

# **Application of a Global Systems Engineering Competency Framework**

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# Framework Development Motivation

**The need for visualization of a competency framework through implementation**

**Applicable to a wide range of industry, government and academic situations**

**A model with enough depth to be usable at several layers of a global enterprise**

**The author's perceived business need for the rapid Creation and deployment of a 3-D competency model through the use of standards**

# Why Deploy A Competency Framework?

Per the U.K. Chapter of INCOSE, a competency framework can be use to:

- Tailor/complement/supplement other enterprise competency frameworks,
- Profile an enterprise,
- Profile a team,
- Provide job/role descriptions,
- Enhance recruitment,
- Identify gaps in a skill base,

# Competency/Capability Definitions

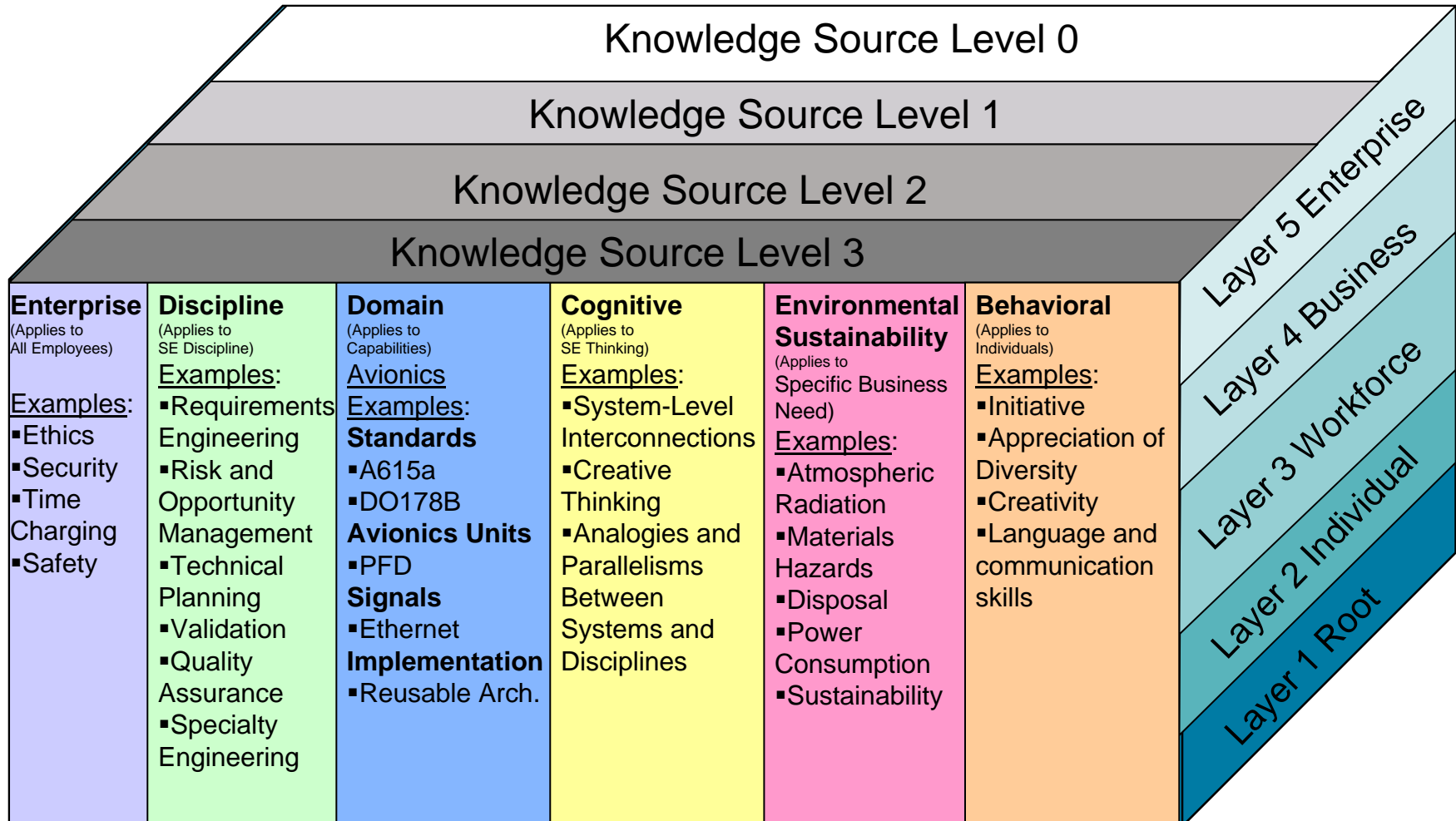
## Competencies:

- The **knowledge, experience, skills, abilities, and attributes of an organization**, made up of individuals' personal competencies (root level competencies).

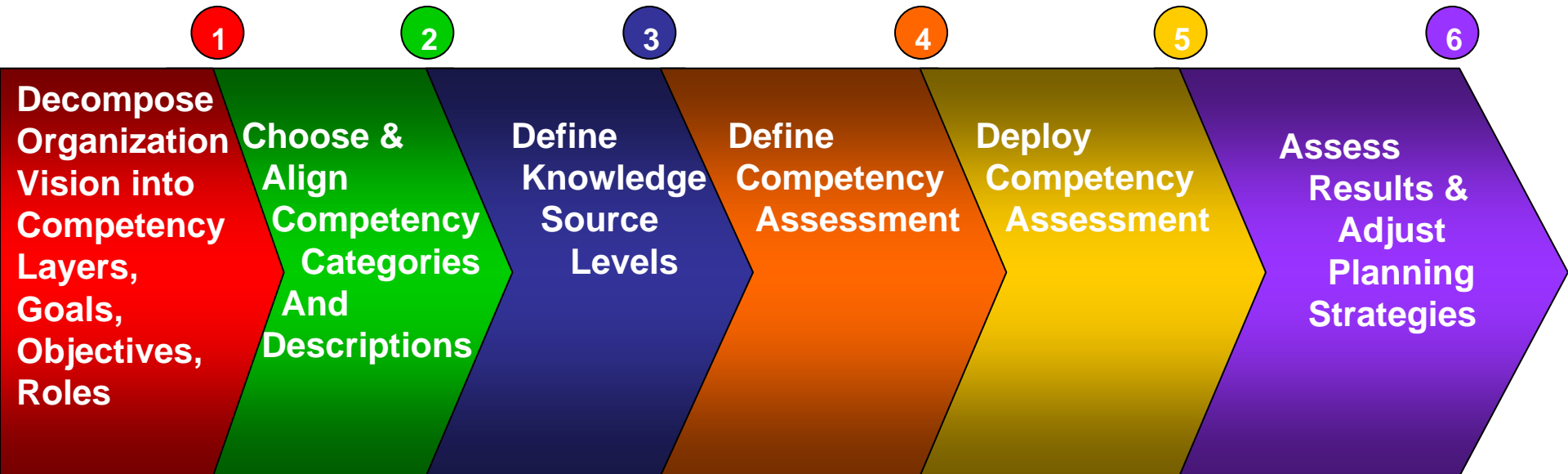
## Capabilities:

- The **physical manifestations of technology**, both the end products and systems and the physical infrastructure required to design, develop, manufacture, produce, verify and validate the technology or service.

# 3-Dimensional Competency Model



# Competency Development Activities



## Decompose Organization Vision into Competency Layer(s) Goals, Objectives, Roles

1. Review/align/create a business vision, goals, objectives, aligned to a strategic plan
2. Align/determine a flow down of the vision/goals/objectives
3. Assign job roles to employees

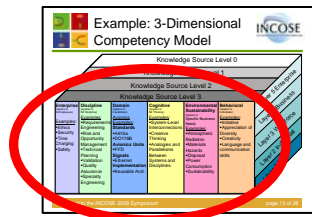
# Vision, Goals, Objectives Example

**Vision:** To be the Systems Integrator of choice for global aircraft avionics.

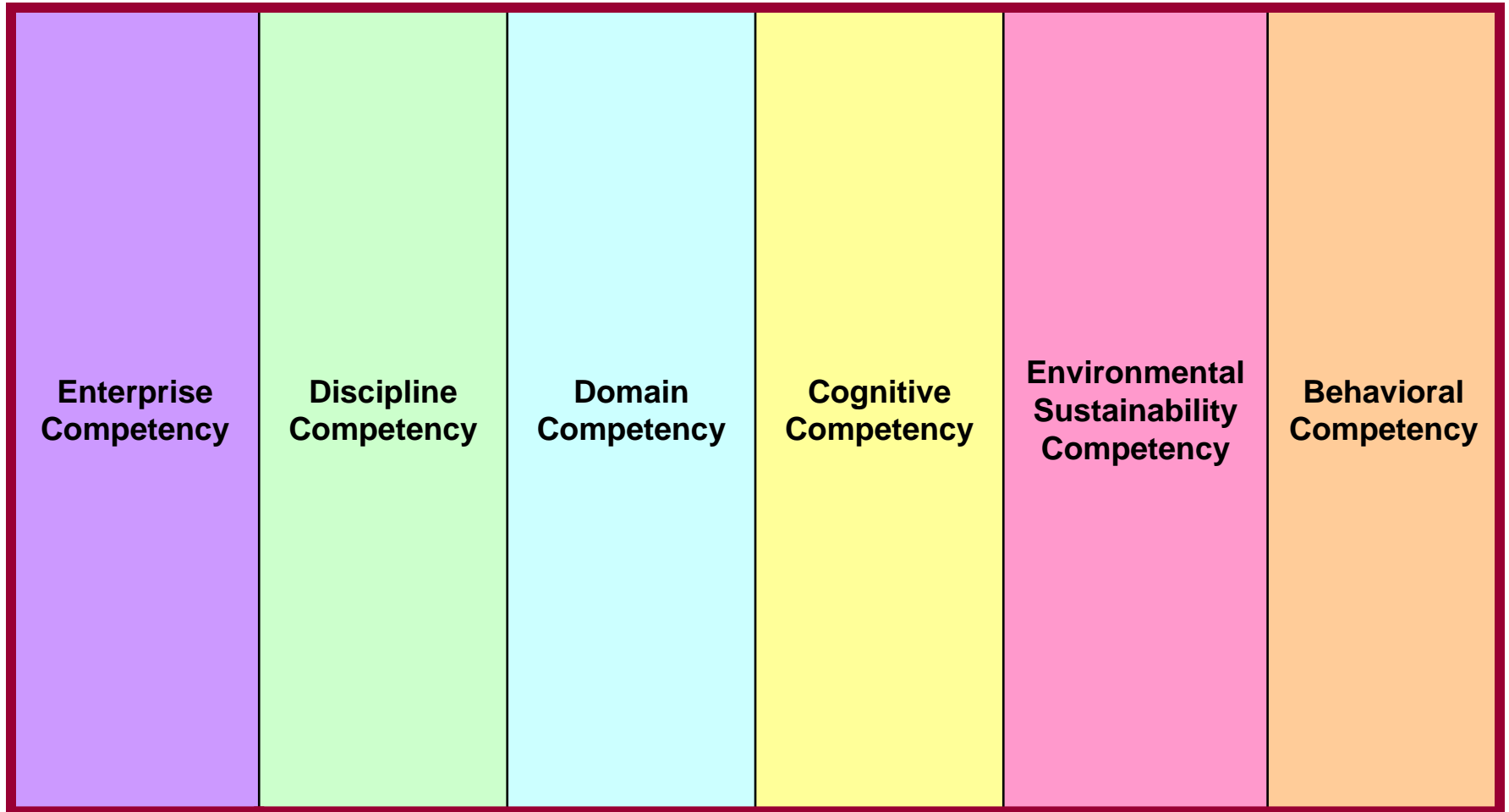
Goal		Objective
Time frame: 3 years		Time frame: 1 year
<b>Goal 1:</b> Instill Avionics Systems Engineering Integration Competencies across the Enterprise.		<b>Objective 1:</b> Identify enterprise layer SE integration competencies gap rolled up from employees assigned the role, "Avionics Systems Integration Engineer".
		<b>Objective 2:</b> Set 3-year enterprise layer SE avionics competency target for employees assigned the role, "Avionics Systems Integration Engineer".
		<b>Objective 3:</b> Attain 25% enterprise layer competency targets for the Avionics Systems Integration Engineer Workforce by July 31, 2010.

## Choose & Align Competency Categories And Descriptions

1. Choose Competency Categories
2. Choose Individual Competencies
3. Choose Competency Descriptions

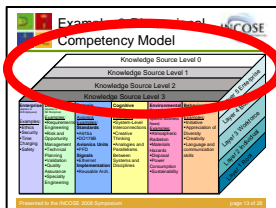


# Competency Model Categories



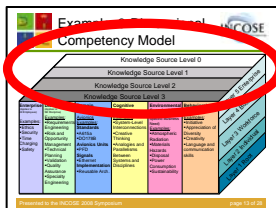
## Define Knowledge Source Levels

This activity contains a single step that is crucial for defining the attainment of experiential and rote learning levels.



# Knowledge Source Level Example

Level	Experience (ELKS)	Rote Knowledge (RLKS)
3 - Mastery	More than 5 years	3 or more years
2 - Synthesis	3 - 5 years	2 - 3 years
1 - Comprehension	1 - 3 years of Experience	1 - 2 years
0 - Awareness	Less than 1 year	Less than 1 year



# Knowledge Source Target Example

Employee	Experiential Knowledge			Rote Knowledge		
	Enterprise Target	Supervisor Target	Employee Knowledge	Enterprise Target	Supervisor Target	Employee Knowledge
<Employee Name>						
Requirements Engineering	1	0		1	0	
Integration Engineering	2	0		3	2	
Standards	2	1		2	2	
System-Level Understanding	2	2		2	3	
System Synergy	2	1		2	1	

## Define Competency Assessment

- Determine which Tool would be used to administer the Assessment
- Create the Competency Assessment Instrument
- Define Templates and Reports

<b>Role: Avionics Systems Integration Engineer</b>			
<b>Competency</b>	<b>Competency Description</b>	<b>Knowledge Source</b>	<b>Rating</b>
<b>Discipline: SE</b> <b>Competency: Requirements Engineering</b>	Analyzing customer and stakeholder needs, generate/develop requirements, perform functional analyses, derive requirements, ensure requirements quality, allocate requirements, control requirements, maintain requirements database, develop and implement Requirements Management Plans, develop measures of effectiveness and performance.	<b>ELKS:</b>	
		<b>RLKS:</b>	
<b>Discipline: SE</b> <b>Competency: Integration</b>	Defining technical integration strategy, develop Integration Plans, develop integration test scripts, develop and implement integration test scenarios, conduct and document integration tests, track integration test results and retest status.	<b>ELKS:</b>	
		<b>RLKS:</b>	
<b>Domain: Avionics</b> <b>Competency: Standards</b>	Understanding of ISO15288 Systems Engineering Lifecycle, EIA 632, 600 Series ARINC Specifications and Reports, ASTM F 2639 - Practice for Design, Alteration and Certification of Airplane Electrical Wiring Systems.	<b>ELKS:</b>	
		<b>RLKS:</b>	
<b>Cognitive: SE</b> <b>Competency: System-Level Understanding</b>	Understanding the whole System and seeing the "big picture beyond its elements/subsystems/assemblies/components functions as part of the entire system. Understand how subsystems integrate into a whole system, aimed at fulfilling predetermined requirements and specifications. Understand the system and the environment in which it performs. Understand mutual relationships and interconnections, discerning change patterns.	<b>ELKS:</b>	
		<b>RLKS:</b>	
<b>Cognitive: SE</b> <b>Competency: System Synergy</b>	Understanding that a system is more than a collection of parts. Understand system properties, capabilities, and behaviors emerge from the system parts. The whole is more than the sum of the parts. Knowledge that Systems have emergent properties that do not exist in their individual parts.	<b>ELKS:</b>	
		<b>RLKS:</b>	

## Deploy Competency Assessment

This activity contains a single step that is crucial for implementing the planned rollout of the framework - administer.

## Assess Results & Adjust Planning Strategies

- Assess Results
- Adjust Planning Strategies

Role: Avionics Systems Integration Engineer					
Competency	Competency Description	Knwldg Source	Entrprs Target Value	Layer 3 Org Workforce	Layer 5 Entrprs
				# Empls. Below Trgt	Below Trgt
Discipline: SE Competency: Requirements Engineering	Analyzing customer and stakeholder needs, generate/develop reqts, perform functional analyses, derive reqts, ensure requirements quality, allocate reqts, control reqts, maintain reqts database, develop and implement reqts management plans, develop measures of effectiveness and performance.	ELKS:	1	3	17
		RLKS:	1	4	20
Discipline: SE Competency: Integration Engineering	Defining technical integration strategy, develop Integration Plans, develop integration test scripts, develop and implement integration test scenarios, conduct and document integration tests, track integration test results and retest status.	ELKS:	2	10	39
		RLKS:	3	12	52
Domain: Avionics Competency: Standards	Understanding of ISO15288 Systems Engineering Lifecycle, EIA 632, 600 Series ARINC Specifications and Reports, ASTM F 2639 - Practice for Design, Alteration and Certification of Airplane Electrical Wiring Systems.	ELKS:	2	2	123
		RLKS:	2	2	123
Cognitive: SE Competency: System-Level Understanding	Understanding the whole System and seeing the "big picture beyond its elements/subsystems/assemblies/components functions as part of the entire system.	ELKS:	2	5	64
		RLKS:	2	2	48
Cognitive: SE Competency: System Synergy	Understanding that a system is more than a collection of parts. Understand system properties, capabilities, and behaviors emerge from the system parts. The whole is more than the sum of the parts. Knowledge that Systems have emergent properties that do not exist in their individual parts.	ELKS:	2	8	45
		RLKS:	2	9	45
<b>Total Gap</b>				57	576

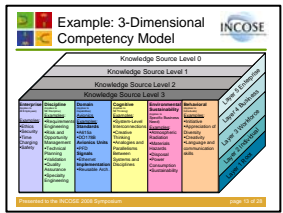
# Competency Profile – Individual Example

**Knowledge Source Levels**

<b>Mastery:</b> More than 5 years of Experience / 3 or more years of Rote Knowledge	3										
<b>Synthesis:</b> 3-5 years of Experience / 2-3 years of Rote Knowledge	2										
<b>Comprehension:</b> 1-3 years of Experience / 1-2 years of Rote Knowledge	1										
<b>Awareness:</b> Less than 1 year of Experience / Less than 1 year of Rote Knowledge	0										
		ELKS	RLKS	ELKS	RLKS	ELKS	RLKS	ELKS	RLKS	ELKS	RLKS
		Discipline Competency : SE		Discipline Competency: SE		Domain Competency: Avionics		Cognitive Competency: SE		Cognitive Competency: SE	
		Requirements Engineering		Integration Engineering		Standards		System-Level Understanding		System Synergy	

**Key**

- Organization Need
- Current Employee level
- Manager Need for employee
- Employee gaps/management need



# Summary

- Planning for a competency model begins with understanding the company vision, goals and objectives flow down
- Use core competencies identified from standards
- Competency models do not need to be expensive
- Activities needed for development and deployment of a competency model are in the paper, with steps provided to help your organization eliminate a few of the more costly pitfalls
- A sample gap identification profile illustrates the end result

# Questions?

