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## **The U.S. Department of the Navy's Systems Engineering Career Competency Model: Identification of Proficiency Levels and Career Path Modeling**

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# Overview



- Brief introduction to the Systems Engineering Career Competency Model (SECCM)
  - Project Scope, methodology and approach
- Competency Model Verification process
- SECCM Development Methodology and Structure
- Occupational Analysis Methodology
- Proficiency Level Development
- Career Development
- Summary of Results and Implications of Research

# Problem Statement



- Recent studies into career development models have led to the general finding that contemporary firms are searching for well-rounded individuals, who possess both technical and non-technical skills (Joshi et al. 2010).
- Scholarly studies examining hiring practice trends through content analysis of job advertisements and job types, have observed that stakeholders prefer to employ well-rounded employees with business knowledge, interpersonal skills and technical skills (Joshi et al. 2010).
- Research also cites the notion that while skills can be taught and learned, skilled workers continue to be in short supply (Moore and Rudd 2005)

# Introduction - Gap Analysis



- The Naval Postgraduate School (NPS) has identified systems engineering as an area requiring a career development model, to ensure employees performing systems engineering tasks, particularly within the US Department of the Navy (DON), are proficient in the competencies required for success.
- NPS', the US Office of Personnel Management's and the US Navy's research highlights the application of competency modeling for ***establishing career paths*** and for ***determining appropriate proficiency levels required to complete job related SE tasks.***

# What is a Competency?

An observable, measurable pattern of knowledge, skills and abilities (KSAs), and other characteristics, that an individual needs to perform work roles or occupational functions successfully (OPM).



# What is Competency Modeling?

The activity of determining the specific competencies that are characteristic of high performance and success in a given job (LaRocca) - a key tool for ensuring a capable staff.



# Project Scope

- In an effort to cover the scope of the overall SECCM project, it was broken down into 3 phases:

1. Development of the competency model

2. Competency assessment via an occupational analysis (reference White et al., 2016)

3. Competency Gap Analysis and Career Path Modeling

# SECCM Project Scope



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**FOCUS:**  
**Competency**  
**Gap Analysis**  
**and Career**  
**Path Modeling**  
(Steps 4 and 5)

## 2 MODEL DEVELOPMENT

- Conduct SME Panels
- Administer occupational analysis survey
- Analyze the results of survey data
- Create a technical report documenting occupational analysis

## 3 PROFICIENCY LEVEL DEVELOPMENT

- Design and administer an online questionnaire to gather current SE proficiency data for supervisors and incumbents
- Work with SME Panels to set generic proficiency level scale
- Work with SME Panels to set custom proficiency level scale

## 5 CAREER PATH MODELING

- Provide career path progression documentation

## 1 PROJECT MANAGEMENT

- Plan, coordinate and manage the delivery of products and services as defined in the memorandum of agreement
- Conduct SME panels

## 4 COMPETENCY GAP ANALYSIS

- Analyze questionnaire data
- Document methodology and results in a technical report

# Competency Model Verification – Why?



There is no systems engineering competency model verified IAW  
Uniform Guidelines on Employee Selection Procedures.

Only a **model** that is verified with the Uniform Guidelines can be  
**used with confidence for human resource functions.**

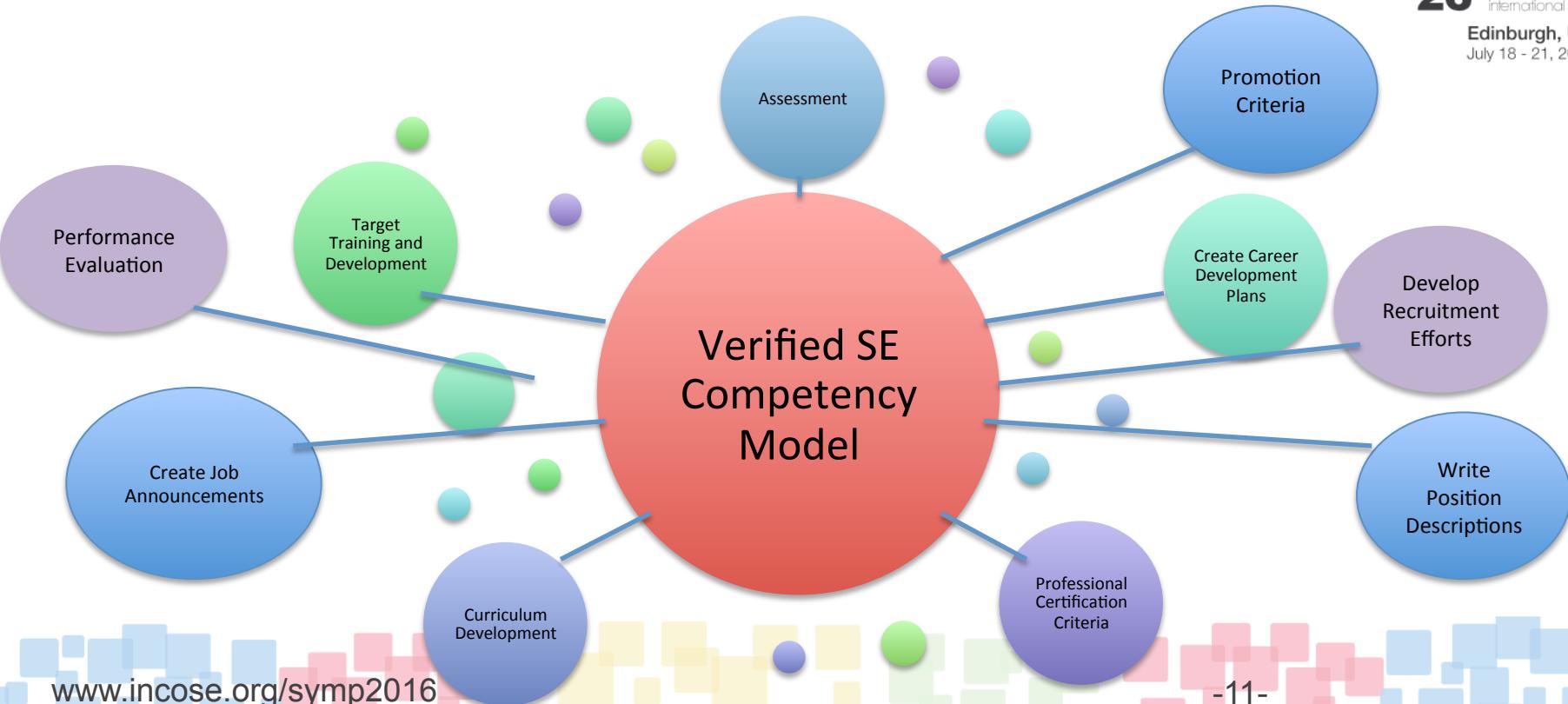


# Competency Model Verification



- The ***Uniform Guidelines*** are federal regulations designed to assist employers, labor organizations, employment agencies and licensing/certification boards in complying with requirements that prohibit discriminatory employment practices.
  - Designed to provide a framework for determining the proper use of tests and other selection procedures in employment practices
- Due to the importance of having a model verified for HR functions, NPS engaged in a model verification process with the U.S. Office of Personnel Management (OPM) in an effort to make a model that is useful for all of the US Department of Defense and related defense organizations.

# Applications of a Verified Competency Model (Following Uniform Guideline Procedures)

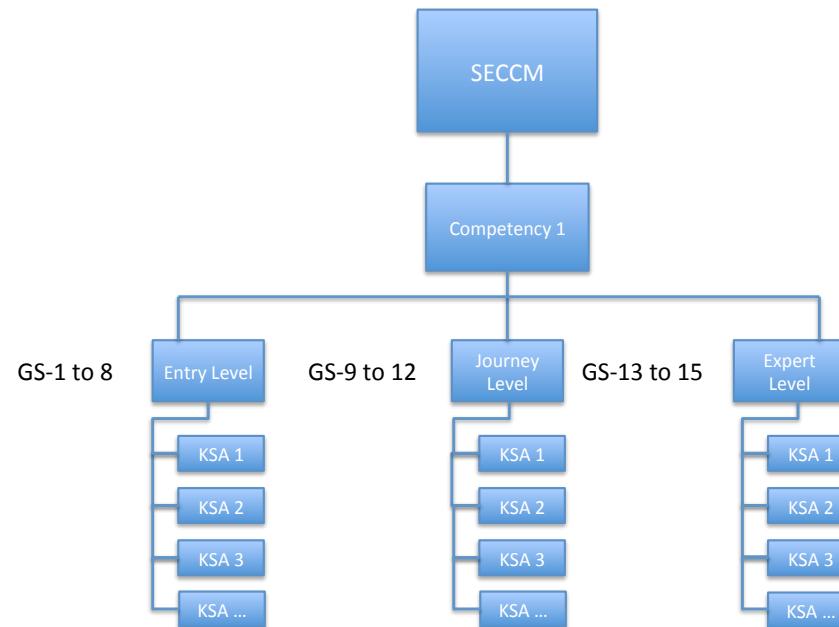


# SECCM - Structure



- The SECCM competencies are categorized across 41 technical, technical management and professional competencies.
- The KSAs in each competency are divided into one of three notional career levels, designated as *Entry Level*, *Journey Level* or *Expert Level*

## SECCM Structure



SECCM Proficiency Level Structure for Career Development

# SECCM – Bloom's Taxonomic Approach



The SECCM categorizes KSAs using Bloom's taxonomic classification schema: Cognitive and Affective learning processes



Cognitive and affective processes within Bloom's taxonomy refer to levels of observable actions that indicate learning is occurring



**If a KSA and its cognitive/affective level can be identified, it can be reasonably assumed that learning is occurring and as such, the amount and depth of learning can be assessed and measured**

(Khan 2014)

# SECCM – Using Bloom's Taxonomy



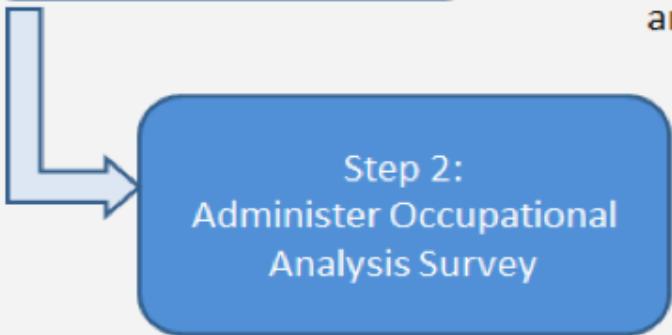
- Categorizing the KSAs using Bloom's taxonomic classification schema allowed the NPS research team to highlight the cognitive and affective learning levels needed for achievement of the competencies requisite of proficient systems engineers.
- A benefit in using Bloom's taxonomic classification schema was that the KSAs would be stated such that their achievement by systems engineers could be assessed using typical methods, already widely employed by educational organizations.
- Bloom's taxonomy also allowed the NPS team to map the competencies into proficiency levels, in an effort to create a foundation for a SE career development path within the Department of the Navy.

# Verification of SECCM (Following OPM Guidelines)

## Verification of SE Competency Model with OPM

Step 1:  
Conduct SME Panels

- Use existing information to develop competency descriptions and list of tasks
- Conduct SME panels to refine the task and competency lists



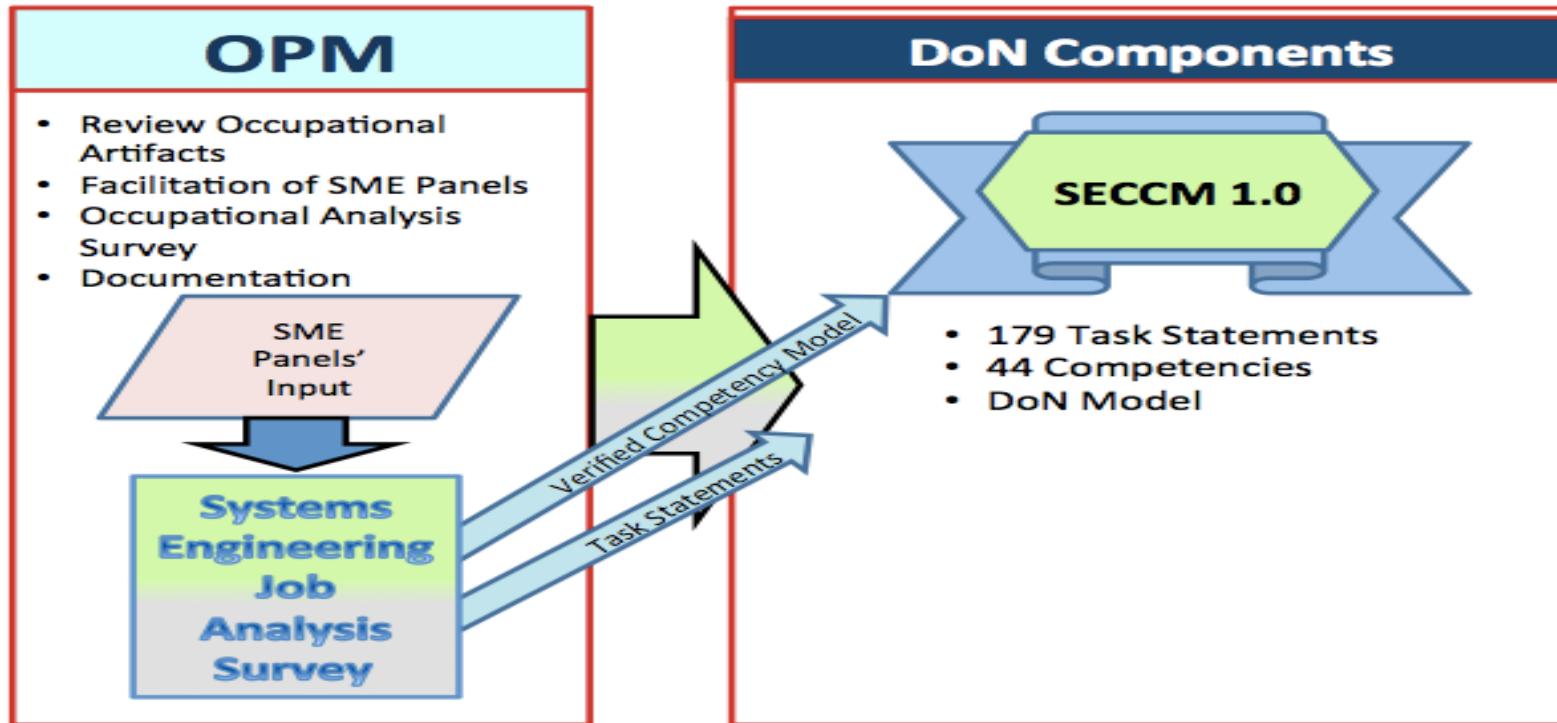
Step 2:  
Administer Occupational  
Analysis Survey

- Assess competency importance along with frequency and importance of tasks
- Analyze results to identify critical tasks and competencies

# OPM Occupational Analysis Methodology- Survey



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# US Department of the Navy's Survey Analysis: Critical Tasks



Examples

No.	Task	GS-7	GS-9	GS-11	GS-12	GS-13	GS-14	GS-15	urgh, UK - 21, 2016
		Critical							
127	Contributes to the strategic planning process by providing input on the feasibility of organizational goals.				✓	✓	✓	✓	
128	Converts organization-wide strategies and policy direction into action items.				✓	✓	✓	✓	
129	Complies with governing ethics and standards of conduct in engineering and business practices to ensure integrity across the acquisition life-cycle.	✓	✓	✓	✓	✓	✓	✓	
130	Demonstrates ethical practices by showing consistency among principles, practices, and behaviors.	✓	✓	✓	✓	✓	✓	✓	
131	Maintains the confidentiality of information.	✓	✓	✓	✓	✓	✓	✓	



Grade Level	Critical Tasks
GS-07	18
GS-09	19
GS-11	76
GS-12	165
GS-13	174
GS-14	175
GS-15	176

# Career Development – Competency Gap Analysis



- A competency gap analysis includes establishing required proficiency levels, and determining employees' current proficiency levels.
- A gap exists when an employee's current proficiency level is below the required proficiency level.
- OPM conducted competency gap analyses for the DON systems engineering professionals

# Career Development – Competency Gap Analysis



- OPM designed and administered an online questionnaire to gather current proficiency data
  - Two separate questionnaires were developed, one for supervisors and one for incumbents (employees)
  - Supervisors provided ratings of employees' required and current levels of proficiency for each competency
  - Employees provided ratings of their own proficiency
  - Respondents used generic benchmarks that have been used in competency gap analyses with other federal agencies



# OPM Occupational Analysis Survey



EXAMPLE TASKS	IMPORTANCE RATING						
	GS-7	GS-9	GS-11	GS-12	GS-13	GS-14	GS-15
1 Contacts others orally to obtain information.	① ② ③ ④ ⑤	① ② ③ ④ ⑤	① ② ③ ④ ⑤	① ② ③ ④ ⑤	① ② ③ ④ ⑤	① ② ③ ④ ⑤	① ② ③ ④ ⑤
2 Reads charts, graphs, diagrams, or tables.	① ② ③ ④ ⑤	① ② ③ ④ ⑤	① ② ③ ④ ⑤	① ② ③ ④ ⑤	① ② ③ ④ ⑤	① ② ③ ④ ⑤	① ② ③ ④ ⑤

For the first task statement, Contacts others orally to obtain information, the supervisor indicated that the task was "Important" for GS-7, GS-9, GS-11, and GS-12 employees by selecting the option corresponding to 3 and "Very important" for GS-13, GS-14, and GS-15 employees by selecting the option corresponding to 4. For the second task statement, Reads charts, graphs, diagrams, or tables, the supervisor indicated that the task was Important for GS-7, GS-9, GS-11, GS-12, and GS-13 employees, and "Very important" for GS-14 and GS-15 employees.

Please rate all of the tasks listed, beginning on the next page, using the importance scale.



Total Surveys Administered to US Department of the Navy	Incumbents		Supervisors	
	N	%	N	%
3,995	100		645	100
697	17.45		26	4.03

Usable Responses

# Career Path Modeling

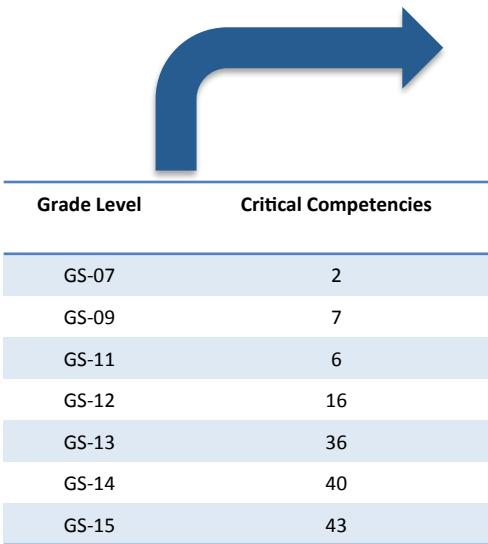


- Career paths are established to guide employees, their supervisors, and the organization as a whole for employee development purposes
  - Example: career path models serve as a resource to employees seeking to further develop their professional skills and introduce employees to opportunities they may otherwise not know exist.
- OPM facilitated eight four-hour meetings with a focus group consisting of employee and supervisor SMEs to define career paths for Navy employees
- Paths inform employees of career progression options outlining a career lattice while identifying available enrichment activities, such as developmental assignments and training that are appropriate for employees at each level of the career path

# US Department of the Navy's Survey Analysis: Critical Competencies/Results



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## Systems Engineering Competencies



# SECCM 1.0



Technical Management	Business Acumen	Analytical	Professional
<ul style="list-style-type: none"><li>• Acquisition</li><li>• Risk Management</li><li>• Requirements Management</li><li>• Configuration Management</li><li>• Technical Assessment</li><li>• Data Management</li><li>• Software Engineering Management</li><li>• Decision Analysis</li><li>• Interface Management</li><li>• Technical Planning</li></ul>	<ul style="list-style-type: none"><li>• Industry Awareness</li><li>• Organization</li><li>• Cost Estimating</li><li>• Proposal Process</li><li>• Supplier Management</li><li>• Negotiations</li><li>• Requirements Analysis</li><li>• Cost, Pricing and Rates/ Cost Management</li><li>• Financial Reporting and Metrics</li><li>• Business Strategy</li><li>• Industry Motivation, Incentives, Rewards</li></ul>	<ul style="list-style-type: none"><li>• Transition</li><li>• Integration</li><li>• Design Considerations</li><li>• Tools and Techniques</li><li>• Stakeholders Requirements Definition</li><li>• Validation</li><li>• Verification</li><li>• Mission-Level Assessment</li><li>• Architecture Design</li><li>• Implementation</li></ul>	<ul style="list-style-type: none"><li>• Communication</li><li>• Leading High Performance Teams</li><li>• Personal Effectiveness/ Peer Interaction</li><li>• Problem Solving</li><li>• Professional Ethics</li><li>• Strategic Thinking</li><li>• Coaching &amp; Mentoring</li><li>• Managing Stakeholders</li><li>• Mission and Results Focus</li><li>• Sound Judgment</li><li>• Continual Learning</li></ul>

# Developing Supplemental Resources



## SECCM User Guide



Describes how to use the information for

- Job announcements
- **Position descriptions**
- Skill gap analyses
- Career development plans
- Career path models

## SECCM 1.0 Database

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Competency Number	Competency	ID	KSA	Category	Cognitive Level	Affective Level
31.0	ROUND JUDGEMENT	SECCM0001	Accept accountability for decisions	Professional	Value	Value
32.0	PERSONAL EFFECTIVENESS/PERF	SECCM0003	Accept responsibility for outcomes (positive or negative) of one's work	Professional	Value	Value
33.0	PERSONAL EFFECTIVENESS/PERF	SECCM0007	Achieve problem resolution between differing parties including influential	Professional	Remember	Value
34.0	PERSONAL EFFECTIVENESS/PERF	SECCM0008	Achieve problem resolution between differing parties including influential	Professional	Apply	Value
35.0	PERSONAL EFFECTIVENESS/PERF	SECCM0009	Acknowledge individuals' questions and concerns	Professional	Remember	Value
36.0	PERSONAL EFFECTIVENESS/PERF	SECCM0007	Acknowledge individuals' questions and concerns	Professional	Apply	Value
37.0	PROBLEM SOLVING	SECCM0009	Acknowledge what is unknown and seek greater understanding from application	Professional	Remember	Value
38.0	PROBLEM SOLVING/PERFORMANCE TEAM	SECCM0010	Act as an arbitrator in marginal cases	Professional	Remember	Characterize
39.0	COMMUNICATION	SECCM0011	Act as an authority on lifecycle definitions and the implication of the	Professional	Remember	Characterize
40.0	COMMUNICATION	SECCM0012	Act as an authority on lifecycle definitions and the development of optimization strategies	Analytical	Remember	Characterize
7.0	VERIFICATION	SECCM0013	Act as an authority on the development of optimization strategies	Analytical	Remember	Characterize
8.0	LEADING HIGH PERFORMANCE TEAM	SECCM0014	Act as an authority on lifecycle definitions and the implication of the	Professional	Remember	Characterize
25.0	LEADING HIGH PERFORMANCE TEAM	SECCM0015	Act as an instigator by identifying and eliminating causes of	Professional	Remember	Characterize
26.0	LEADING HIGH PERFORMANCE TEAM	SECCM0016	Act concisely in a manner that conveys organizational, social, and	Professional	Remember	Characterize
27.0	PROFESSIONAL ETHICS	SECCM0017	Adapt communication methods and style based on the players involved	Professional	Apply	Characterize
28.0	COMMUNICATION	SECCM0017	Adapt communication methods and style based on the players involved	Professional	Apply	Characterize
1.0	MISSION-LEVEL ASSESSMENT	SECCM0018	Adapt spatial and temporal boundaries as new information is discovered	Analytical	Remember	Characterize
22.0	PERSONAL EFFECTIVENESS/PERF	SECCM0021	Address team conflicts in a timely fashion	Professional	Remember	Characterize
30.0	PERSONAL EFFECTIVENESS/PERF	SECCM0022	Address team conflicts in a timely fashion	Professional	Remember	Characterize
31.0	PROFESSIONAL ETHICS	SECCM0023	Adhere to ethical requirements/tenacity, including unrelated items as	Professional	Remember	Characterize
32.0	PROFESSIONAL ETHICS	SECCM0024	Adhere to ethical requirements/tenacity, including unrelated items as	Professional	Remember	Characterize
33.0	PERSONAL EFFECTIVENESS/PERF	SECCM0025	Adhere to the team's expectations and guidelines	Professional	Remember	Organize
34.0	PERSONAL EFFECTIVENESS/PERF	SECCM0026	Adhere to the team's expectations and guidelines	Professional	Remember	Organize
35.0	PERSONAL EFFECTIVENESS/PERF	SECCM0027	Adapt better to the environment when observed differences in others	Professional	Remember	Characterize
26.0	COMMUNICATION	SECCM0027	Adapt messages to the audience	Professional	Remember	Characterize
4.0	PERSONAL EFFECTIVENESS/PERF	SECCM0028	Adapt messages to the audience	Professional	Remember	Characterize
30.0	PERSONAL EFFECTIVENESS/PERF	SECCM0029	Admit mistakes	Professional	Remember	Value
28.0	COACHING AND MENTORING	SECCM0030	Advise clients and senior program managers on concurrency	Professional	Remember	Value
27.0	COACHING AND MENTORING	SECCM0031	Advise clients and senior program managers on concurrency	Professional	Remember	Value
9.0	TRANSITION	SECCM0032	Advise the system element to the next level in the physical architecture	Analytical	Remember	Value
17.0	RISK MANAGEMENT	SECCM0033	Advise customers and senior program managers on concurrency	Technique Management	Characterize	Characterize
4.0	ARCHITECTURE DESIGN	SECCM0038	Advise on complex issues and resolve conflicting design requirements	Analytical	Characterize	Characterize
4.0	ARCHITECTURE DESIGN	SECCM0039	Advise on complex issues and resolve conflicting design requirements	Technique Management	Characterize	Characterize
17.0	RISK MANAGEMENT	SECCM0040	Advise on potential areas causing risks of engineering change	Technique Management	Characterize	Characterize
14.0	LEADING HIGH PERFORMANCE TEAM	SECCM0041	Advise on the allocation of technical managers	Professional	Remember	Characterize
28.0	LEADING HIGH PERFORMANCE TEAM	SECCM0042	Advise on the allocation of technical managers as a system	Professional	Remember	Characterize
29.0	LEADING HIGH PERFORMANCE TEAM	SECCM0043	Advise on the organization of specialized functions	Professional	Remember	Characterize
11.0	ARCHITECTURE DESIGN	SECCM0044	Advise on the suitability and limitations of models and simulations	Analytical	Characterize	Characterize
4.0	ARCHITECTURE DESIGN	SECCM0045	Advise on the suitability and limitations of models and simulations	Technique Management	Characterize	Characterize
12.0	DESIGN ANALYSIS	SECCM0046	Advise on the techniques for selection of preferred solutions	Technique Management	Characterize	Characterize
36.0	LEADING HIGH PERFORMANCE TEAM	SECCM0047	Advise on the techniques for selection of preferred solutions	Professional	Characterize	Characterize

Provides access to the following

- 44 competencies & 3,272 KSAs
- Overview of critical tasks
- Overview of critical competencies
- Critical tasks & critical competencies per GS-Level

# Example: SECCM 1.0 Impact on Position Descriptions



Existing SE Position Descriptions could only **“Desire”** SE Competencies, Tasks, and KSA

*It is **“highly desired”** that the employee have the ability to...*



- SECCM 1.0 can now be used as a resource to
  - **“Require”** SE Critical Competencies and Tasks for a position
  - Identify Critical Competencies and Tasks by GS level

*The employee **“shall”** have the ability to...*

# Questions?

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