SYSTEMS ENGINEERING RESEARCH CENTER

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THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

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

Sponsor: DASD(SE)

By

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FHI 360 CONFERENCE CENTER

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Project Overview

- Objective
  - Develop an enterprise transformation model that can be used to provide insight into Digital Engineering and its impact on defense acquisition
- Project team
  - Chris Paredis, Georgia Tech (PI)
  - Tom McDermott, Georgia Tech (co-PI)
  - Paul Collopy, University of Alabama, Huntsville (co-PI)
  - Molly Nadolski, Georgia Tech (faculty researcher)
- Timeline
  - July 14, 2017 through July 13, 2018
  - Subcontracts finalized at the end of August

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Defense Acquisition Lifecycle

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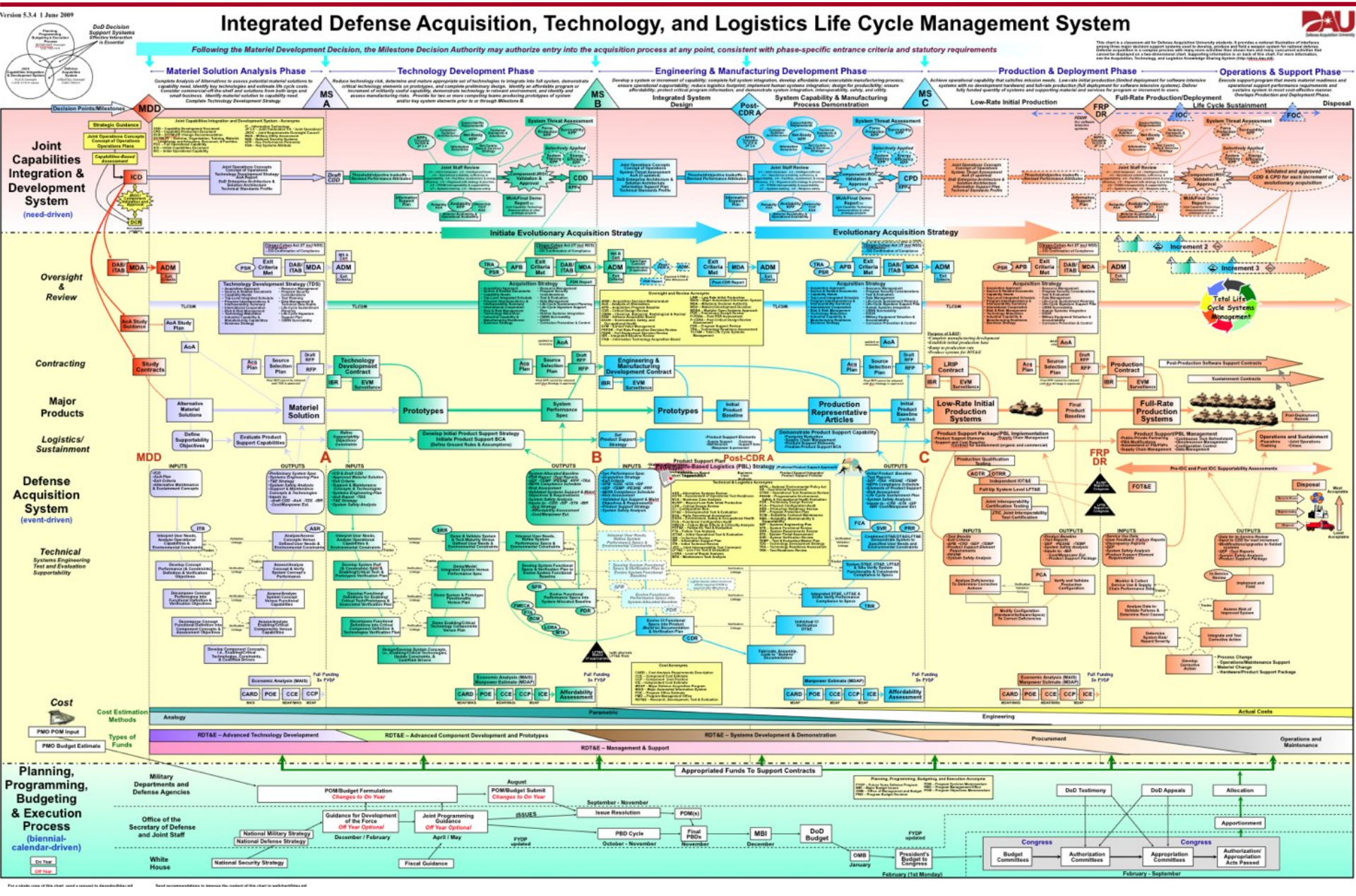
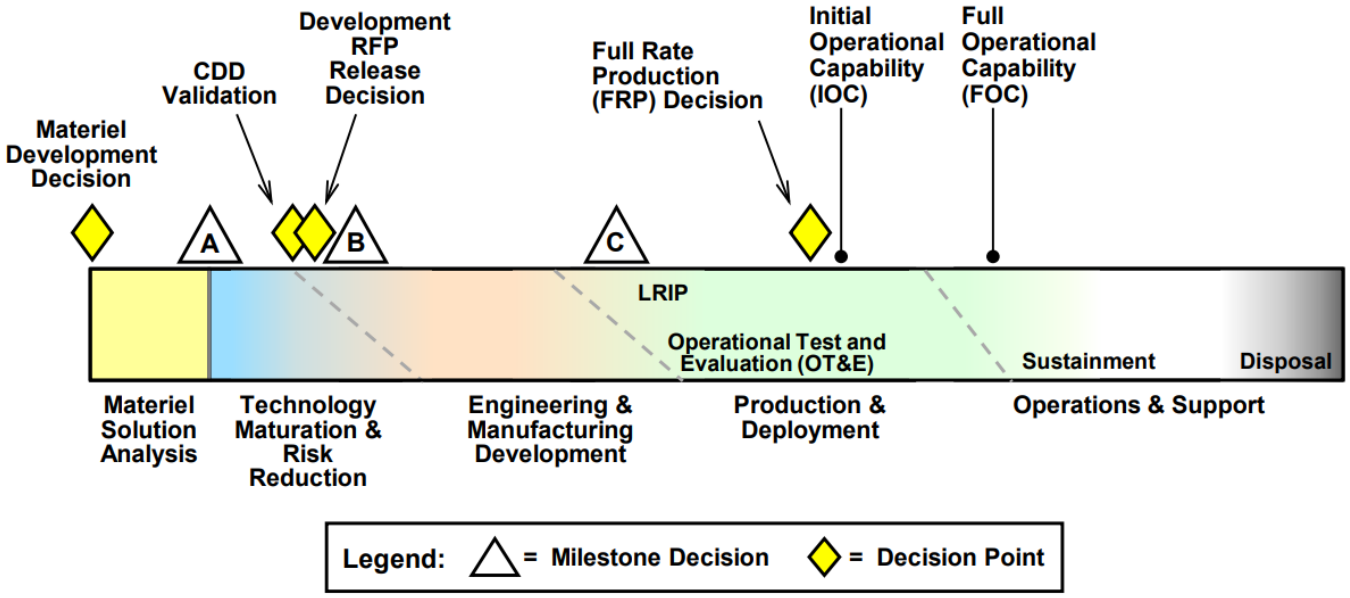


Context — Current DoD Acquisition System

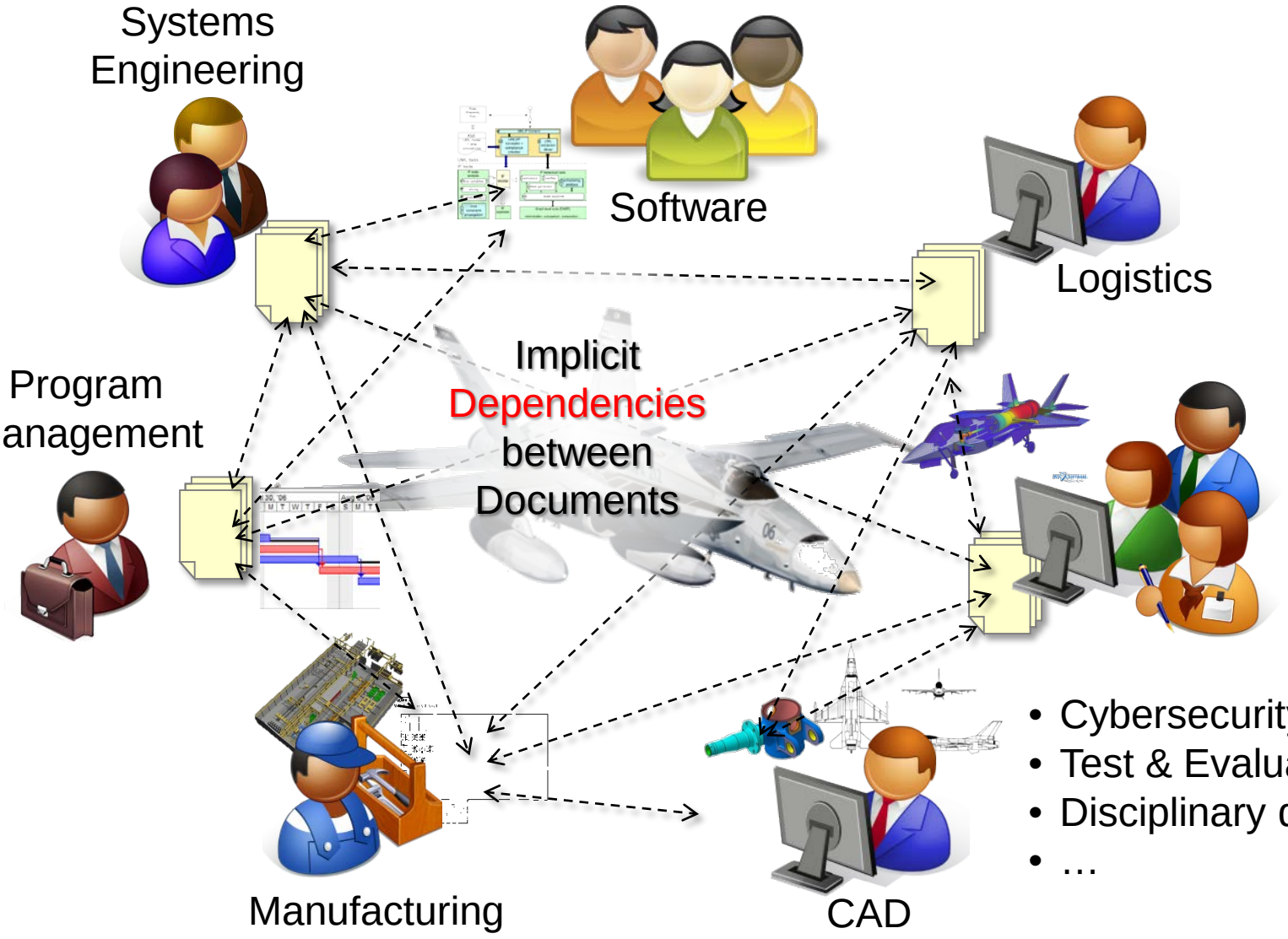
- Follows mostly linear process through milestones and phases
- Stove-piped infrastructure



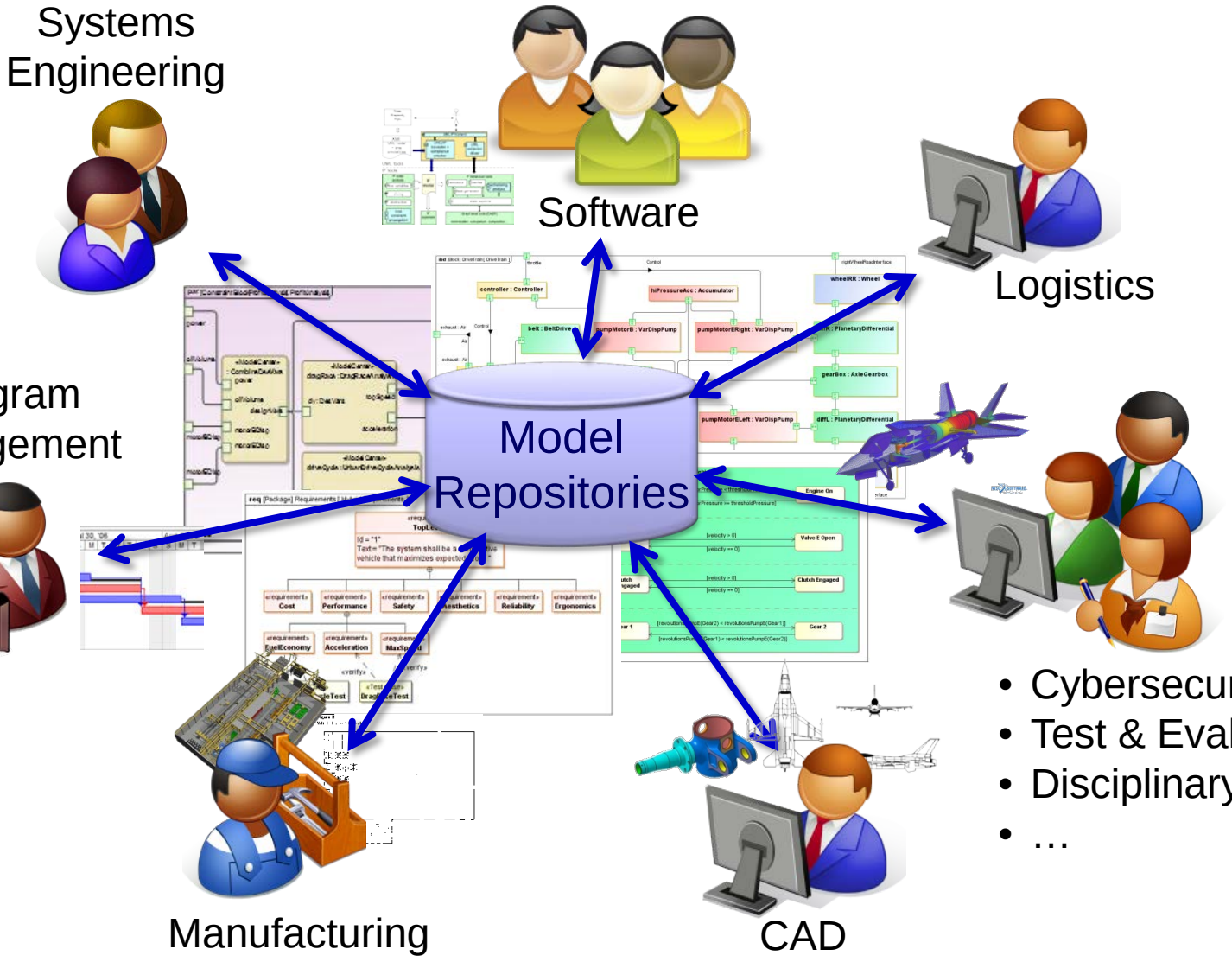
- Communication is supported by static disconnected documents
- Some discipline-specific models but not integrated across disciplines
- Process lacks agility and resilience — not suited for fast-paced technology innovation

Based on: P. Zimmerman, “Advancing the Use of the Digital System Model Taxonomy,” NDIA SE Conference, 2016.

Traditional Engineering



Digital Engineering



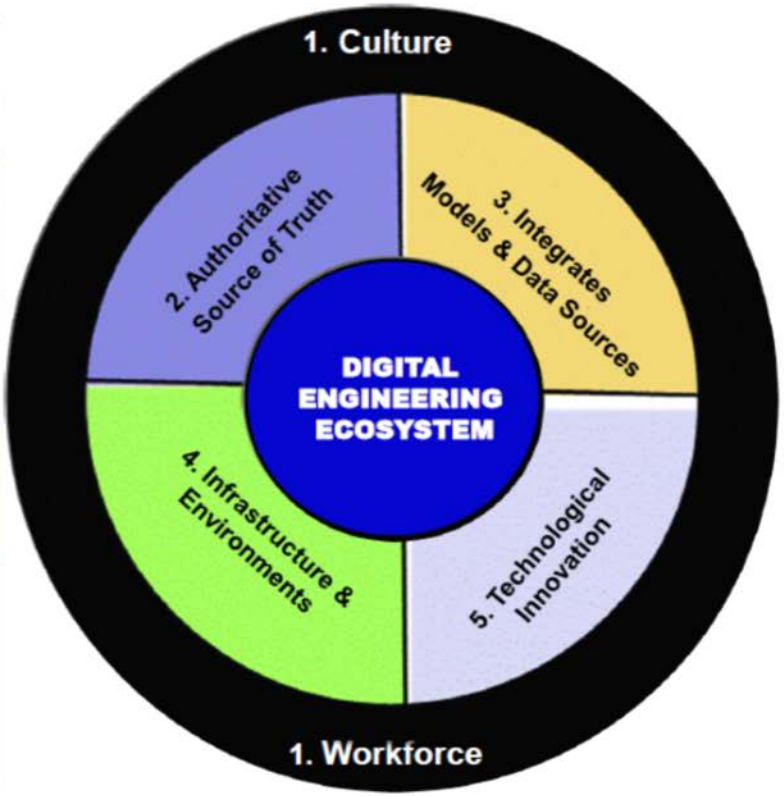
Digital (Model-Based) Engineering

- *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*

Model-Based Systems Engineering (MBSE) Infusion Task Team, Interagency Working Group on Engineering Complex Systems (IAWG), "Digital Model-based Engineering: Expectations, Prerequisites, and Challenges of Infusion" (March 2017)

Digital Engineering Strategic Goals

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.

Project Focus

- We expect DE will affect
  - —Engineering processes
  - —Information sharing between stakeholders
  - —The structure of 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
- Approach:
  Create an enterprise systems-of-systems model
  for DE Enabled Acquisition

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

- Builds on enterprise systems-of-systems methodology
- Semi-structured interviews with key stakeholders
- Iteratively develop Systemigram model
  - —Identifies key actors, activities, enablers and barriers to change that drive desired system outcomes
  - —From interviews, develop a series of narratives
  - —Get additional feedback from stakeholders during workshop

Methodology

- 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

Interviews — Approach

- Structure
  - 1 – 1½ hours
  - Semi-structured — prepared list of questions but with room for adaptation
- Focus
  - Change and transformation at multiple levels: individuals, processes, institutions and domain
- Changing horizons — from current state to envisioned future state
- Technology — evolution, innovation, adoption, impact
- Workforce — changing needs
- Domain — acquisition initiatives and policies
- Community — collaboration, data sharing and knowledge transfer
- Innovation Stakeholders, Enablers and Barriers

Interview Questions (sample)

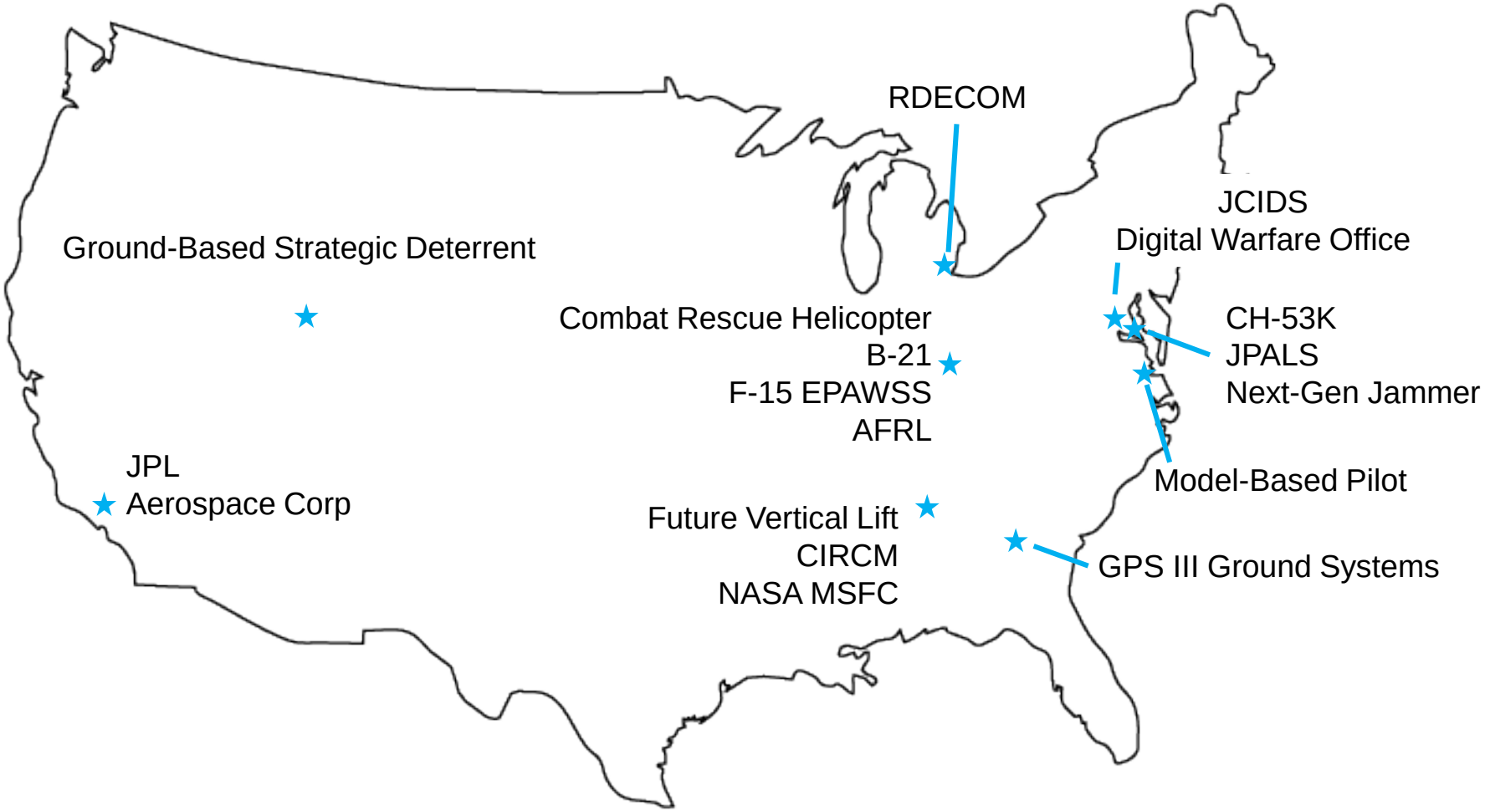
- Tell us about your knowledge of systems engineering, model-based systems engineering (MBSE), and the defense department's "Digital Engineering" initiative, and how these are being used today.
- Will "Digital Engineering" change the work your group does? In what ways?
- What activities or practices cannot be sustained in the current defense acquisition process as we know it today?
- What will systems engineering and related defense acquisition activities look like 10-15 years from now?
- How have new technologies changed systems engineering support to acquisitions over the last several years?

Visit Plan — Approach

- Identify potential interviewees according to the following criteria
  - People who have direct involvement and first-hand experience in the identified acquisition activities (mostly not executives)
  - People involved on both sides (gov't & contractors) of the same program
  - People with expertise in MBSE (pilot leads, leading edge practitioners)
  - People involve in programs of different size and lifecycle phase.

- Organize the interviews in geographic clusters

Visit Plan


RDECOM
JCIDS
Digital Warfare Office
Ground-Based Strategic Deterrent
Combat Rescue Helicopter
B-21
F-15 EPAWSS
AFRL
CH-53K
JPALS
Next-Gen Jammer
Model-Based Pilot
JPL
Aerospace Corp
Future Vertical Lift
CIRCM
NASA MSFC
GPS III Ground Systems

Summary

- Objective
  - Develop an enterprise transformation model that can be used to provide insight into Digital Engineering and its impact on defense acquisition
- Status
  - Interview structure developed
  - Interviewees identified
  - Ready to start interviewing…
- Stay tuned — more insights and conclusions when we have collected and analyzed the data