# RT-182: Enterprise Systems-of-Systems Model for Digital Thread Enabled Acquisition

Chris Paredis, Paul Collopy, Tom McDermott, Molly Nadolski

**SYSTEMS ENGINEERING RESEARCH CENTER**

**Georgia Institute of Technology**

**THE UNIVERSITY OF ALABAMA IN HUNTSVILLE**

## Research Task / Overview

This research will use the enterprise systems of systems methodology developed within the SERC to develop an enterprise transformation model that can be used to provide insight into the value of different acquisition strategies and incentives.

It is currently not adequately understood what the impact of digital engineering will be on acquisition processes and the corresponding ecosystem. We expect that the DE could affect:

- How existing engineering processes are performed
- How information is shared
- How engineering functions are structured in organizations
- The entire business eco-system: competition, risk attitudes, business models

Before we make changes and define new policies... let's aim to understand the consequences of the policies and how they may transform the acquisition eco-system.

## Background
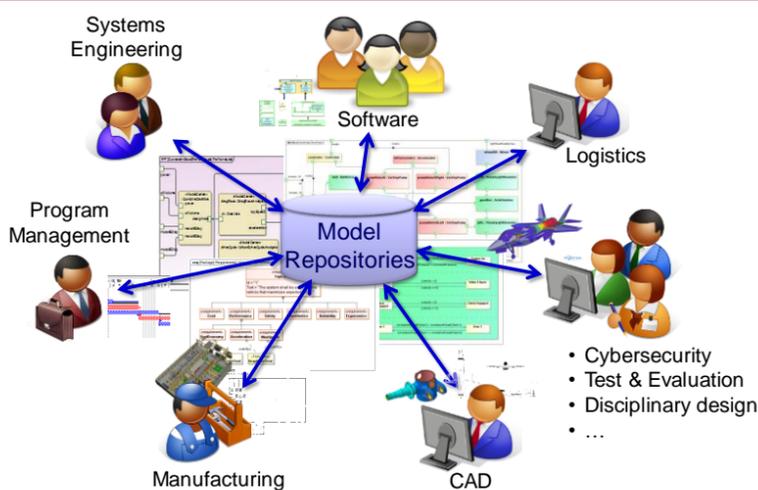


The Interagency Working Group on Engineering Complex Systems defines Digital Engineering as follows [1]:
- Digital Model-based Engineering (DMbE) is the use of digital artifacts, digital environments, and digital tools in the performance of engineering functions.
- DMbE is intended to enable practitioners to engineer capabilities using digital practices and artifacts in a collaborative environment, creating a digitally integrated approach with a federated single source of truth.
- DMbE is intended to allow an organization to progress from documentation-based engineering methods to digital methods that may provide greater flexibility, agility, and efficiency.

The Department of Defense has defined a comprehensive strategy for Digital Engineering



① Develop and maintain a *culture* and *workforce* that adopts and supports Digital Engineering across the lifecycle

② Formalize development and use of models for providing an enduring *authoritative source of truth*

③ Foster the *integration of models and data sources* across functional disciplines to inform enterprise and program decision making

④ Establish supporting *infrastructure & environments* to perform engineering activities, collaborate, &communicate across stakeholders

⑤ Leverage advanced tools, computing power, and advanced capabilities to improve system capabilities, automate workflow processes (as applicable) and generate digital artifacts and deliverables using models
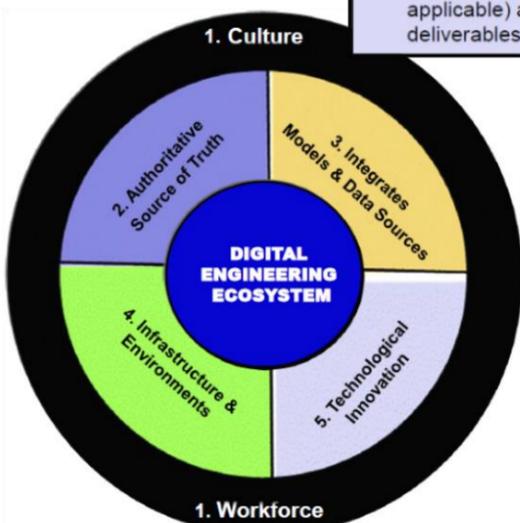


From: P. Zimmerman, "Advancing the Use of the Digital System Model Taxonomy," NDIA SE Conference, 2016.

## Goals & Objectives

The objective of this research is to identify the consequences of the policies and how they may transform the acquisition eco-system

The aim is to address the following research questions:
- What changes are likely to emerge from the transition to digital engineering 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?

## Methodology

The project will use a qualitative research method based on semi-structured interviews. Starting from an enterprise analysis, a Systemigram model will be created that identifies key relationships in the enterprise that can be focused on with change strategies. The model identifies key actors, activities, enablers and barriers to change that drive desired system outcomes. Through semi-structured interviews with key stakeholders in DoD and major defense contractors, a conceptual model will be developed via a series of narratives generated in the interview process, and refined in one or more design workshops with key stakeholders in the enterprise. The conceptual model will capture the impact of digital engineering on the emerging model-centric system acquisition process. It will provide a baseline to identify the consequences of Digital Engineering policies and how they may transform the acquisition eco-system.

## Future Research

- Conduct interviews with key stake holders in the acquisition ecosystem
- Diagram interview data in a Systemigram
- Generate and analyze scenarios (with Systemigram "shows")
  - Identify opportunities and challenges (e.g., intellectual property, training, infrastructure,...)
  - Identify and analyze potential modifications/improvements to DE and corresponding processes
  - Identify short-term and long-term value propositions for each of the key stakeholders
  - Identify possible incentives to accelerate adoption
- Conduct a design workshop to agree upon and refine the conceptual model

### Example Stakeholders for Interviews



RDECOM

JCIDS Digital Warfare Office

Ground-Based Strategic Deterrent

Combat Rescue Helicopter
B-21
F-15 EPAWSS
AFRL

CH-53K
JPALS
Next-Gen Jammer

JPL
Aerospace Corp

Future Vertical Lift
CIRCM
NASA MSFC

Model-Based Pilot

GPS III Ground Systems
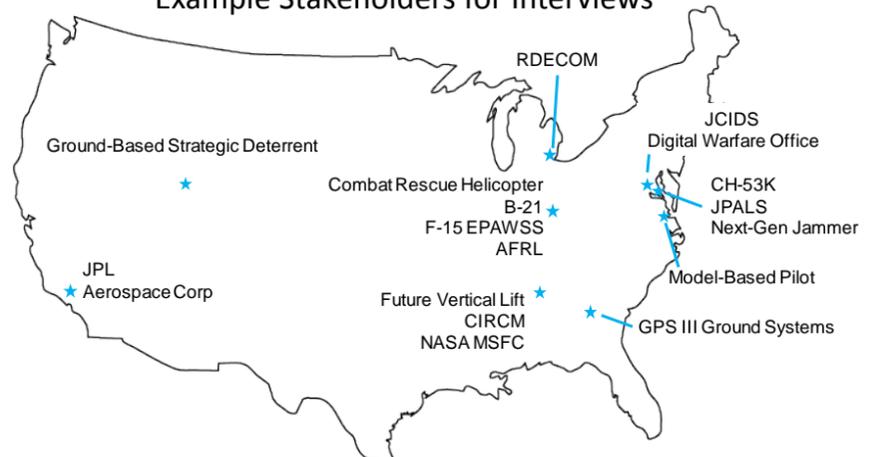
## Contacts/References

*Chris Paredis, Georgia Tech, chris.paredis@me.gatech.edu*
*Tom McDermott, Georgia Tech, tom.mcdermott@gtri.gatech.edu*
*Molly Nadolski, Georgia Tech, molly.nadolski@gtri.gatech.edu*
*Paul Collopy, Univ of Alabama, Huntsville, paul.collopy@uah.edu*

[1] "Digital Model-based Engineering: Expectations, Prerequisites, and Challenges of Infusion," Model-Based Systems Engineering (MBSE) Infusion Task Team, March 2017.