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Update on the Department of the Navy Systems Engineering Career Competency Model Acquisition Activities

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Panel 3. Systems Engineering: New Thinking for a New Age

Wednesday, May 4, 2016	
11:15 a.m. – 12:45 p.m.	**Chair: John D. Burrow,** Deputy Assistant Secretary of the Navy for Research, Development, Test, & Evaluation (DASN RDT&E) ***Rethinking the Systems Engineering Process in Light of Design Thinking*** Ronald Giachetti, Chair and Professor, NPS Clifford Whitcomb, Professor, NPS ***Content Analysis in Systems Engineering Acquisition Activities*** Karen Holness, Assistant Professor, NPS ***Update on the Department of the Navy Systems Engineering Career Competency Model*** Clifford Whitcomb, Systems Engineering Professor, NPS Corina White, Systems Engineering Research Associate, NPS Rabia Khan, Research Associate, NPS Dana Grambow, Research Psychologist, OPM Jessica Delgado, Technical Workforce Strategy Lead, DASN (RDT&E) José Vélez, Technical Workforce Lead, DASN (RDT&E)

Update on the Department of the Navy Systems Engineering Career Competency Model

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Corina L. White—has expanded her professional work experience from 2007 to 2015 as a U.S. Navy civilian in several unique disciplines, including research and development, aerospace engineering, and materials engineering. She has had the opportunity to work with the National Aeronautics and Space Administration (NASA), Naval Air Systems Command (NAVAIR), and currently the Naval Postgraduate School (NPS). Her educational experience includes a bachelor's degree in chemical engineering from Prairie View A&M University and a master's degree in systems engineering from NPS.

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Abstract

The Department of Defense (DoD) acquisition workforce is growing rapidly, and the need to align tasks to job positions and competencies with individuals to ensure positions are filled with the "best fitting" candidate is extremely important. DASN RDT&E has funded NPS on a multi-year project to lead a multi-agency working group in the development of a Systems Engineering Career Competency Model (SECCM). The current phase of the SECCM development project is heavily focused on the verification of the model. OPM joined the SECCM working group to assist in the refinement, confirmation, and strategic planning required to ensure the systems engineering competency model is a legally defensible,

relevant, and sound tool. The analysis of the ongoing verification effort and an overview of how NPS and OPM plan to assist with DoN implementation of the SECCM will be discussed. Research results from the SECCM verification process can be used for key human resources functions, such as hiring, promoting, administering skill(s) gap assessments, and in career path modeling/development plans.

Introduction

The Department of Defense (DoD) has established a competency-based approach to strategic workforce management. This approach includes assessing the critical skills and competencies needed now and in the future within the civilian workforce, along with strategies to bridge competency and skill gaps. A competency-based approach supports strategic workforce planning and effective talent management. The specifications of 5 C.F.R. 300A, *Employment Practices*, a federal regulations guide, require (1) a job analysis for selection and competitive promotions in Federal employment, (2) compliance with the job-relatedness requirements of the *Uniform Guidelines on Employee Selection Procedures* (43FR38290), and (3) that resulting assessments target competencies required for the occupational position. The Uniform Guidelines are a set of principles designed to assist employers, labor organizations, employment agencies, and licensing/certification boards in complying with requirements prohibiting discriminatory employment practices. As such, the Uniform Guidelines are "designed to provide a framework for determining the proper use of tests and other selection procedures [in employment practices]" (Biddle Consulting Group, 2015).

A DoD working group (WG), led by the Naval Postgraduate School (NPS), has been studying and refining the definition of what competencies acquisition workforce engineers must have in terms of systems engineering. Since there is currently no occupational series for systems engineering in the U.S. government, the need to align tasks to job positions and competencies with individuals to ensure systems engineering positions are filled with the "best fitting" candidate is extremely important (Whitcomb, White, & Khan, 2014). With these thoughts in mind, Deputy Assistant Secretary of the Navy (DASN) for Research, Development, Test, and Evaluation (RDT&E) funded NPS on a multi-year project to lead a multi-agency working group in the development of the Systems Engineering Career Competency Model (SECCM).

Over the past few years, the SECCM WG has operated with members—including the U.S. Office of Personnel Management (OPM), Navy, Army, Air Force, Marine Corps, and the Missile Defense Agency—to develop and verify the competencies used by defense systems engineers. OPM joined the SECCM working group to assist in the refinement, confirmation, verification, and strategic planning required to ensure the systems engineering competency model is a legally defensible, relevant, and sound tool. Within the U.S. government, only a model that is verified in accordance with the Uniform Guidelines can be used with confidence for all human resource (HR) functions, especially for high stakes functions such as hiring, selection, writing position descriptions, and creating job announcements. Verification of the competencies within the SECCM is critical to allow it to be used as a basis for "high stakes" HR functions for all of the U.S. Department of Defense.

The SECCM WG identified a collection of knowledge, skills, and abilities (KSAs) that define the basis for developing effective systems engineers that evolved over time based on availability of related systems engineering competency data. One of the latest pieces of information arrived in 2016 when the Office of the Secretary of Defense (OSD) released their updated and refreshed competency model for the engineering (ENG) career field for systems acquisition. Their competency model includes systems engineer career

professionals (previously under the Systems Planning, Research, Development, and Engineering career field) along with all other engineers under one career field: ENG. The SECCM was subsequently modified to match the new ENG model. In the current configuration management controlled state, the SECCM Baseline Rev 1 has 3,272 individual KSAs categorized within 44 competencies. The evolution of the SECCM is summarized in Figure 1.

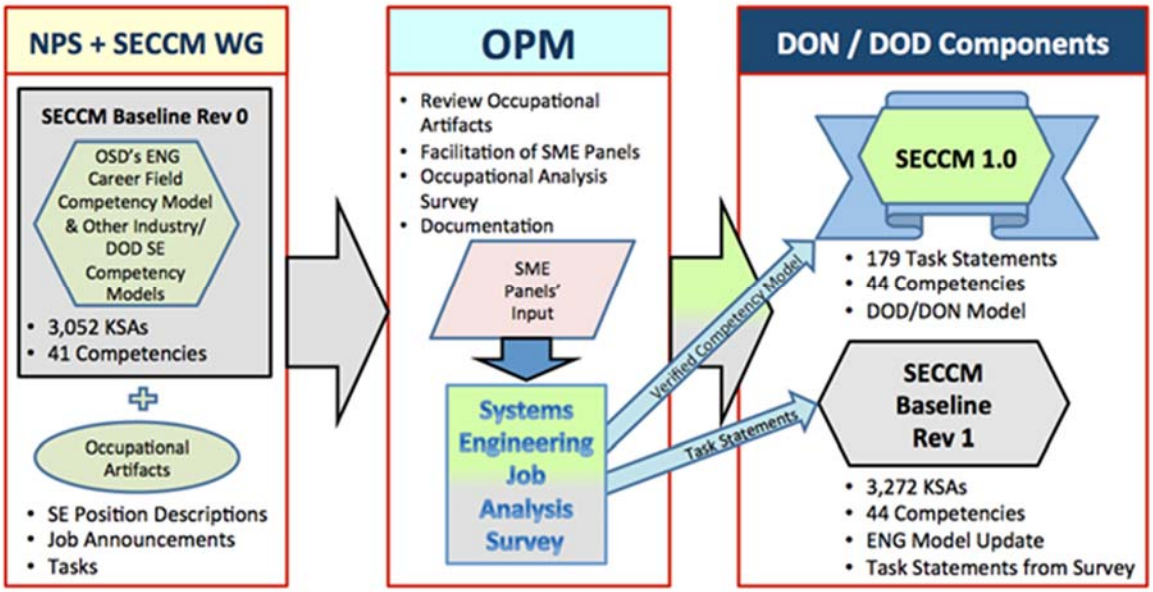

Figure 1. Evolution of the SECCM

The SECCM project focus is to concentrate on the details for career development aspects related to the model and the creation of a "road map" to aid in the implementation. The current phase of the SECCM development project is heavily focused on the OPM section for verification of the model. OPM is currently overseeing the occupational analysis aspects as a part of the verification process of the competencies identified within the SECCM.

Many organizations within the DoD have SE competency models that have been locally "verified" or "validated" for their own individual use. These uses include career development, tracking education and training requirements, and understanding the work-related activities that systems engineers have to accomplish. These SE competency models have been verified or validated locally in the sense that they have proven useful in their operational environment to define what the respective systems engineers do. However, none of these existing models is currently verified IAW the Uniform Guidelines.

Once verified, however, the SECCM can be used to guide career choice and self-selection by describing in detail what is required to be successful at a particular job/role. As a verified model, the SECCM would also assist human resource efforts to find the "right fit" for a position, as potential applicants would have an informed understanding of what KSAs are needed for a particular position prior to applying for it. Furthermore, as a verified competency model, the SECCM can also be used to assist with leadership development and career development plans. For example, appropriate training and development plans could be created based on the results of the verified competency model. Courses can be created to bridge specific competency gaps by developing specific competencies. Competency Assessment tools could also be derived to supplement academic qualifications

of applicants (Patterson et al., 2000). Competency models can also be used to evaluate employees' performance, to reward employees by using the competencies to establish promotion criteria (Morgeson, Campion, & Levashina, 2009), and to manage employee information by using the competency models to record and archive employee skills, training, and job experience information. Employees could be compensated using the model to structure pay differences between jobs and/or to evaluate employees for pay increases. Retention of critical skills and reduction-in-force activities can also be managed through identifying and measuring competencies aligned to the current and future organizational objectives (Campion et al., 2011).

OPM Occupational Analysis Survey

OPM took a four-pronged approach to the job, or occupational, analysis: review of occupational information, facilitation of SME panels, administration of surveys, and documentation. The occupational analysis methodology focuses on identifying the competencies and tasks that are critical for employees functioning as systems engineers. This method of analysis establishes which competencies are suitable for assessment in human resources activities.

OPM began the occupational analysis with a review of the competencies along with additional occupational information provided by NPS and other DoD components, including MDA. The occupational information served to further define the competencies. Adding descriptions to the competencies served to ensure each competency included in the model is clear and unique. OPM also conducted an initial review of the KSAs to refine the list. OPM personnel research psychologists facilitated SME panels, removing and revising KSAs that were not behaviorally based or measurable to ensure the resulting task statements had the characteristics necessary to support a variety of HR activities based on the SME input.

The occupational information helped OPM identify a set of SE competencies and draft task statements that subject matter experts (SMEs) would evaluate during the review panels. Panels were held first with incumbents who currently perform systems engineering activities and then with individuals who supervise those who perform systems engineering activities. NPS recruited SMEs to participate in the panels, requiring them to meet experience criteria to ensure each participant had a minimum level of familiarity with systems engineering activities. SMEs provided input to further revise competency definitions and task statements, to identify competencies and tasks critical to systems engineering, which were not represented in the existing models researched, and to eliminate tasks not representative of the job. The revised competencies and tasks served as the foundation for an occupational analysis survey.

In preparation for the SECCM survey deployment, the SE population was needed to assist in the identification of those SEs to include in the survey pool. Identifying the population of systems engineers was a challenge for the DoN as well as the other defense organizations, as there is currently no professional engineering occupational code or position description for SEs within the DoD. The SE population was identified based on input from all participating organizations. There was no single best way to identify a systems engineer, so each component was required to identify their own population based on identifying those engineers who performed tasks related to SE.

The occupational survey was launched in September 2015. It was administered to a personnel sample representing the great majority of the SE population. Oversampling was done to ensure a robust sample for the results could be used to represent the population of SEs. Two separate questionnaires were developed, one for supervisors and one for employees. OPM invited employees who perform systems engineering activities and their

supervisors to participate in the survey, only retaining data from employees with established minimum experience levels to ensure adequate familiarity with systems engineering work. Additionally, survey branching methodology was used, which required participants to respond to questions designed to distinguish participants who function as a systems engineer from those who serve in other engineering disciplines.

The survey was sent to 6,011 employees and 1,519 supervisors across the DoD. Survey participants were asked to evaluate each competency and task on criteria such as frequency, importance, required immediately upon entry into the position, and need for training. Figures 2 and 3 show a 21% response rate for the employee survey and 6% for the supervisor survey. The survey response rates increased with time due to the concerted effort the WG provided to ensure the survey respondents had support from senior leadership.

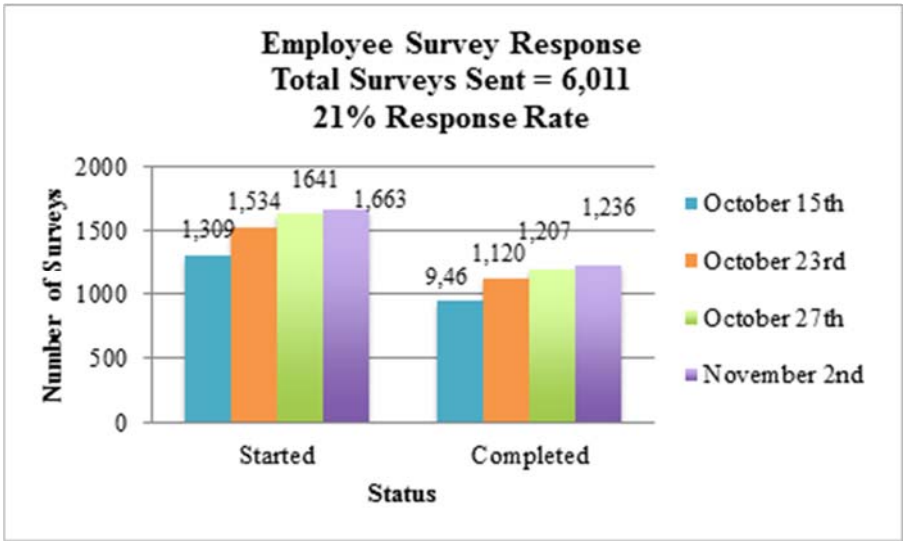

Figure 2. Employee Survey Response Rate Progression

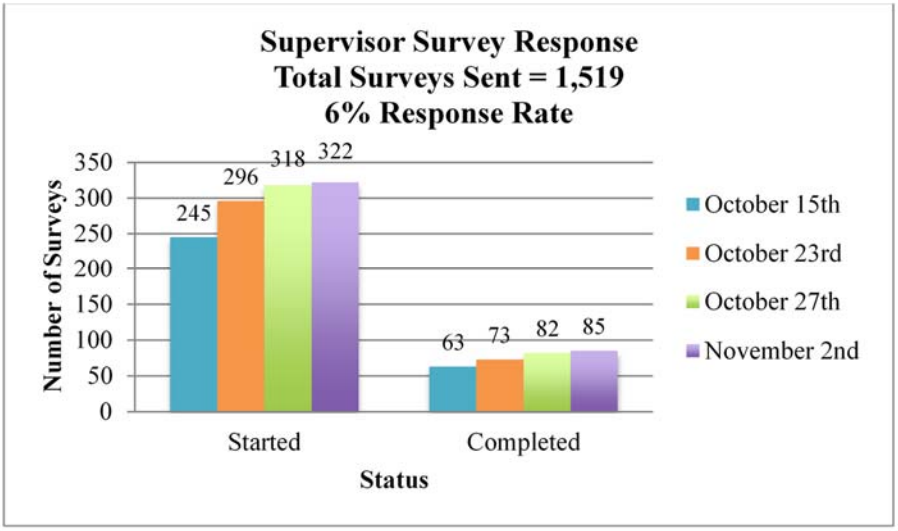

Figure 3. Supervisor Survey Response Rate Progression

In the occupational analysis survey, incumbents indicated how frequently they perform the tasks. For the competencies, the incumbents rated importance and degree to which training in the competency would help them perform their jobs more effectively. The supervisors rated the importance of the tasks, and for each competency, they rated importance and degree to which the competency is required at entry to the job. Supervisors provided separate ratings of the tasks and competencies based on the requirements for incumbents at each grade level (GS-07 to GS-15; OPM, 2016). The survey was estimated to take about 2.5 hours. Initial feedback from supervisors suggested that their survey took considerably longer, which could explain the lower response rate.

Department of the Navy Survey Analysis

OPM started the statistical analyses for the Navy and Marine Corps survey data on January 2016. To identify the critical tasks, the research psychologists analyzed task ratings of importance and the percent of respondents who indicated the task is performed by SEs. Competencies critical for performing systems engineering activities were identified by analyzing competency ratings of importance. The resulting critical tasks and competencies create the occupational profile for individuals performing systems engineering work. In conformance with legal and professional guidelines, OPM documented the methodology and results for all phases of the occupational analysis. The documentation is a necessary component for demonstrating the process is sufficient to serve as a component of a content validation approach for ensuring the validity of future human resources activities.

OPM used the results of the survey to identify the critical tasks and competencies for successful performance as a systems engineer at the GS-07 to GS-15 grade levels. The survey was administered to 3995 incumbents and 645 supervisors from the Navy and Marine Corps. The analysis resulted in identifying a number of critical tasks and competencies for systems engineers from GS-07 to GS-15, as shown in Table 1.

Table 1. Summary of Critical Tasks and Competencies by Grade Level
(OPM, 2016)

Grade Level	Critical Tasks	Critical Competencies
GS-07	18	2
GS-09	19	7
GS-11	76	6
GS-12	165	16
GS-13	174	36
GS-14	175	40
GS-15	176	43

Of note in Table 1 is the lower number of tasks and competencies determined to be critical for grade levels GS-07 to GS-11. Based on conversations occurring throughout the SME panels, it is possible many engineers do not enter into the systems engineering profession until later in their career because they begin in a specific engineering discipline and then transfer to systems engineering at higher grade levels. Therefore, the competency model developed for systems engineers focused more heavily on technical competencies specific to the systems engineering profession (OPM, 2016).

In addition, OPM psychologists analyzed the competency proficiency data to identify competency gaps, computed as the percentage of incumbents who rated themselves below the required proficiency level identified by supervisors. The skills assessment analysis revealed widespread skill gaps across the systems engineer workforce. Navy can use the

competencies identified in the current occupational analysis as the basis for future initiatives in any of these areas. In addition, Navy can use the skill gaps identified across the systems engineer workforce to identify and target training and development for systems engineers (OPM, 2016).

Considerations for creation, formatting, promulgation, and use are important, since there are considerations for which competencies/KSAs/tasks can be used for high stakes human resource functions, as well as other workforce career planning, development, and shaping purposes. OPM's analyses of the survey results identify critical competencies and critical tasks. The Navy plans to promulgate the verified SECCM (Version 1.0) to all the Naval components, Systems Commands, and Warfare Centers for their use in writing position descriptions and job announcements, drafting assessment questionnaires for hiring actions, and using for gap analysis, employee analysis, and other human resource functions.

The next phase of survey results analysis includes the USA, USAF, and MDA, due from OPM by the end of FY 2016. Once all the survey results are known, the SECCM WG can review the results with OSD to inform and offer its results for possible use by the entire defense community.

Summary

The SECCM development was led by NPS as funded by DASN RDT&E. From its inception to FY 2016, the project has shifted to concentrate on the details for career development aspects related to the model. The current phase of the project is focused heavily on the verification of the model, which is significant because without a verified competency model, job announcements, position descriptions, and so forth cannot currently require SE competencies, knowledge, skills, and abilities. Unless a local occupational, or job, analysis has been completed, they can only desire them.

The results of the survey analysis is a verified SECCM. Furthermore, the proficiency level criteria for each individual competency at each proficiency level is documented in the model. Organizations that employ systems engineers will be able to use the verified SECCM to support their high stakes HR functions (i.e., job announcements, position descriptions, etc.). Additionally they will be able to develop: workforce vectors; component, command, center, and program workforce risk analyses; workforce mission/business case analysis; targeted training investment; and targeted enrollment communication and skill gap analyses.

The SECCM is also informing graduate academic programs to specify student outcomes and learning objectives within systems engineering programs that will ensure the students have the entry-level KSAs required to perform successfully in their job. The implications of this research can also be used to develop structured curriculum content, assessment, and continuous process improvement techniques related to the development of SE learning, and to develop more valid and reliable instruments for assessing what systems engineers need to learn, need to know, and need to do (Khan, 2014).

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