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Version 0.5 of the Proposed INCOSE Systems Engineering Competency Framework

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Purpose

- Describe Version 0.5 of the proposed INCOSE Systems Engineering Competency Framework.
- Describe the newly developed competency framework tables along with notional examples
- Provide a working example of a framework derived competency model for Systems Security Engineering.

Changes to Current Competency Framework

- Evolve the current framework to an SE role-based **competency framework** that is extensible, scalable, and tailorable by the customer organization.
- Add the **Concepts of Roles and Activities**.
- Add the **Concept of Categories**.
- Add a **Professional Category**.
- Enhance the proficiency levels by adding a new level: **Senior Practitioner**.

Competency Framework Taxonomy

SE Role	A collection of interrelated and interdependent activities assigned to a person in a contextual environment such as Systems Engineering
Activity	A specified pursuit defined by a set of essential functions and desired outcomes that enable the successful accomplishment of one's role
Category	A grouping of closely related competencies considered essential to an individual's ability to successfully perform an activity
Competency	An observable and measurable pattern of knowledge, skills, abilities, behaviors, and other characteristics that an individual needs to successfully perform an activity
Description and Why It Matters	A depiction of the competency that clearly defines its essential function, desired outcomes and reasons for why the competency is needed
Knowledge Skills Abilities Behaviors	The measurable characteristics of proficiency that make up a competency

Concept of Categories

- **Technical Processes** – competencies required to perform fundamental SE activities.
- **Technical Management** – competencies required to plan, assess and control the technical effort.
- **Analytical** – competencies required to develop inputs for decisions or fundamental SE activities.
- **Professional** – non-technical competencies that enable systems engineers to effectively and efficiently achieve objectives in the organizational context.

Professional Category

- Globally accepted belief that if you are a systems engineer, then you must also be a leader.
- Includes professional and interpersonal competencies such as leadership, team dynamics, communications, problem solving, negotiation, persuasion, ethics, cultural change management, judgment, mission and results focus, coaching and mentoring, etc.
- Collection of enabler competencies for the successful accomplishment of SE activities.

Senior Practitioner

- Defined as: “the person displays both in-depth and broad knowledge of the subject based on practical experience and is capable of leading others to create and evaluate solutions to complex problems in the subject.”
- Provides a bridge to make it easier to transition from the Practitioner level to the Expert level.

Competency Framework Table

Systems Engineering Competency Framework				
Role – Title of the Role				
Role Description: explains the role and provides meaning to the role				
Why it matters: indicates the importance and value of the role and the problems that may be encountered in the absence of that role				
List of Activities	**Activity Description**	**Category**	**Competency**	**Recommended Proficiency Level**
Name of the activity	Explains the activity, the value of the activity and how it supports the role.	Technical Processes	Competency Title	Proficiency Level
			Competency Title	Proficiency Level
		Technical Management	Competency Title	Proficiency Level
			Competency Title	Proficiency Level
		Analytical	Competency Title	Proficiency Level
			Competency Title	Proficiency Level
		Professional	Competency Title	Proficiency Level
			Competency Title	Proficiency Level
Name of the activity	Explains the activity, the value of the activity and how it supports the role.	Technical Processes	Competency Title	Proficiency Level
			Competency Title	Proficiency Level
		Technical Management	Competency Title	Proficiency Level
			Competency Title	Proficiency Level
		Analytical	Competency Title	Proficiency Level
			Competency Title	Proficiency Level

Proficiency Level Table

Systems Engineering Competency Model - Proficiency Level Table				
COMPETENCY AREA – Category: Competency				
Description: explains the competency and provides meaning behind the title.				
Why it matters: indicates the importance of the competency and the problems that may be encountered in the absence of that competency.				
EFFECTIVE INDICATORS OF KNOWLEDGE, SKILLS, ABILITIES AND EXPERIENCE				
AWARENESS	**SUPERVISED PRACTITIONER**	**PRACTITIONER**	**SENIOR PRACTITIONER**	**EXPERT**
The person is able to understand the key issues and their implications. They are able to ask relevant and constructive questions on the subject.	The person displays an understanding of the subject but requires guidance and supervision.	The person displays detailed knowledge of the subject and is capable of providing guidance and advice to others.	The person displays both in-depth and broad knowledge of the subject based on practical experience. The person is capable of leading others to create and evaluate solutions to complex problems in the subject.	The person displays extensive and substantial practical experience and applied knowledge of the subject.

Example Competency Model

Systems Engineering Role-Based Competency Model				
Role – System Security Engineering				
Role Description: System Security Engineering (SSE) is a specialty engineering discipline within Systems Engineering (SE) focused on ensuring a system can function under disruptive conditions associated with misuse and malicious behavior. SSE involves a disciplined application of SE principles in analyzing threats and vulnerabilities to systems and assessing and mitigating risk to the information assets of the system during its lifecycle. It applies a blend of technology, management principles and practices, and operational rules to ensure sufficient protections are available to the system at all times.[1]				
Why it matters: Appropriate SSE activities are needed because an adversary may attempt to sabotage, maliciously introduce unwanted function, or otherwise subvert the design, integrity, manufacturing, production, distribution, installation, operation, or maintenance of a covered system so as to surveil, deny, disrupt, or otherwise degrade the function, use, or operation of such system.				
Activity	**Activity Description**	**Category**	**Competency**	**Recommended Proficiency Level**
Supply Chain Risk Management	The U.S. Department of Defense (DoD) defines supply chain risk as "the risk that adversaries will insert malicious code into or otherwise subvert the design, manufacturing, production, distribution, installation, or maintenance of components that may be used in DoD systems to gain unauthorized access to data, to alter data, to	Technical Processes	Supply Chain Verification	Practitioner
			Supply Chain Validation	Practitioner
		Technical Management	Trusted Supply Chain Management	Expert
			Technical Risk Management	Senior Practitioner
		Analytical	Design Considerations/Specialty Engineering	Practitioner
			Reliability, Maintainability, and Availability Analysis	Practitioner
			Leadership	Practitioner

Example Proficiency Level Table

Systems Engineering Competency Framework				
COMPETENCY AREA – Professional: Communications				
Description: Facilitates an open and supportive environment using effective two-way communication, verbally and in writing, including active listening, ensuring understanding and providing constructive feedback.				
Why it matters: Effective communications is crucial to the success of any program. Most major program failures can be traced back to systemic root causes that include inefficient, ineffective, or the lack of communications.				
EFFECTIVE INDICATORS OF KNOWLEDGE, SKILLS, ABILITIES AND EXPERIENCE				
AWARENESS	**SUPERVISED PRACTITIONER**	**PRACTITIONER**	**SENIOR PRACTITIONER**	**EXPERT**
Understands the importance of effective communications	Knows how to read, write and communicate verbally, but requires guidance, supervision and experience to do it more effectively	Effectively communicates verbally and in writing Checks for understanding	Translates complex information into a clear and organized manner that can be efficiently communicated and understood by others	Effectively and efficiently communicates in a manner that persuades others to adopt and act on specific ideas.

Future Work to V0.75

- Include all Systems Thinking and Holistic Lifecycle View competencies from current INCOSE UK Competency Framework.
- Develop an initial draft Role Definition Guide that describes the typical roles that systems engineers may assume.
- Develop example Competency Models for Systems Security Engineering, Energy, Transportation, and Health Care domains.

Future Work to V0.75

- Add the category of **Enterprise**:
  - Systems Thinking & Dynamics
  - Business Knowledge
  - Technical Basis for Cost
  - Portfolio Management
  - System of Systems Management
  - Strategy
  - Quality Management
  - Technical Workforce Development & Management

Future Work to V0.75

- Coordinate and Align with
  - US Navy's SE Competency Career Model (SECCM)
  - DAU Competency Model and Acquisition Workforce Qualification Initiative (AWQI)
  - INCOSE Systems Engineering Handbook V 4.0 and Systems Engineering Professional Program
  - INCOSE Professional Development Initiative
  - Systems Engineering Research Center's Helix Study
  - Systems Engineering Body of Knowledge (SEBoK Part 5)
  - Information Technology Body of Knowledge (ITBoK)

Future Work to V1.0

- Coordinate and Align with:
  - INCOSE PMI Working Group
  - Other models (i.e., CMMI, etc.) and how they may impact the framework
- Develop Use Cases
- Develop an Assessment Methodology
  - Consider how to support an Individual / Supervisor Assessment of Competence
- Find out more about the Omega-Alpha Society
- Examine competencies outside traditional SE to provide breadth
- Consider Vision 2025 Roles and Competencies
- Include foundational systems principles

Summary

- Purpose
- Summary of Changes to UK Competency Framework
- CF and Proficiency Level Table Formats
- Example Tables
- Future work to get to V0.75 and V1.0

Questions?

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