WRT 1006: Digital Engineering Competency Framework

Sponsor: OUSD(R&E) | CCDC

Dr. Nicole Hutchison (nicole.hutchison@stevens.edu)

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DECF Team

Dr. Nicole Hutchison
Dr. Dinesh Verma
Dr. Mark Blackburn
Ms. Kara Pepe
Dr. Hoong Yan See Tao
Mr. Benjamin Kruse

Dr. Russell Peak
Mr. Adam Baker

Dr. Cliff Whitcomb
Ms. Rabia Khan

Dr. Jon Wade
Outline

• Introduction
• Methodology
• Results
  — Digital Engineering Competency Framework (DECF) v.1.0
  — Gap Analysis
• Current Status
• Future Plans
The World Today
Technology Is Transforming the Battlespace

- The proliferation of knowledge and technology erodes historic U.S. advantages
- Our near-peers are increasing their rate of investment in military R&D
- A hyper-competitive environment for National Security technologies
- The discriminators are speed and cycle time

- 2017 GLOBAL R&D FUNDING FORECAST WINTER 2017 Industrial Research Institute, R&D Magazine

R&D - Research & Development
NSB - National Science Board

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Digital Engineering Overview

- **What is Digital Engineering?**
  - Combines model-based techniques, digital practices, and computing infrastructure
  - Enables delivery of high payoff solutions to the warfighter at the speed of relevance

- **Reforms Business Practices**
  - Digital enterprise connects people, processes, data, and capabilities
  - Improves technical, contract, and business practices through an authoritative source of truth and digital artifacts

*Modernizes how we design, operate, and sustain capabilities to outpace our adversaries*
Goal 5: Transform the culture and workforce to adopt and support digital engineering across the lifecycle

Focus Areas
1. Improve the digital engineering knowledge base
2. Lead and support digital engineering transformation efforts
3. Build and prepare the workforce

Challenges

<table>
<thead>
<tr>
<th>Topic</th>
<th>Short Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workforce Skills Training</td>
<td>Limited incentives workforce skills, insufficient training capacity and resources to meet the demand</td>
</tr>
<tr>
<td>Policy, Guidance, &amp; Standards</td>
<td>Limited policies, guidance, and standards to comprehensively address digital engineering activities</td>
</tr>
<tr>
<td>Metrics</td>
<td>Lack of a common set of metrics that serve as leading indicators of adoption and effectiveness</td>
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</tbody>
</table>
Use Cases

DECF use cases are a critical input into its design, structure, and scope. The critical objective is for the DECF to enable transformation of the acquisition workforce – in particular the ENG workforce – for successful acquisitions in a digital engineering environment. The following are some of these avenues:

• **Increase skills of current workforce**
  – Workforce evaluation
  – Career Planning
  – Creating DE training programs

• **Grow workforce**
  – Creating Position Descriptions
  – Hiring for Digital Engineering Positions

• **Transform organization**
  – Identifying Critical Roles
DECF Development Approach Methodology

- Zoom out to Big Picture for context
- Identify focus areas at intersections
- Approach from multiple directions simultaneously
  - Investigate SE competency models for gaps and opportunities
  - Review existing material for DE specific competencies and KSAB
    - Develop a start on DECF Competencies, Definitions, and KSAB
  - Review SECCM Competency Definitions for DE Enhancements
    - Inform development of DECF
    - Identify specific SECCM/ENG DE enhancement edits
  - Review SECCM tasks for DE enhancement
    - Inform DECF
    - Develop DE tasks
  - Review SECCM proficiency levels for DE enhancement
    - Inform DECF
    - Develop DE proficiency levels
Gaps Analysis Approach

• At the *competency* level, compare the non-DoD models/frameworks and those identified by the ENG model

• Identify gaps not covered in ENG

• Break the competency descriptions into tasks (not common outside DoD models)

• Compare the task-level items in the identified gaps with the ENG models (“true” gaps)

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- INCOSE SE Competency Framework
- NASA SE/PM Competency Model
- Helix Atlas Proficiency Model
- US Department of Labor Engineering Competency Model
- Mission Engineering Competency Model (SERC)
- SECCM Mission Level Assessment Competencies
- MITRE SE Competency Model (2007)
- IEEE Software Engineering Competency Model (in progress)
# Proficiency Level Definitions

<table>
<thead>
<tr>
<th>Proficiency Level</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Awareness</td>
<td></td>
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</tr>
<tr>
<td>No experience with or knowledge of the competency.</td>
<td>Applies the competency in the simplest situations.</td>
<td>Applies the competency in somewhat difficult situations.</td>
<td>Applies the competency in difficult situations.</td>
<td>Applies the competency in considerably difficult situations.</td>
<td>Applies the competency in exceptionally difficult situations.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Requires close and extensive guidance.</td>
<td>Requires frequent guidance.</td>
<td>Requires occasional guidance.</td>
<td>Generally requires little or no guidance.</td>
<td>Serves as a key resource and advises others.</td>
<td></td>
</tr>
</tbody>
</table>
Digital Engineering Competency Framework (DECF) v.1.0 (released July 2020)

1. Digital Enterprise Environment
   - Digital Enterprise Environment Development
   - Digital Enterprise Environment Management
   - Digital Enterprise Environment Operations and Support
   - Digital Enterprise Environment Security

2. Data Engineering
   - Data Governance
   - Data Analytics

3. Digital Engineering and Analysis
   - Modeling, Simulation, and Analysis
   - Coaching and Mentoring
   - Systems Engineering
   - Digital Architecting
   - Digital Requirements Modeling
   - Digital Verification
   - Model-Based Systems Engineering Process
   - Project Management
   - Organizational Development
   - Digital Model-Based Reviews
   - Digital Engineering Policy and Guidance

4. Systems Software
   - Software Construction
   - Software Engineering

5. Configuration Management
   - Configuration Management

Foundational Digital Competencies
## Foundational Digital Competencies Based on the NAVAIR Model – Reflected in DECF v. 1.0

<table>
<thead>
<tr>
<th>ID</th>
<th>Category</th>
<th>Original Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Information and Data Literacy</td>
<td>To articulate information needs, to locate and retrieve digital data, information and content. To judge the relevance of the source and its content. To store, manage, and organize digital data, information and content.</td>
</tr>
<tr>
<td>2</td>
<td>Communication and Collaboration</td>
<td>To interact, communicate and collaborate through digital technologies while being aware of cultural and generational diversity. To participate in society through public and private digital services and participatory citizenship. To manage one’s digital identity and reputation.</td>
</tr>
<tr>
<td>3</td>
<td>Digital Content Creation</td>
<td>To create and edit digital content. To improve and integrate information and content into an existing body of knowledge while understanding how copyright and licenses are to be applied. To know how to give understandable instructions for a computer system.</td>
</tr>
<tr>
<td>4</td>
<td>Safety</td>
<td>To protect devices, content, personal data and privacy in digital environments. To protect physical and psychological health, and to be aware of digital technologies for social well-being and social inclusion. To be aware of the environmental impact of digital technologies and their use.</td>
</tr>
<tr>
<td>5</td>
<td>Problem Solving</td>
<td>To identify needs and problems, and to resolve conceptual problems and problem situations in digital environments. To use digital tools to innovate processes and products. To keep up-to-date with the digital evolution.</td>
</tr>
<tr>
<td>6</td>
<td>Digital Identity</td>
<td>Ability to build a wholesome online and offline identity</td>
</tr>
<tr>
<td>7</td>
<td>Digital Use</td>
<td>Ability to use technology in a balanced, healthy, and civic way.</td>
</tr>
<tr>
<td>8</td>
<td>Digital Safety</td>
<td>Ability to understand, mitigate, and manage various cyber-risks through safe, responsible and ethical use of technology</td>
</tr>
<tr>
<td>9</td>
<td>Digital Security</td>
<td>Ability to detect, avoid, and manage different levels of cyber threats to protect data, devices, networks, and systems.</td>
</tr>
<tr>
<td>10</td>
<td>Digital Emotional Intelligence</td>
<td>Ability to recognize, navigate, and express emotions in one’s digital intra and inter-personal interactions.</td>
</tr>
<tr>
<td>11</td>
<td>Digital Communication</td>
<td>Ability to communicate and collaborate with others using technology.</td>
</tr>
<tr>
<td>12</td>
<td>Digital Literacy</td>
<td>Ability to find, read, evaluate, synthesize, create, adapt, and share information, media, and technology.</td>
</tr>
<tr>
<td>13</td>
<td>Digital Rights</td>
<td>Ability to understand and uphold human rights and legal rights when using technology.</td>
</tr>
</tbody>
</table>
## Distribution of KSABs in the DECF

<table>
<thead>
<tr>
<th>Competency Group</th>
<th>Competency Area</th>
<th>Total KSABs</th>
<th>KSABs by Proficiency Level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Awareness</td>
</tr>
<tr>
<td>Digital Enterprise Environment</td>
<td>Digital Environment Development</td>
<td>35</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Management</td>
<td>28</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Communications</td>
<td>11</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Planning</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Digital Environment Operations</td>
<td>27</td>
<td>3</td>
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<td></td>
<td>Digital Environment Support</td>
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<td></td>
<td>Digital Environment Security</td>
<td>42</td>
<td>6</td>
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<tr>
<td>Data Engineering</td>
<td>Data Governance</td>
<td>67</td>
<td>1</td>
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<tr>
<td></td>
<td>Data Analytics</td>
<td>19</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Modeling, Simulation, and Analysis</td>
<td>53</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Coaching and Mentoring</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Model-Based Systems Engineering Processes</td>
<td>91</td>
<td>10</td>
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<tr>
<td>Digital Engineering and Analysis</td>
<td>Digital Architecting</td>
<td>26</td>
<td>2</td>
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<tr>
<td></td>
<td>Digital Requirements Modeling</td>
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<td></td>
<td>Digital Verification</td>
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<td>1</td>
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<tr>
<td></td>
<td>Digital Model-Based Reviews</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Project Management</td>
<td>14</td>
<td>0</td>
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<td></td>
<td>Organizational Development</td>
<td>15</td>
<td>0</td>
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<td></td>
<td>Digital Engineering Policy and Guidance</td>
<td>23</td>
<td>2</td>
</tr>
<tr>
<td>Systems Software</td>
<td>Software Construction</td>
<td>18</td>
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<td></td>
<td>Software Engineering</td>
<td>47</td>
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<tr>
<td>Configuration Management</td>
<td>Configuration Management</td>
<td>19</td>
<td>0</td>
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<td></td>
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<td>636</td>
<td>39</td>
</tr>
</tbody>
</table>
OpenMBEE Structure

DECF can be downloaded as a PDF at any time.

DECF CSM
SysML Model

DECF Model Management System

MMS repository

DECF Accessed in View Editor
Research Tasks – Phase 1 (COMPLETED)

The SERC researchers shall perform the following tasks:

1. Define the digital engineering activities – and supporting competencies (knowledge, skills, and abilities) – required to support lifecycle phases from concept through disposal. These activities form the foundation of the Digital Engineering Competency Framework.

2. Building on task 1, identify aspects of the digital engineering lifecycle activities and competencies – that are specific, unique and relevant to the acquisition engineering (ENG) workforce.

3. Develop a Digital Engineering Competency Model, using the DoDI 1400.24 vol.250 “Competency Taxonomy.”

4. Based on the work done in Task 1, map each competency set identified in task 3 to the lifecycle phase. This completes the Digital Engineering Competency Framework.

DECF v. 1.0 released 23 July 2020 – available at https://sercuarc.org/project/?id=86&project=Digital+Engineering+Competency+Framework under “deliverables”
Research Tasks – Phase 2 (CURRENT)

5. Conduct a gap analysis comparing Defense Acquisition University's (DAU) current curricula against the competency requirements.

6. Provide recommendations on creating a digital engineering curriculum as well as modifying the applicable acquisition career fields’ curricula to build interdisciplinary digital engineering knowledge and abilities.

7. Map digital engineering knowledge and abilities to commercial job titles and job descriptions and requirements of Digital Engineering.

Phase 2 - Current Status

• KSABs collected from DAU Digital Engineering Curriculum
  — CLE084 & Coursera MBSE course
  — ~200 individual KSABs identified; reviewing to remove duplicates
  — 44 learning objectives identified from CLE084

• Conducting gap analysis between DECF KSABs and current curriculum
  — Note: WRT-1018 has identified target KSABs for managers and practitioners for digital engineering courses at DAU
  — WRT-1006 and 1018 are coordinating to identify which of the target KSABs are currently covered in the curriculum
• What’s next?
  ― DAU recommendations
  ― DECF 1.1

• Final deliverables
  January 2021
Thank you!

Any questions?