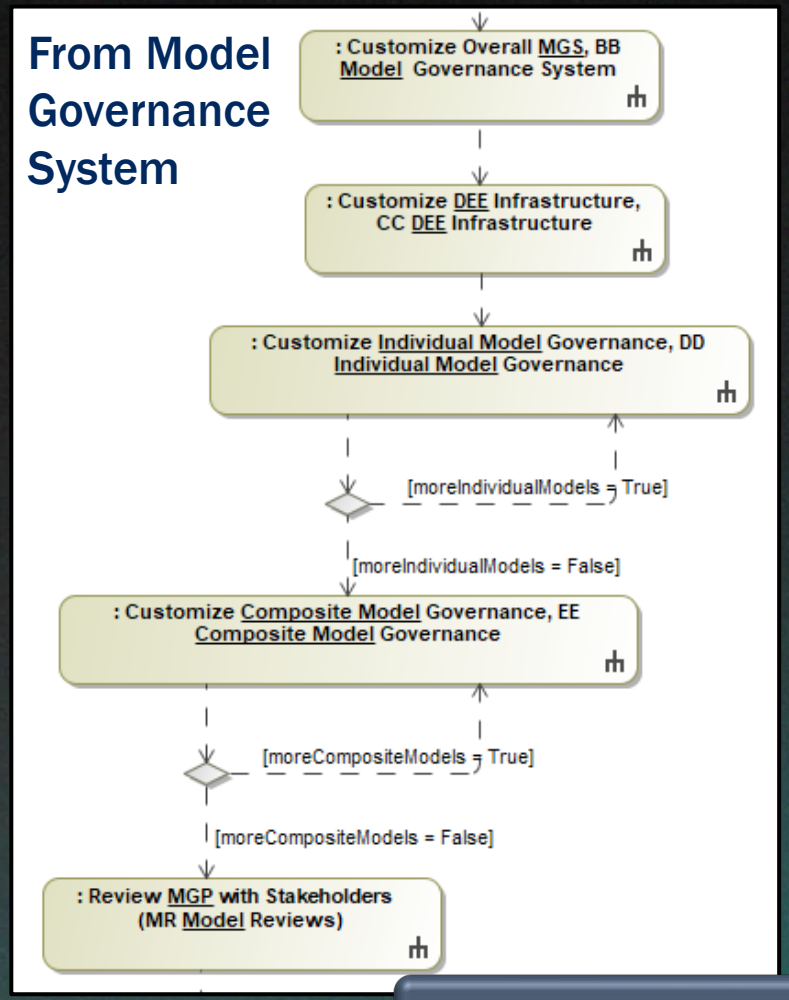
Know How It's Controlled

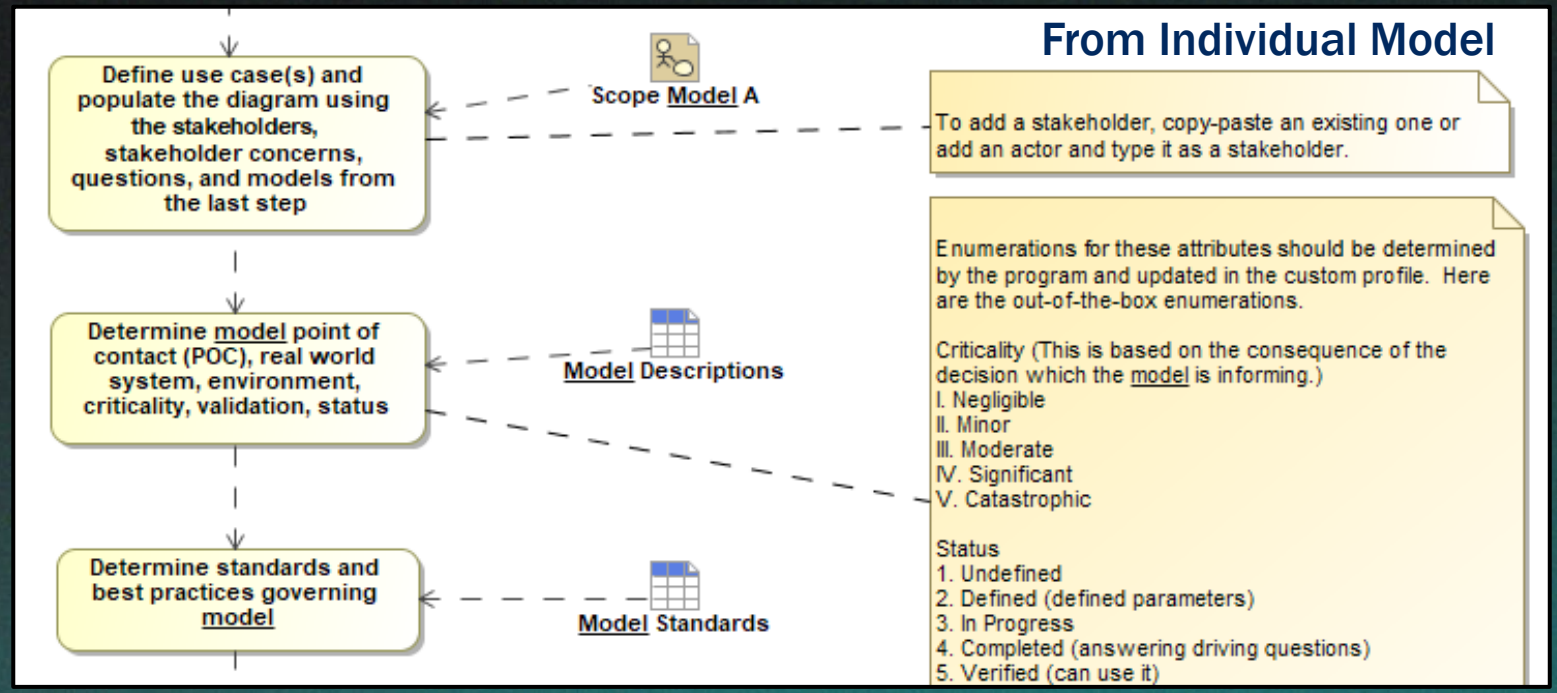


Deploy Governance

- Design, deploy, sustain an effective data and model governance program
- The long-term goal is to be institutionalized in everyday operations, so governance is not perceived as “special” or “new”
- Consider: business model, content governed, degree of federation, methods
- Need applies across data and model supply chain

Purposefully Design Governance System

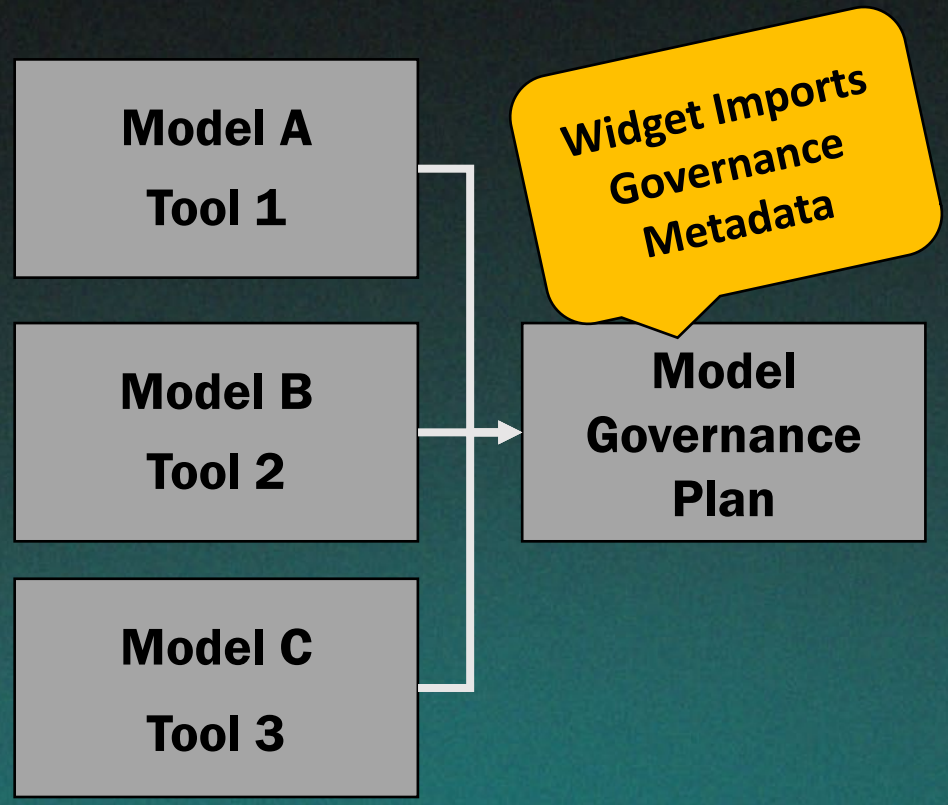




Instructions Provided at Point of Need

Updates Add Automation

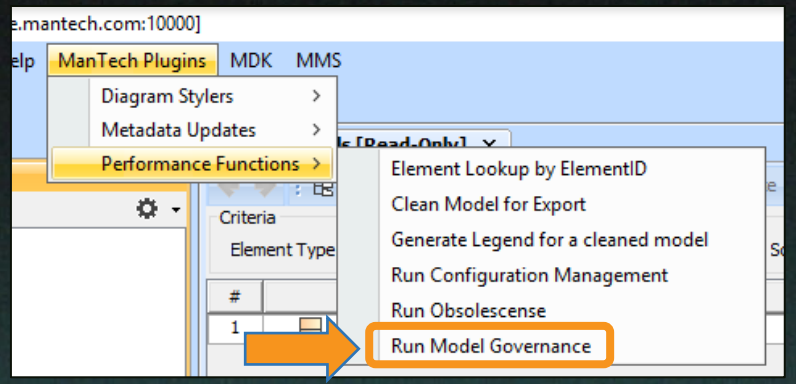
- Automation and ontologies utilized to reduce manual effort
- Widget automatically scrapes constituent models across an ecosystem to report governance information
- Automating ingestion of governance data reduces chance for error
- Where governance metadata are lacking, user interface guides input of missing information

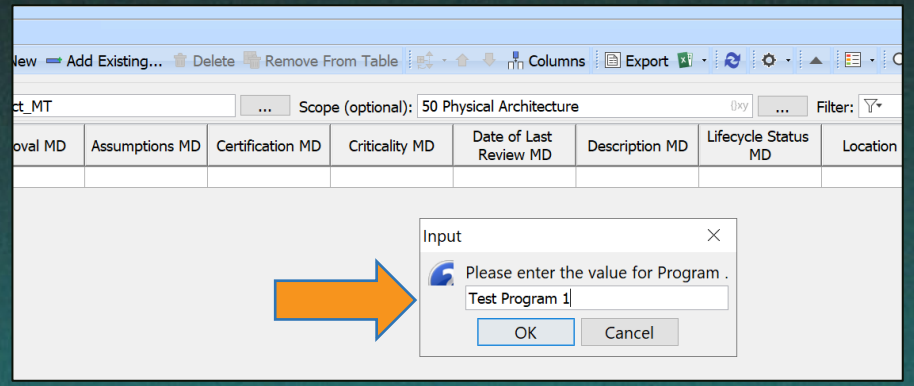


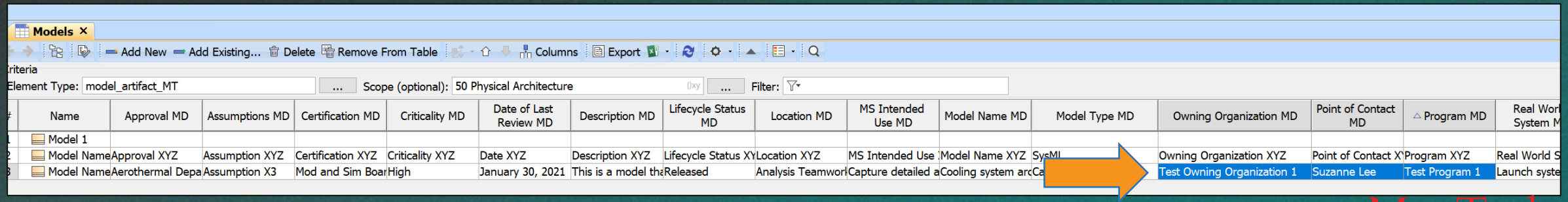
Automation Used to Catalog Model Information Into Governance Plan

Widget to Scrape and Populate Governance Metadata

- Run custom governance plugin
- Scrape models and populate metadata
- Pop-up asks for missing governance metadata, then adds information to governance metadata registry
- Developed to scrape Cameo SysML models and .csv, with concept to scrape models/ data connected to ontology-based digital thread



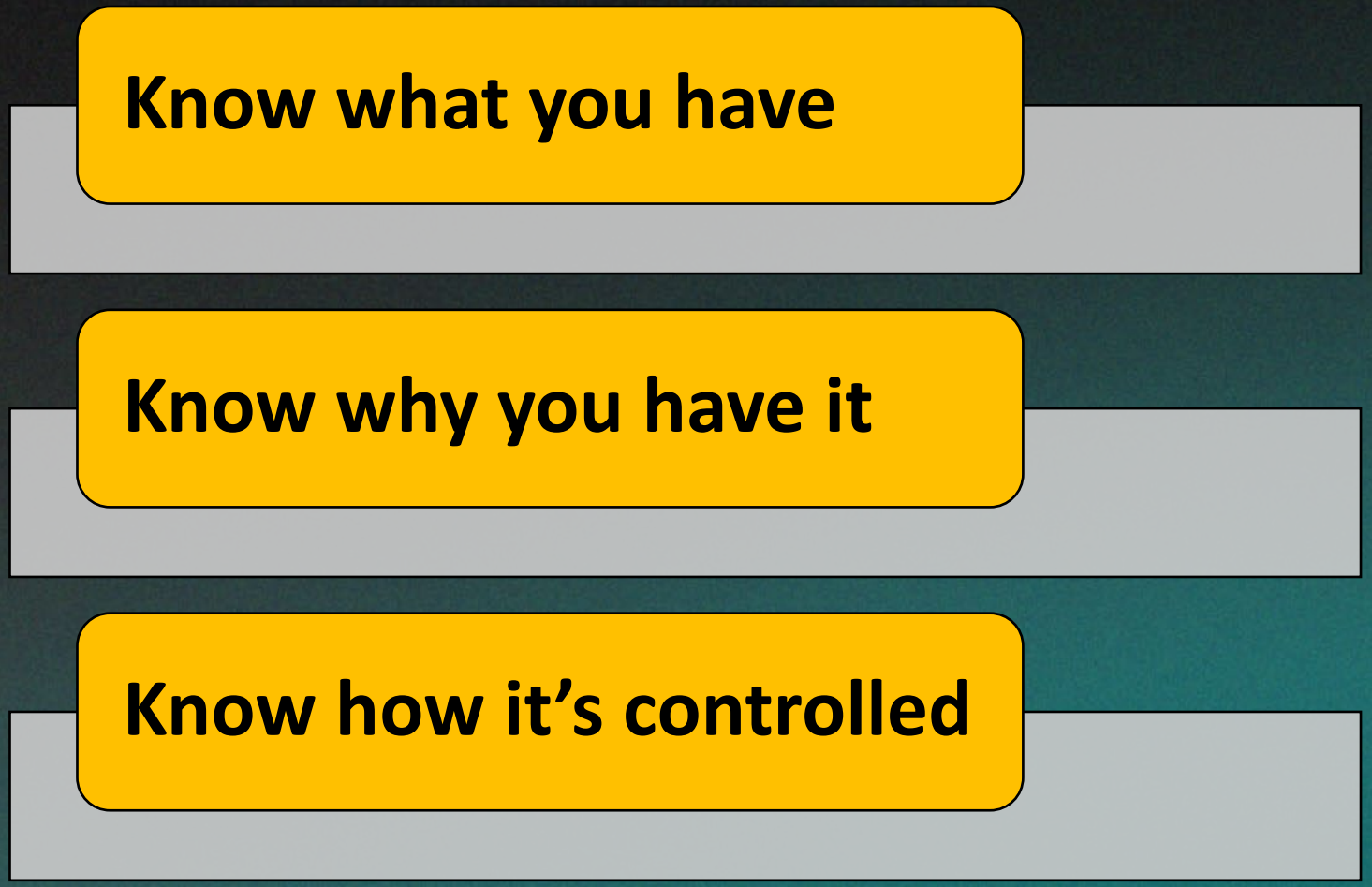




Semantic Integration Aids Governance

- Utilize semantic, ontology-first, hub-and-spoke digital thread integration platform for model governance purposes
- Enhances automation for aggregating metadata, tracking compliance, performing queries, and visualizing results
- Organizing governance using ontologies produces an agnostic approach, allowing use by customers regardless of current tools
- Capturing contextual governance information also supports appropriate model re-use
- Utilizing validation suites to ensure accuracy and completeness assists governance personnel and program office
- Approach allows dashboard views of model governance compliance status to aid program execution

How Can Model Governance Aid Digital Engineering Execution?



References

- Clark, Bill, "A Taxonomy of Tech Debt," available at, https://technology.riotgames.com/news/taxonomy-tech-debt, April 2018, accessed February 2023.
- Davidz, Heidi, Douglas Orellana, Tammy Bogart, Wayne Thomasson, "Utilizing Automation and Ontologies to Design, Deploy, and Sustain an Effective Model Governance Program," NDIA SME 2022, November 2022.
- Davidz, Heidi, Doug Orellana, "Employing Elastic Model Governance to Streamline Ground Vehicle Development," 14th Annual Ground Vehicle Systems Engineering and Technology Symposium and Advanced Planning Briefing for Industry, August 2022.
- Davidz, Heidi, Doug Orellana, "Controlling the Digital Engineering Ecosystem: An Elastic Model Governance Guide for the Digital Thread," 32nd Annual INCOSE International Symposium, Detroit, MI, June 2022.
- Davidz, Heidi, Doug Orellana, "Governing the Digital Ecosystem: ManTech's Elastic Model Governance Guide and Validation Tool," Dassault Systemes 2022 MBSE Cyber Experience Symposium, Allen, TX, March 2022.
- Davidz, Heidi, Doug Orellana, Rebecca Pak, "Taking Authority Over Your Modeling Enterprise: ManTech's Elastic Model Governance Approach," National Defense Industrial Association (NDIA) 2021 Virtual Systems and Mission Engineering Conference, December 2021.
- Duarte, Tiago, "Technical Debt and Unplanned Work on Software Development," September 2020, available at, https://www.coletiv.com/blog/technical-debt-and-unplanned-work-on-software-development, accessed February 2023.
- Grandperrin, Jonathan, "Bad Data: A $3T-per-year Problem with a Solution" (includes IBM and Gartner statistics), April 2022, available at https://venturebeat.com/datadecisionmakers/bad-data-a-3t-per-year-problem-with-a-solution/, accessed February 2023.
- Ladley, John, "Data Governance: How to Design, Deploy, and Sustain an Effective Data Governance Program, 2nd Edition, Academic Press, 2020.
- MoSSEC Project, http://www.mossec.org/welcome, accessed September 2023.
- NASA, "Standard for Models and Simulations," https://standards.nasa.gov/standard/NASA/NASA-STD-7009, accessed September 2023.
- OMG MBAcq, https://www.omgwiki.org/MBSE/lib/exe/fetch.php?media=mbse:incose_mbse_iw_2023:3.6.2023-01-28.iw2023_mbse_workshop_standards_mbacq_summary.pdf, accessed September 2023.
- Pak, Rebekah, "A3 Data Governance: Data Governance Introduction and General Process," May 2021.
- Redman, Thomas C., "Seizing Opportunity in Data Quality" (includes Experian statistic), MIT Sloan Management Review, November 2017,available at, https://sloanreview.mit.edu/article/seizing-opportunity-in-data-quality/, accessed February 2023.
- SAIC, "Digital Engineering Validation Tool," available at, https://www.saic.com/digital-engineering-validation-tool , accessed February 2023.
- Taylor, Matthew, Heidi Davidz, Douglas Orellana, "Solution Debt in the Age of Digital Engineering," NDIA SME 2022, November 2022.
- Taylor, Matthew, "An Elastic Approach to Digital Engineering," NDIA Systems and Mission Engineering Conference, December 2021.
- US Department of Defense, "Digital Engineering Strategy," 2018, viewed 20 November 2021, available at, https://ac.cto.mil/wp-content/uploads/2019/06/2018-Digital-Engineering-Strategy_Approved_PrintVersion.pdf, accessed February 2023.

Thank you!

For additional information contact:

- Dr. Heidi Davidz, Heidi.Davidz@ManTech.com
- Dr. Douglas Orellana, Douglas.Orellana@ManTech.com
- Ms. Kimberly Nunn, Kimberly.Nunn@ManTech.com

Debarment Webinars

Join this free training on contractor labor law violations, called for by Congress and coordinated by AIRC and Defense Acquisition University, by registering below or learn more HERE.

Tuesday, September 12 @ 11:00 AM ET

- AIRC Fellows David Drabkin and Christopher Yukins will discuss their AIRC research report, "Congressionally Mandated Study on Contractor Debarments for Violations of U.S. Labor Laws."
- **Register for Session 1**

Wednesday, October 4 @ 1:00 PM ET

- A roundtable including senior government officials and debarment experts
- **Register for Session 2**

Mr. David A. Drabkin

Mr. Christopher Yukins

AI4SE & SE4AI 2023 WORKSHOPS

- DEADLINE TO REGISTER: September 12 @ 11:59 PM ET

Ms. Jennifer Swanson, Keynote Speaker
Deputy Assistant Secretary of the Army for Data, Engineering & Software (DASA(DES)), ASA(ALT)

Dr. Kimberly Sablon, Keynote Speaker
Principal Director, Trusted Artificial Intelligence and Autonomy, OUSD(R&E)

Mr. Michael "Rabbi" Harasimowicz, Keynote Speaker
Director of Artificial Intelligence Innovations, Lockheed Martin

- An INCOSE and SERC coordinated OPEN virtual workshop
  - —Part I: October 11 @ 8 PM – 12 AM ET
    - Zoom registration
  - —Part II: October 12 @ 8 AM – 12 PM ET
    - Zoom registration

SYSTEMS ENGINEERING RESEARCH CENTER

- Tuesday, November 14:
  - 11th SERC Doctoral Student Forum
    - **Deadline to submit abstracts: October 6**; open to doctoral students at all SERC/AIRC Collaborating Universities, HBCUs and MSIs. | Submit Now
    - Dr. Barry Boehm Award for Doctoral Student Research Excellence
  - Annual Reception
- Wednesday, November 15:
  - 15th SERC Research Review
    - 3 tracks of SERC research highlights
    - Registration opening soon

SERC TALKS

SYSTEMS ENGINEERING RESEARCH CENTER

THANK YOU FOR JOINING US!

Please check back on the SERC website for today's recording and future SERC Talks information.

www.sercuarc.org/contact-us/