Systems Engineering Modernization (SEMod) Key Enablers Panel Discussion

Systems Engineering Division
Education & Training Committee

November 3, 2022

Robert E. Raygan, Ph.D. Robert.Raygan@dau.edu 703-819-4927
Committee Chair
DAU Professor of Engineering Management

Conference Panel: Systems Engineering Modernization (SEMOD) Key Enablers for System Development on DoD Programs

Title: Systems Engineering Modernization (SE MOD) Key Enablers for System Development on DoD Programs

Short Summary: The OUSD(R&E) Systems Engineering Modernization (SE MOD) initiative focuses on identifying and integrating advances in SE that enable DoD programs to develop systems more quickly, effectively, at lower cost, with reduced risk. In this panel, Service leaders will share approaches and lessons learned.

Abstract: OUSD(R&E) presented systems engineering modernization "Pain Points" at the 2022 NDIA Systems Engineering Division (SED) annual kickoff meeting. The SED Education and Training (E&T) Committee initiated a joint project to address those pain points with DoD programs and organizations, the Defense Acquisition University (DAU), Stevens Institute of Technology Systems Engineering Research Center (SERC), Naval Postgraduate School (NPS), MITRE, and many other community collaborators. This panel has identified several programs and organizations as exemplars for their approaches and actions implementing policy and guidance for the SE MOD Focus Areas (Digital Engineering, Mission Engineering, Modular Open Systems Approach, Agile SE) as well as continuous iterative development and modern software acquisition practices.

Effective systems engineering practices and approaches are considered “enablers” in that they enable DoD programs to develop systems and solutions more quickly, effectively, at lower cost, and with reduced risk.

Dr. Robert Raygan of DAU, NDIA SED E&T Committee Chair, will moderate the panel.

Panelist

MOSA	PEO AVN	John T Stough Chief Architecture Officer (CAO), JHNA Supporting US Army PEO Aviation MOSA Transformation Office
DE	Air Force Institute of Technology (AFIT)	Dr. Richard Sugarman Dept Head – Systems & Software Engr Mgmt School of Systems and Logistics Air Force Institute of Technology
Agile & MBSE	AFSOC	Brandon P. Froberg, Maj, USAF Integration & Interoperability Branch AFSOC/A8II
ME & SoSE	Israeli Air Force	Maj Tzvika Kaminisky Chief System Engineer IAF Helicopter Programs Branch

SE Modernization High Level Overview

Problem Statement

"There is a lack of an integrated approach to implementation of SE Focus Areas that is creating a delay in full implementation of the Digital Transformation which is necessary to ensure the relevant guidance, skills, and training are available to deliver a robust, disciplined approach to weapon systems acquisition."

SE Focus Areas

- Digital Engineering
- Modular Open Systems Approaches (MOSA)
- SW Engineering/Agile
- Mission Engineering

Key Enablers

- Reference Architecture
- Enterprise/SoS Data Strategy
- Model Based Systems Engineering
- Modeling & Simulation
- Engineering Workflow
- Workforce Training/Culture

Strategic Partnerships/Collaborations

INCOSE | Vision 35

IAWG

NDIA – AT THE HEART OF THE MISSION

DAU

SYSTEMS ENGINEERING RESEARCH CENTER

FY 21/22 Ongoing Lines of Effort

- Policy Review
- Integration Framework
- Body of Knowledge/Community of Practice
- Ontology Development
- Implementation Roadmaps

ALIGNED TO R&E Goals

- Advance the Engineering Practice (LOE 1)
- Connect & Strengthen the Technical Community (LOE 2)
- Develop the Workforce (LOE 3)

SEMOD Team

Director
Ms Nadine Geier

Chief Engineer
Dr Kelly Alexander

SEMODBoK/ MOSA
Ms Monique Ofori

SE Industry Engagement
Mr. Ed Moshinsky

SOS Mr. Mike Guba

SERC Lead Mr. Tom McDermott

DAU Lead: Dr Robert Raygan

SE Modernization Problem Statement

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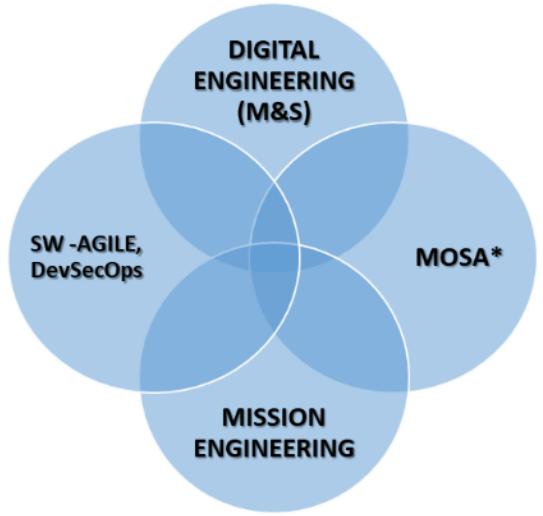
"There is a lack of an integrated approach to implementation of SE Focus Areas that is creating a delay in full implementation of the Digital Transformation which is necessary to ensure the relevant guidance, skills, and training are available to deliver a robust, disciplined approach to weapon systems acquisition."

SE Modernization Focus Areas (Initial Scope)



Cross Cutting Key Enablers

Architecture	Modeling Mission & Platform levels, embracing Reference Architectures
Model Based Systems Engineering (MBSE)	Enterprise-wide implementation; models as Source of Truth
SOS/Enterprise Collaboration & Data	Understand/Assess cross-platform capabilities
Engineering Workflow	Evolving SE processes/ techniques, including V&V
Workforce Training & Culture	A focused approach to workforce initiatives that enable culture change

Collaborating with Government, Industry & Academia

ENABLERS RESULTED FROM INITIAL OUTREACH/INFORMATION SESSIONS

FOCUS AREA INTEGRATION – INTENT OF POLICY AND GUIDANCE

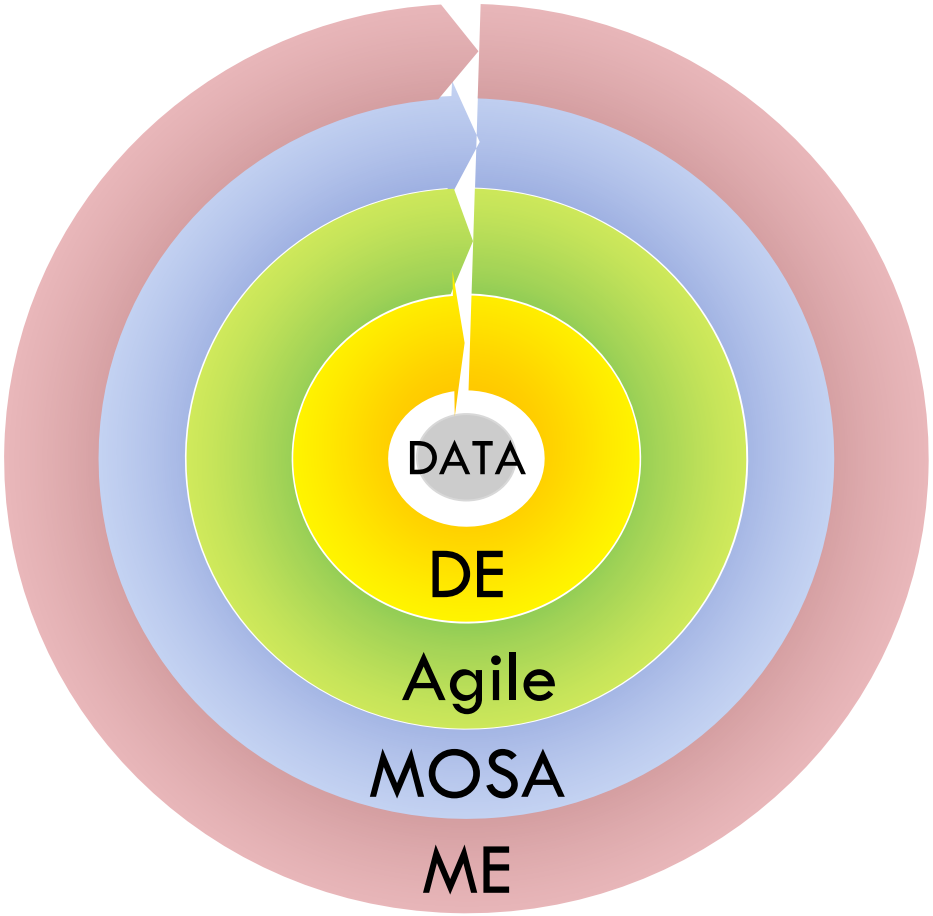
Digital Engineering (DE): implement "an integrated digital approach that uses authoritative sources of system data and models as a continuum across disciplines to support lifecycle activities from concept through disposal." Enabler to manage lifecycle efficiency.

Agile/DevOps: begin with a high-level capture of business/ technical needs, continually implement and deploy to define & build value. Enabler to manage risk.

Modular Open Systems Approach (MOSA): use modular design, control interfaces, adopt open standards, measure conformance. Enabler to manage adaptability and change.

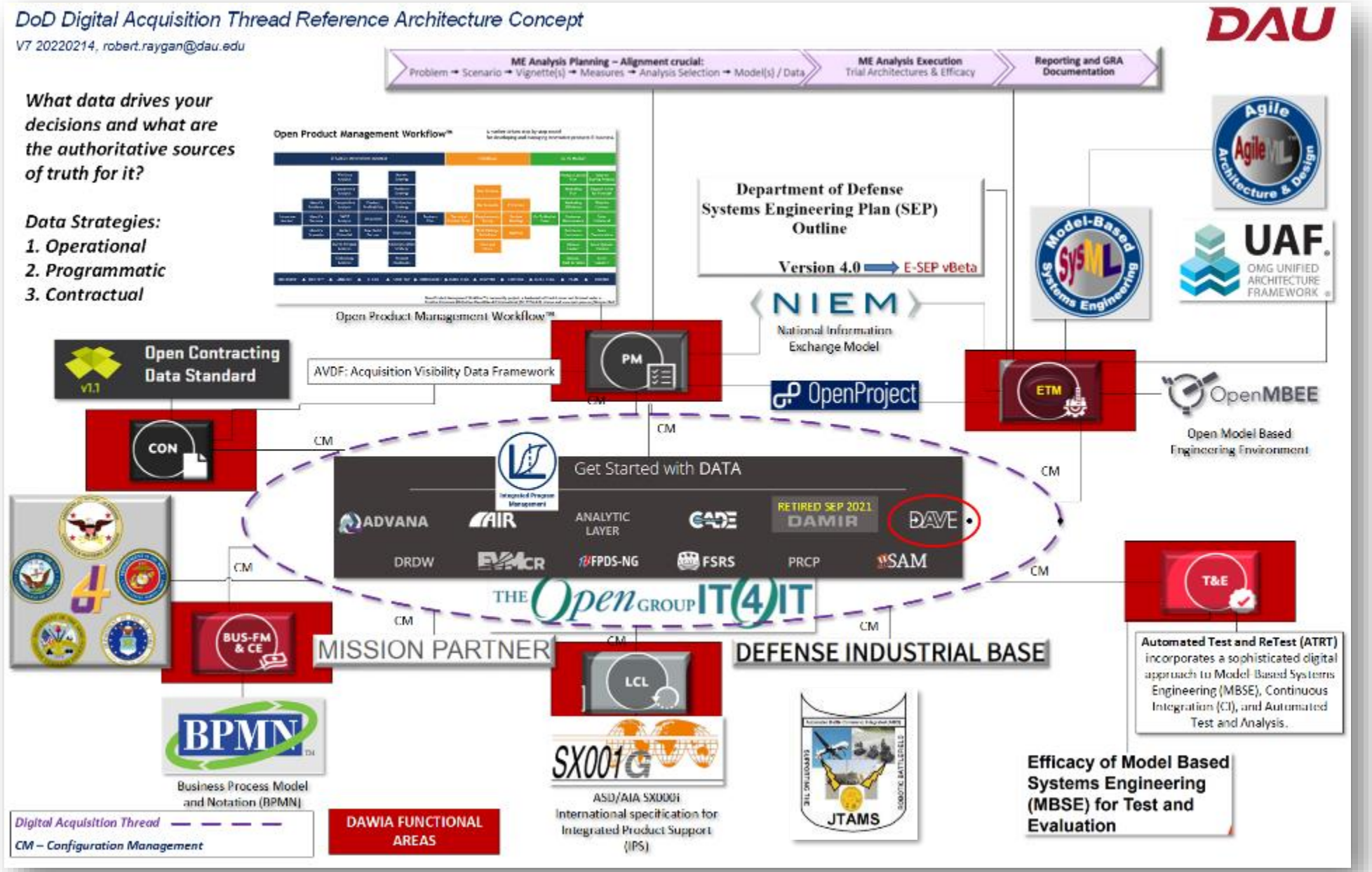
Mission Engineering (ME): continually provide engineered mission-based outputs to inform requirements, prototypes, design, and investment. Enabler to manage portfolios.

DoD Data Strategy: "data as a strategic asset"



The 4 focus areas generate a layered, continual, and data-centered model

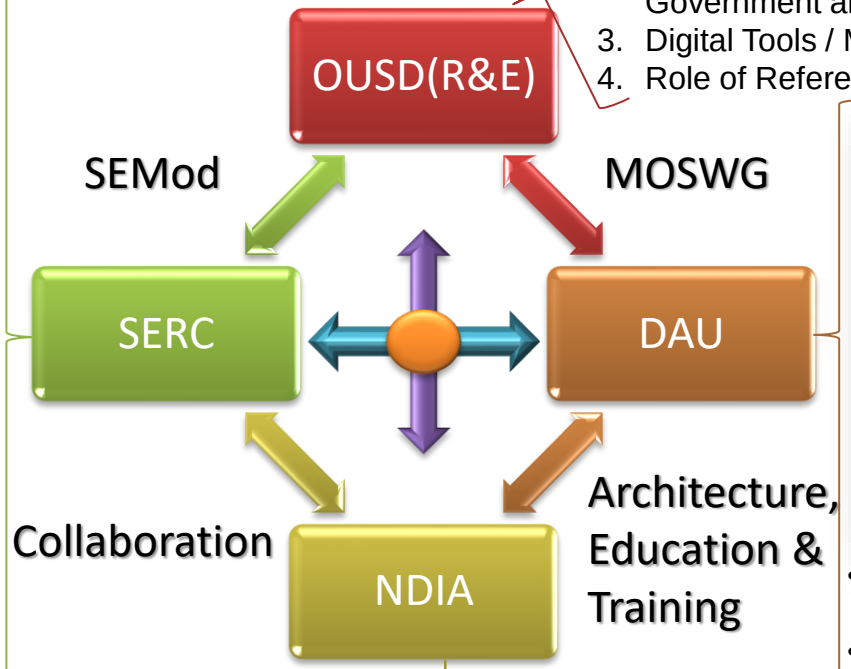
Concept: What are Systems Engineering Modernization focus area dependencies across the Digital Acquisition Thread?

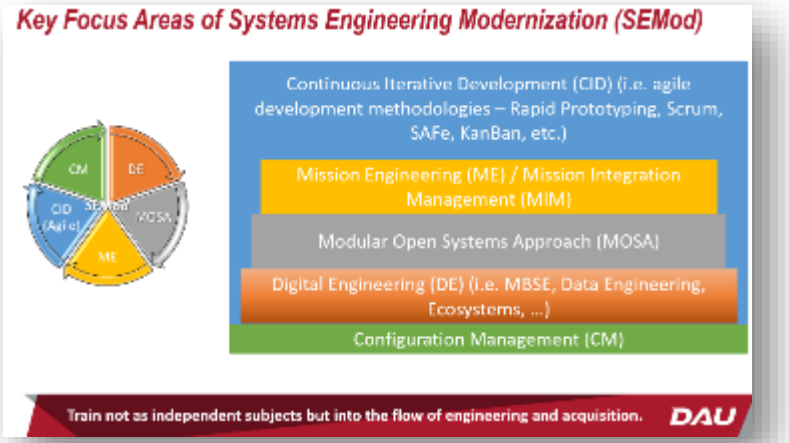


SEMod Collaborative Results

1. Get the integration framework into the flow down of policy and guidance to training.
2. ME, MOSA, and Agile need to be trained not as independent subjects but into the flow of engineering and acquisition.
3. Creating versions of that “bomb cyclone” model with accompanying narratives to describe this flow for different acquisition pathways as well as different functional areas.
4. Compiled a list of ~600 lessons learned from open literature at the detailed process level. This is not ready to be distributed yet but as SERC abstracts them upward they hopefully will provide more detail on the activities across the focus areas that are useful learning in a training setting.
5. Studying a digital ontology that relates military doctrinal language to acquisition language to systems engineering language. These are horribly disconnected right now. Hopefully this can also help with the background. (This includes the DAU definitions and taxonomy now but we are looking more broadly)
6. Collaborate with DAU on training how to define and contract for an appropriate digital infrastructure that looks forward toward the digital transformation.

A. Digital Processes and Products (Digital Acquisition / E-Programs)
B. Enterprise Systems Engineering approach integrating:
   1. Key areas: DE/MOSA/SWE-CID/ME/CM
   2. Collaboration and Data Sharing challenges between Government and Industry
   3. Digital Tools / Methods
   4. Role of Reference Architecture (RA)





- Identified many exemplar programs and organizations across the community.
- DoD CIO identified DISA native digital SATCOM RA created to publicly share - stimulating innovation and non-traditional industry contributions.
- Identified DoD policy gap preventing public sharing of digital artifacts like DISA SATCOM RA
- NDIA Cross-committee, cross-community collaborative project led by OMG UAF developing “Model Based Acquisition” digital artifacts and guidance

- Created “Systems Engineering Modernization,“ Webcasts Series
- Created: WSE027 MOSA and WSE028 ME Workshops, Developing CM and Architecture Workshops
- Delivered SEMod concept to Defense Acquisition Executives, Executive PMs, ACQ1700 Agile, WSA004 Cloud, ETM2020 Mission and Systems Thinking, ETM2070 Digital Literacy, ETM2080 Software Literacy and Army Agile / Software Pathway cross-functional teams.
- Awareness and Sharing: AIR FORCE MATERIEL COMMAND (AFMC) , GUIDEBOOK FOR IMPLEMENTING MODULAR OPEN SYSTEMS APPROACHES IN WEAPON SYSTEMS, 12SEP22

Modular Open Systems Approach (MOSA)

PEO Aviation Enterprise MOSA Strategy

Update for NDIA Systems Engineering Conference

Mr. John T. Stough
Architecture SME (Contractor Support)
On behalf of Mr. Matt Sipe, Director of MOSA Transformation, PEO Aviation

1-3 Nov 2022

PEO Driving MOSA Transformation Effort

Aligning People, Tools, Processes for Successful Execution

Current State

MOSA 9 LOEs

Creating Standardization, Increasing Communications, Applying Lessons Learned, Eliminating Stovepipes

FY21 NDAA MOSA ICRD

1. Governance & Policy
2. Architecture & Standards
3. Software Development
4. Collaborative Digital Environment
5. MOSA Conformance Center
6. Qualification & Materiel Release
7. Affordability & Savings
8. Contracting
9. Strategic Communications

Future State

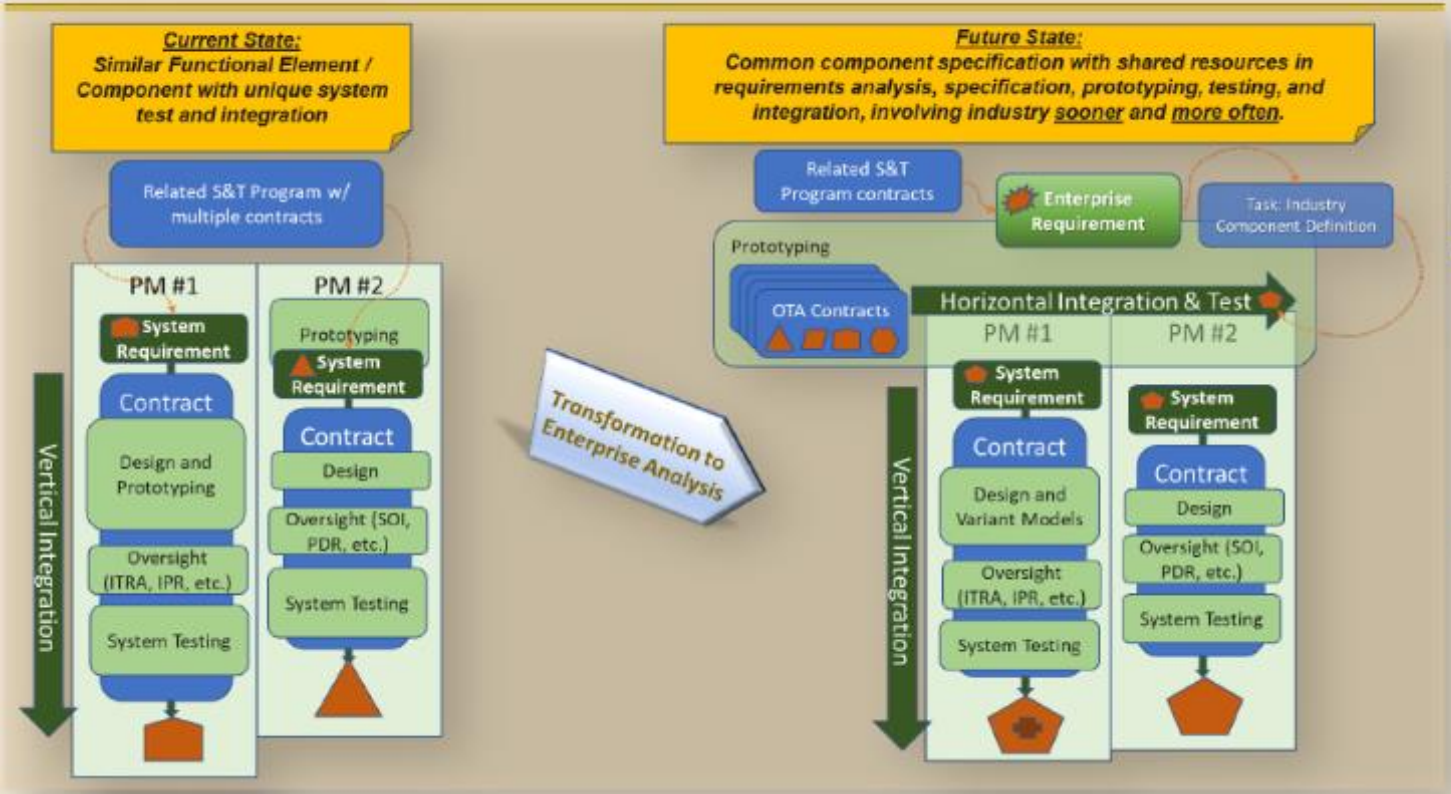
'Ready to Catch' Modernization Efforts

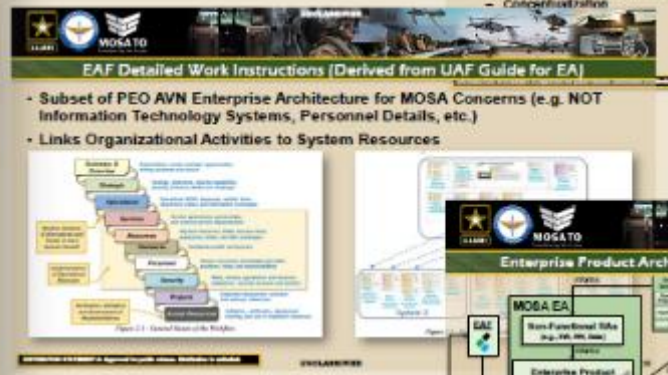
Results of VLC MOSA Industry Day

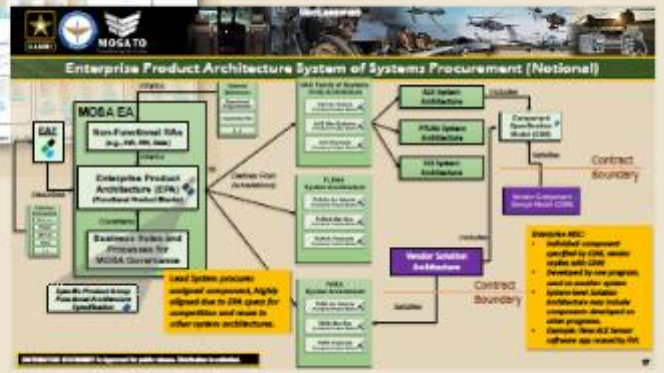
- Increasing Open Collaboration with Broad Industry Participation
- CRADA, Tasks, and Demos drive down risk and demonstrate value
- Enterprise-focused Major System Components (MSC) across the entire portfolio
- Use of potential future prototypes to achieve modular procurement
- Enterprise Governance and use of a common Enterprise Architecture Framework (EAF) for Component Specification Models (CSM)

Transforming To Meet The New Paradigm In Modular Acquisition

- **Emerging requirements are multi-domain rather than platform focused**
- **EAF allows trace and consistent model management across the Enterprise**







Competency-Based Technical Continuing Education using AFIT'S AVOLVE Application

Richard Sugarman
Department Head, Technical Continuing Education
AFIT, School of Systems and Logistics

~2017 – DAF push for new “CoL”

Revolutionize AF learning to develop the most effective, innovative, and agile multi-domain warfighters in Air Force history

CoL 2.0 Five interlinking initiatives

On-Demand and On-Command

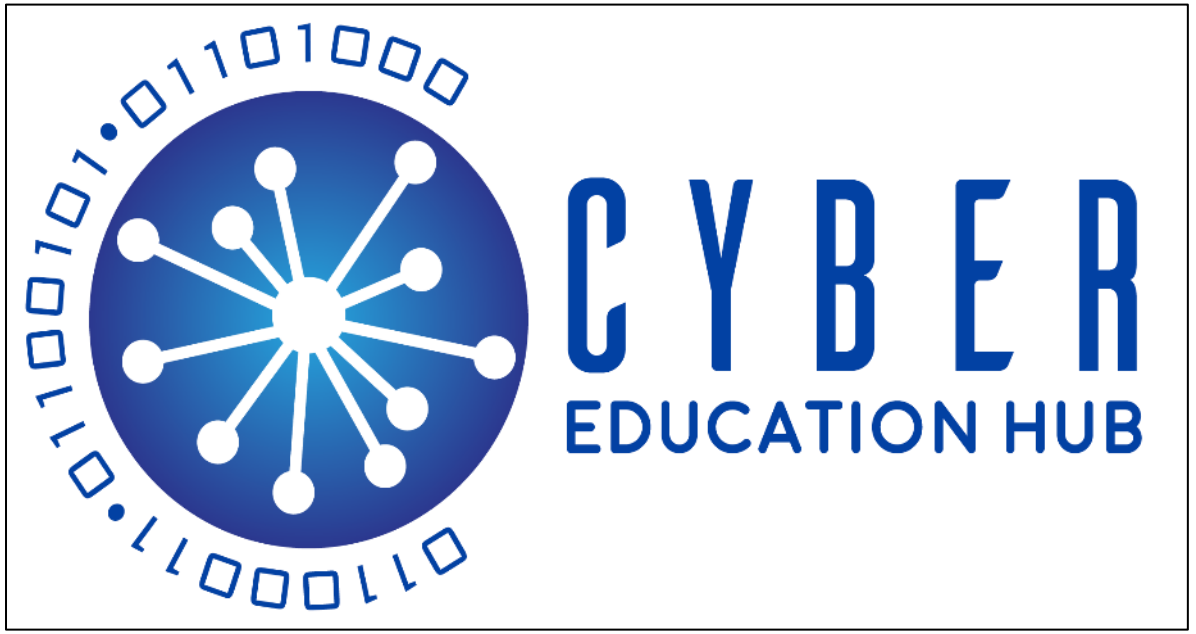
Modular learning

Blended Learning

Competency Based learning

Airman Learning Record

Also ~2017 – “Cyber Edu Hub”



Cyber Education Hub

2ua6342l51:8080/ceh-0.0.1/#userHome

Apps New Tab

CYBER EDUCATION HUB

Search

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Cyber Hygiene for Aircraft and Equipment Maintenance

An introduction to the critical role cyber hygiene plays in actions that Aircraft and Equipment Maintenance Management personnel take every day.

AF CyTCoE AFIT

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- Investigate
- Operate and Maintain
- Oversee and Govern
- Protect and Defend
- Securely Provision

Trending

Honeypots
John Doe
04/20/2018
27 2
19:00

Cyber Hygiene for Aircraft and Equipment
Rick Kroll
05/14/2018
125 3
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Cyberspace Workforce Development
Rick Kroll
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Redefining DoD's Role in Critical Infrastructure
Rob Roseman
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Mitigation of Cyber Warfare in Space
John Doe
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Framework for Assessing Cyber Risk
Stacy Burns
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Rick Kroll
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Operating in Today's Multi Domain
Rob Roseman
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Multi Domain C2
John Doe
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Redefining DoD's Role in Critical Infrastructure
Rob Roseman
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13 2
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Mitigation of Cyber Warfare in Space
John Doe
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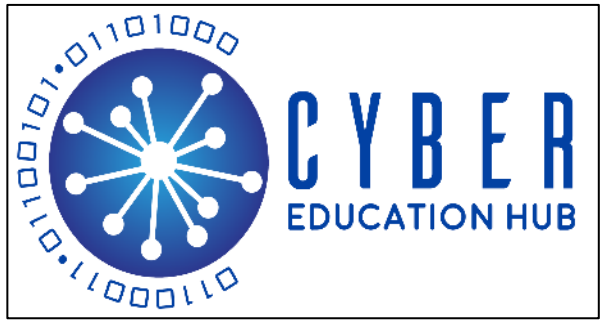
Comparison of the Increased Cyber and
Rob Roseman
05/07/2018
6 4
13:16

Then…to Now

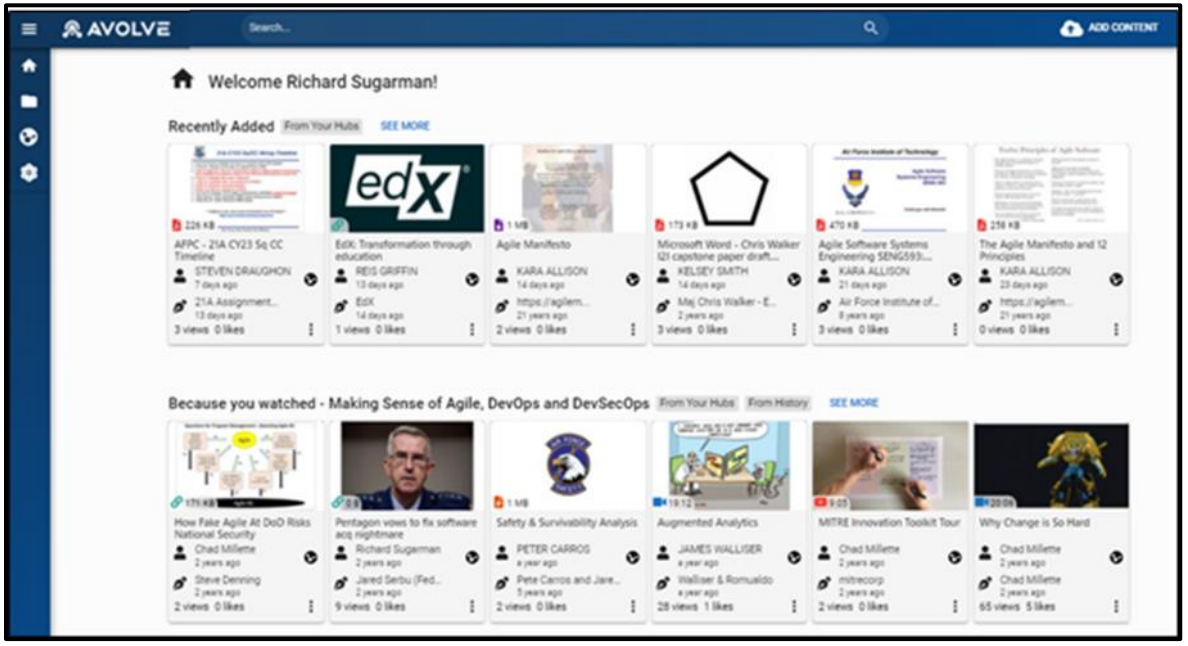
Cyber Education Hub → Education Hub → Avolve



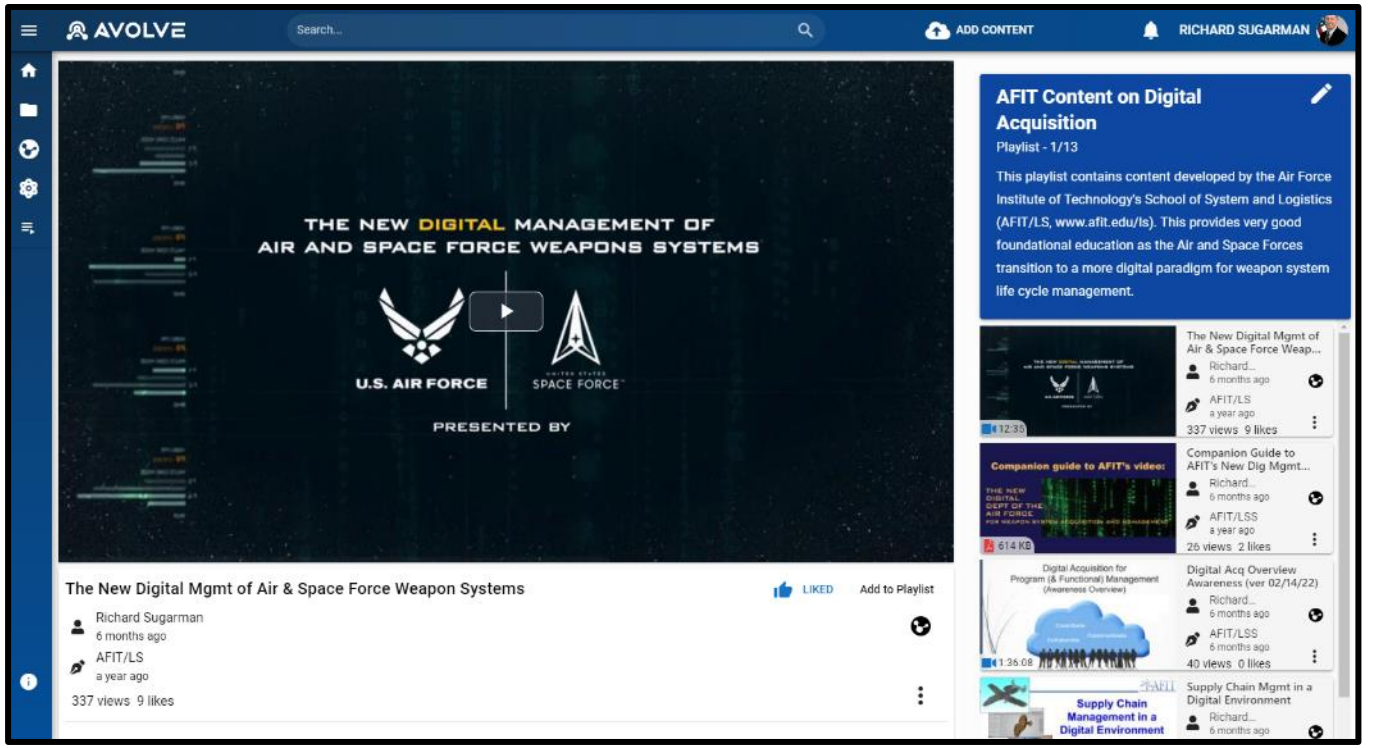
AVOLVE

AVOLVE https://avolve.apps.dso.mil

AFIT Air Force Institute of Technology



- Content sharing application with look & feel of popular streaming services
- User-generated, crowd-sourced content + user-created "Playlists"



- Content organized into domain "Hubs" & tag-searchable
- CAC accessed – IL-4 certified

Learning Paths

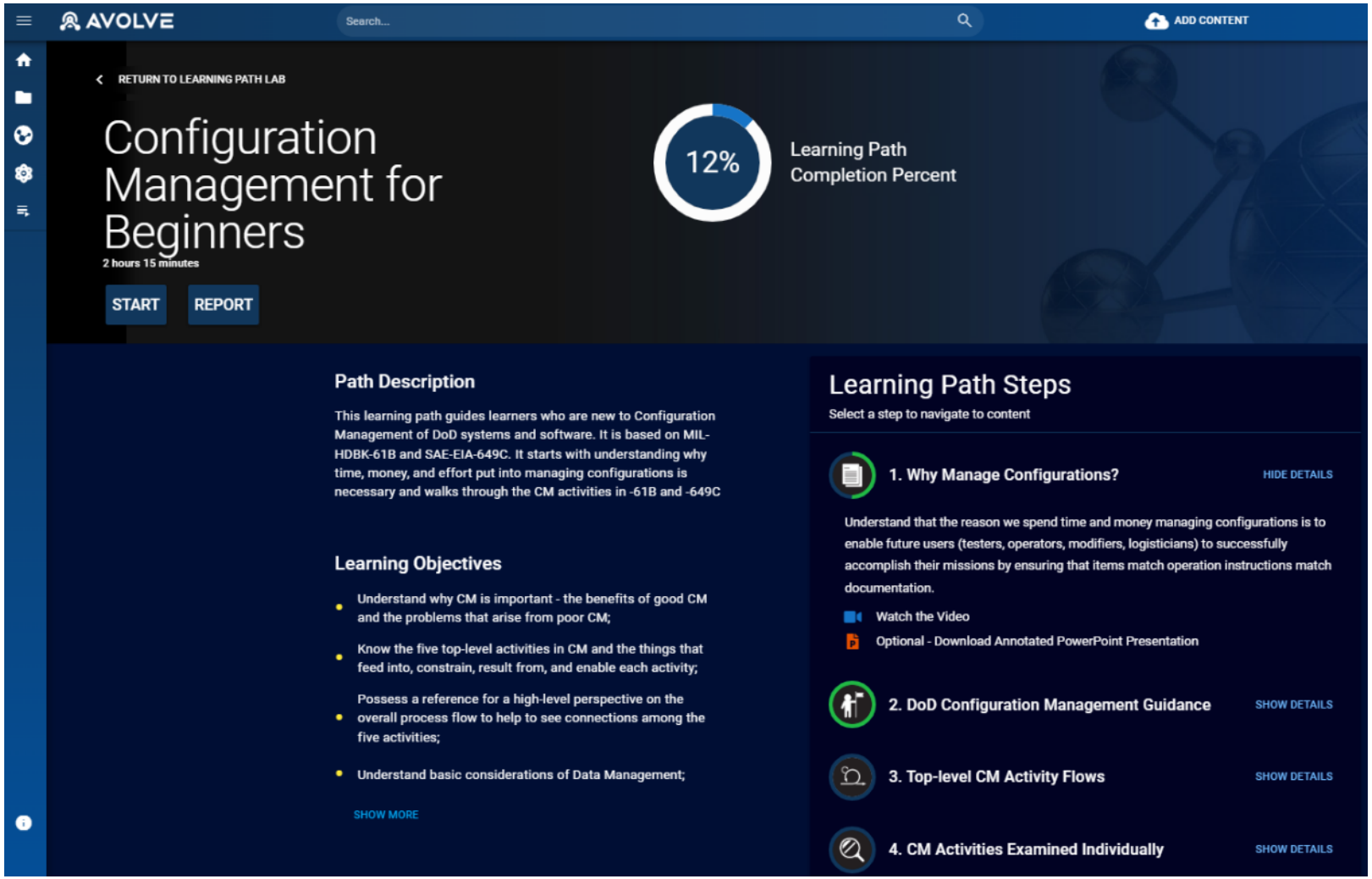
Guided Educational Resources

https://avolve.apps.dso.mil

AFIT
Air Force Institute of Technology

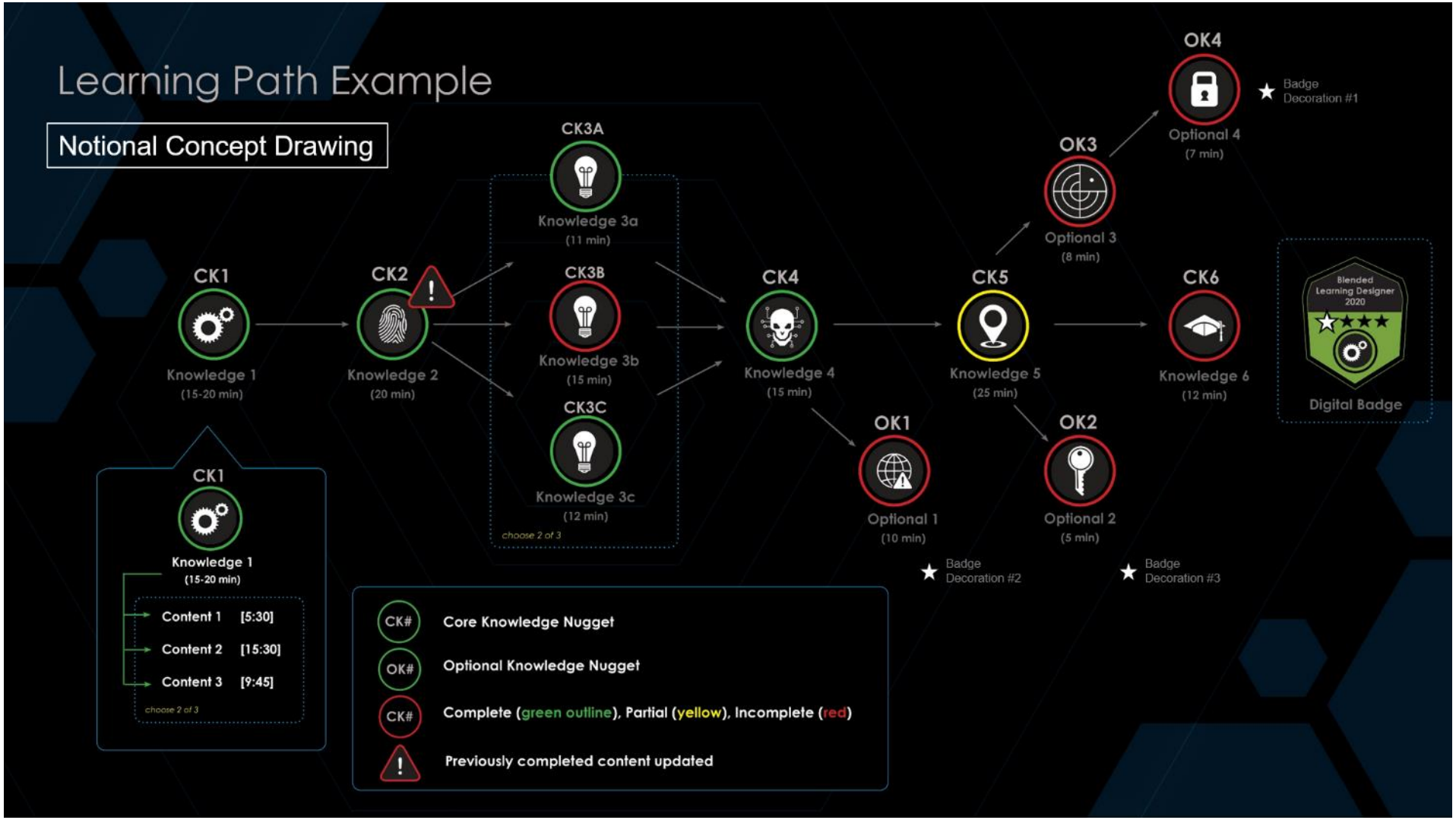
Curated paths of content designed to support *Agile Airman & Guardians*

- Learner-centric
- Competency-based
- Accessible anywhere/anytime



Future Capabilities

- Gamification
- Adaptive scenarios
- Artificial Intelligence
- Digital Badging



AVOLVE

For those with CAC-access:

https://avolve.apps.dso.mil

(Note: 1st-time login requires setting up a Platform One account)

If you do not have CAC-access, can still learn more about Avolve at:
https://www.afit.edu/CYBER/page.cfm?page=1849

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https://www.linkedin.com/in/richard-sugarman-daf/

Blinq digital business card:

Air Force Institute of Technology
School of Systems & Logistics
https://www.afit.edu/LS/

Current Practices:

- Leverage Partnerships (Larger programs are able to contract the support needed for MBSE (e.g., the MC-130 Amphibious Capability -- MAC) --AFRL/DARPA)
- Local Standards and Processes (to support SysML in DoDAF; HAD on contract-- offline for 3 months)
- "Normal DoDAF use" for formal requirements (e.g., in our "A-5 Shop" + trying to integrate MBSE considerations)

Lessons Learned:

1. Tools (speak to: needs to be funded, easy to use, "industry accepted" --no homebrew)
2. Training (speak to: Keep-it-stupid-simple + asynchronous)
3. Expertise (speak to: on staff -- for when the training fails)
4. Time (speak to: dedicated time needs to be made by leadership)
5. Overlaid to all: MONEY

Major Brandon P. Froberg, USAF
Integration & Interoperability Branch
AFSOC/A8II

The Israel Air Force SE-Mod approach

By Maj. Tzvika K

Distribution statement

This presentation is unclassified and Approved for public release: distribution unlimited.

No official (FOUO/CUI) program materials were used in the preparation of this presentation

SE Challenges in the IAF

- **Small "market" – external customers act as a major stakeholder**
- **Ever changing personnel – planning forward and maintaining req. is a challenge**

IAF SE – Modernized!

- **Successful:**
  - **The Island approach**

clear and independent growth process

  - **Modular systems**

additional capacity as needed

  - **Agile**

meeting requirement changes

IAF SE – Modernized!

- **Less Successful:**
  - **MOSA/Standards**

    Delivery of HW compatibility
  - **MBSE**

    Changing a "state of mind"

Discussion

Driving questions from the DoD:

- What is working well?
- What could use some work?
- What are your best demonstrated practices?
- What are your biggest lessons learned or challenges (overcome or being worked)?

What are your questions for the panel?

Deeper Learning

SOFTWARE ENGINEERING

- Defense Acquisition University
- Tools Catalog
- SE Brainbook
- **Configuration Management**

LOG 2040 Configuration Management

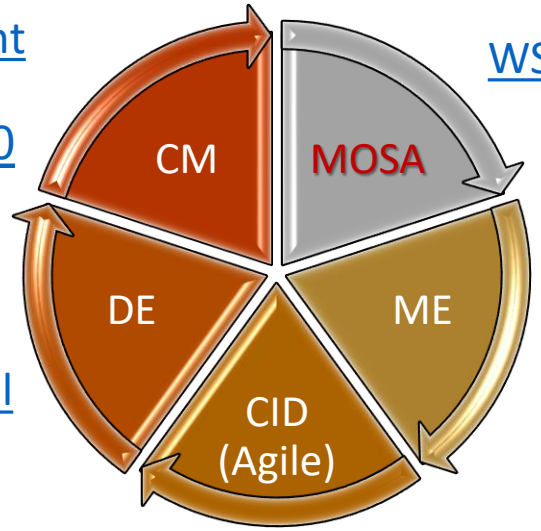
MIL-HDBK-61 07APR2020

MODULAR OPEN SYSTEMS APPROACH

DEFENSE STANDARDIZATION PROGRAM
MAKING SYSTEMS WORK TOGETHER

CLE 019 Modular Open Systems Approach

WSE 027 Modular Open Systems Approach (MOSA) Awareness and Planning Workshop



DIGITAL ENGINEERING

CLE 084 Models, Simulations, and Digital Engineering

ETM 1070 Digital Literacy Fundamentals

ETM 2070V Digital Literacy for Practitioners

Digital Engineering (DE) Measurement Framework

MISSION ENGINEERING

ETM 1020 Mission and Systems Thinking Fundamentals

ETM 2020V Mission and Systems Thinking for Practitioners

WSE 028 Mission Engineering Awareness and Planning Workshop

DAU Agile skills

Continuous Iterative Development (*Agile*) Measurement Framework

SYSTEMS ENGINEERING MODERNIZATION

June 21, 2022

DAU