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ARMY CONTRACTING TRAINING AND TASK EXECUTION ANALYSIS

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NAVAL POSTGRADUATE SCHOOL

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ARMY CONTRACTING TRAINING AND TASK EXECUTION ANALYSIS

by

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December 2019

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13. ABSTRACT (maximum 200 words)

Since 1992, the General Accountability Office placed the DoD contract management on the high-risk list due to the workforce's lack of training, experience, and education. Their report found that budget constraints in the mid-1990s forced the DoD to reduce the acquisition workforce. The DoD began rebuilding its acquisition workforce in 2009. The Army founded the Army Contract Command (ACC) in 2008 to address issues in the contracting workforce. The ACC developed the 51C Proficiency Guide Assessment in 2010 and replaced the training guidance in 2019 with the 51C Job Aid.

The purpose of this research was to identify the training requirements in each contracting environment including home-station, short-duration deployments, and long-duration deployments. This study used 22 of the 29 contract training tasks from the Job Aid and contracting data from the ACC Business Analyst Division to analyze the differences in tasks experienced between contracting environments. We captured the differences in each environment by accounting for the frequency of tasks performed in the environment.

We concluded that the tasks performed in each contracting environment with varying frequency. The tasks contracting personnel executed in home-station were significantly different than the tasks they performed in deployment. Our study suggests that Army contracting should consider developing separate training plans that address tasks required to perform in each contracting environment.

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ARMY CONTRACTING TRAINING AND TASK EXECUTION ANALYSIS

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ABSTRACT

Since 1992, the General Accountability Office placed the DoD contract management on the high-risk list due to the workforce's lack of training, experience, and education. Their report found that budget constraints in the mid-1990s forced the DoD to reduce the acquisition workforce. The DoD began rebuilding its acquisition workforce in 2009. The Army founded the Army Contract Command (ACC) in 2008 to address issues in the contracting workforce. The ACC developed the 51C Proficiency Guide Assessment in 2010 and replaced the training guidance in 2019 with the 51C Job Aid.

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LIST OF ACRONYMS AND ABBREVIATIONS

ACC	Army Contracting Command
BAD	Business Analyst Division
CMBOK	Contract Management Body of Knowledge
DA	Department of the Army
DAU	Defense Acquisition University
DAWIA	Defense Acquisition Workforce Improvement Act
GAO	General Accountability Office
HQ	Headquarters
METL	Mission-Essential Task Lists
MOS	Military Occupational Skill
NCMA	National Contract Management Agency
PGA	Proficiency Guide Assessment
TDA	Tables of Distribution Allowance
TOE	Tables of Organization Equipment

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EXECUTIVE SUMMARY

A. PROJECT SUMMARY

The study used the Army Contract Command (ACC) 51C Job Aid to assess the training gaps among the contracting environments: home-station, long duration, and short duration. The study used the Job Aid to quantify the contracting tasks performed in each environment. The training strategy from the Job Aid states that newly assessed contracting soldiers should have 12 months of home-station experience to gain proficiency before deployments. This research sought to determine if there were training differences among the three different contracting environments.

This study initially proposed to evaluate the training gaps among each environment; however, the team could not measure gaps directly. The study acquired data from the ACC Business Analyst Division (BAD), which provided contracting records from the three environments during the timeframe spanning 2008–2018. The study used task occurrence and the frequency of those tasks to determine the difference in each contracting environment. The tasks that were more likely to occur in a deployed environment than a home-station environment indicated potential training gaps, as a result, the study updated its research questions: are the environments different for the contracting officer, how different are the environments, and how important is the difference in the environments? The study was able to answer all three questions with varying degrees of certainty.

B. BACKGROUND

The ACC published its initial training guidance in the 2010 51C Proficiency Guide Assessment (PGA). The guide included 29 training tasks, mentorship guidance, and a follow-on online assessment to gauge proficiency in the ACC 51C workforce. In 2019, the ACC retired the PGA and updated its training program to publish the 51C Job Aid that encompassed required training tasks as well as guidance on mentorship and assessment. Both the 51C PGA and Job Aid required senior civilian and military personnel to train and assess 51C proficiency. As noted from a 2007 Department of the Army (DA) report, only 53% of civilians and 56% of military contracting personnel met certification requirements

for their current contracting positions. The DA highlighted that the Army Acquisition community did not have enough trained and experienced personnel to lead and mentor the workforce. In a 2012 study, Abbruzzese concluded there is a lack of properly skilled civilian workforce to mentor and train newly assessed contracting soldiers. The ACC also had to ensure personnel had the skillsets for their positions. Each contracting position is different and requires a unique set of skills. A study conducted by McMillon (2000) found that home-station contracting tasks do not prepare contracting officers for the tasks they perform in the deployed environment.

C. FINDINGS AND CONCLUSION

The first question the study attempted to answer was, "Are the environments different with respect to tasks performed?" The study developed two hypotheses. The null hypothesis was that all three environments are equal. The alternative hypothesis was that none of the environments were equal when the study compared the environments against each other. To test the hypotheses, the study used the Pearson's Chi-squared test. The study found that the environments were different. The data shows that the likelihood of performing any specific task varied by environment. Likelihood percentages varied as much as 25% for a specific task. The study was able to reject the null hypothesis with a high level of statistical confidence.

The second question the study attempted to answer was, how different are the three environments? The study used the likelihood comparison test to evaluate the likelihood between tasks. Most tasks more likely to occur in short-duration and long-duration environments than home-station. The study was able to examine 22 tasks of the total 29 tasks listed in the Job Aid. Of the 22 tasks from the Job Aid, 19 tasks are more likely to occur in a long-duration environment versus home-station. Of the 22 tasks, 15 tasks were more likely to occur in a short-duration environment versus home-station.

The final question the study answered was, how important are the differences? The study used dollars as a proxy for criticality or the importance. The study ranked the 22 tasks from most critical to least critical. Generally, the capstone assumed the more expensive tasks were more critical.

D. RECOMMENDATION FOR FUTURE RESEARCH

The results from this study will aid contracting commanders in developing a training plan to address weak areas based on the findings of this report.

The capstone study recommended considered criticality in addition to the frequency it is performing. A future study could explore additional metrics to measure criticality as well as the difficulty of performing the tasks. Future capstone studies could explore the amount of repetitions a soldier would need to complete to master a task. A final suggestion is to conduct the analysis of alternatives to determine the best incentives to grow and retain contracting officer subject matter experts.

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I. INTRODUCTION

A. PROBLEM STATEMENT

Prior research identified concerns in whether the contracting battalion's annual training plans accurately address contracting requirements in the three main environment environments: home-station, short-duration deployment, and long-duration deployment (McMillion 2000; Campbell 1993). In 2010, the Army Contracting Command (ACC) Headquarters (HQ) developed the 51C Proficiency Guide Assessment (PGA), a training aid, to guide ACC subordinate units' training requirements. ACC HQ published the 51C PGA to provide standardization for training and assessment across the ACC (Army Contracting Command [ACC] 2010). In 2019, ACC HQ published the 51C Job Aid to replace the 51C Proficiency Guide to coincide with the release with the ACC's new proficiency process model (ACC 2019). The proficiency process model requires senior contracting leaders to train and mentor junior contracting soldiers. Both the PGA and the Job Aid made a fundamental assumption that a soldier would get the contracting experience needed in the first year of her home-station assignment to accomplish her missions in the other environments (ACC 2010; ACC 2019).

If the profiles are different in the three different theaters, it is not clear how well the ACC training guidance addressed the different tasks profiles. As a result, training plans may not have included realistic contingency training. For example, when a contracting officer conducts market research in the U.S. they have accessibility to a wide range of tools to provide a synopsis on the cost of a product versus conducting market research in deployment. There may be little to no information about the local market due to the lack of database systems. Therefore, contracting professionals may not have been prepared for deployments to long-duration deployment and short-duration deployment environments. This capstone study offers an analysis of the root causes of proficiency issues that may exist within the ACC. Commanders may need to tailor training plans for each environment. This approach may allow an ACC commander to more efficiently and effectively use training time.

B. REQUIREMENTS

This capstone study will provide Contracting Commanders with a qualitative and quantitative assessment of the current Job Aid. The Job Aid is a comprehensive training tool that identified the 29 essential tasks ACC determined a contracting officer will train to accomplish worldwide contracting operations. The study is an opportunity to provide an objective comparison between each environment that would provide commanders with a quantitative historical analysis of contracting actions. We used data from 546,364 records across 70 DODAACs to identify current and future training trends. Analysis of individual DOCAACs showed where units have historically over and undertrained critical job aid tasks. It also compared these actions to the dollar amounts as a metric to classify their criticality and importance. This capstone study's objectives were to answer the following questions for commanders:

C. RESEARCH QUESTIONS

(1) Are the operating environments (home-station, long-duration deployment, short-duration deployment) different?

The Job Aid assumption has been that work in home-station prepares soldiers for work overseas, implying that tasks occur at near equal frequencies in all three environments. Equal performance in all three environments would serve as the study's Null Hypothesis (Ho). Proof of unequal task frequency would support the Alternative Hypothesis (Ha) and reject the Ho. Rejecting the Ho would validate that the task frequency in each environment is not the same.

(2) If the tasks performed are different in each environment, then what were the task frequency differences?

Each environment had a different number of contract actions performed. To compare them, the capstone group needed a way to address the difference in volumes. The ratio of every time a contracting officer performed the task in an environment compared to the total number of contract actions in that environment enabled comparisons between the environments. The task ratios described how likely a contracting worker performed a task

given a contract action. Inter-environment differences in task ratios indicated a potential for under or over-training.

(3) How much does the difference matter?

The capstone group used dollars as a proxy for importance. When a task occurred, and the data reflected an obligation, the capstone study assigned the absolute value of the obligation to that task. The capstone study investigated obligations in excess when the expected value was different than we expected based on the frequency of the task. We explored infrequent tasks that obligated a large percentage of dollars as areas of risk. The capstone study's has rationalized that infrequently performed tasks are unlikely to be well-trained. Infrequent tasks cost large amounts of money that lead to salient risk.

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II. BACKGROUND

Two studies, The Department of Defense study in 1985 and the Packard Commission study in 1986, both indicated that the DoD Acquisition workforce was untrained and inexperienced in their acquisition responsibilities (Thomas 1986). These two studies led to Congressional establishment of the Defense Acquisition Workforce Improvement Act (DAWIA) in the fiscal year 1991 National Defense Authorization Act (H.R.4739). Although Congress implemented the law in 1991, the untrained and inexperienced issues continued to persist in the Army Acquisition Corps. According to a 2007 Department of the Army reform report, only 53% of civilians and 56% of military contracting personnel met certification requirements for their current contracting positions (DA 2007). Although the studies identified training issues since 1985, these issues continued to persist for the last 20 years.

Formed in 2008, the ACC develops, field, and sustain major weapon systems and services that provide soldiers with capabilities to accomplish the nation's military mission (USAASC 2019). The ACC published the PGA as the training guidance for contracting soldiers. The 51C PGA contained a contracting task guidebook and a series of computer-based tests that assessed proficiency. The guide contained "basic tasks that all ACC 51Cs should be proficient in, and it applies to all ACC 51Cs" (Army Contracting Command 2010, 1–1). After a year on the job, ACC expected contracting soldiers to pass all the online assessments in the 51C PGA to attain proficiency in contracting (ACC 2010).

In April 2019, ACC HQ released the 51C Job Aid that directed all subordinate ACC units to implement the Job Aid training for all personnel within the commands as listed in Appendix A. The 51C Job Aid consisted of twenty-nine tasks that military 51C contracting officers needed to perform their duties. The Job Aid assisted leaders in developing training programs for their contracting organizations. The 51C Job Aid outlined the training strategy that met the training and experience requirements outlined by Congress' DAWIA requirements. The 51C Job Aid contains tasks for 51C contracting soldiers complete to acquire their DAWIA Contracting Certification Levels I-III (Department of the Army, 2010).

A. INDIVIDUAL TRAINING AND CERTIFICATION GUIDANCE

When a soldier transitions to the Acquisition Corps, soldiers complete their training at the Defense Acquisition University (DAU) or an approved equivalency program. Soldiers transitioning in the contracting career field, 51C, develop proficiency in their contracting skills mainly through on-the-job training in their respective units. The 51C Job Aid functionally decompose tasks that all military contracting officers accomplish to acquire proficiency (Army Contracting Command 2019). Each contracting unit offers uniquely challenging yet variable opportunities to excel as contracting officers. No two contracting units are the same. Through repetition, soldiers become proficient at certain training tasks based on their unit's mission. The contracting mission and customer needs vary from unit to unit. A common misconception is that the home-station on-the-job experience is enough to prepare the soldier for short-duration and long-duration deployed contracting environments. However, the similarities between routine home-station tasks and those tasks common to short-duration deployment and long-duration deployment contracting may not be identical.

The 51C Job Aid does not address the training differences in each environment. The Directive Memorandum from ACC Commanding General, Major General Pardew, states, "Units, centers, and directorates, shall, to the maximum extent practical, provide training opportunities to meet these [Job Aid] requirements" (ACC 2019, 3). The directive assumes the Job Aid training prepares contracting professionals for their duties in all contracting environments.

Unlike its predecessor, the PGA, the Job Aid specifically "contains an MOS Training Plan that provides the information needed to plan, conduct, and evaluate unit training on collective tasks that support unit missions," and thus is supportive of directed unit Mission-Essential Task Lists (METL) (ACC 2019, 8). Like the 51C PGA, the Job Aid requires a 12-month learning and integration period, as well as on-the-job experience. A senior 51C contracting soldier, MOS 51C, or contracting civilian, job series 1102, supervises the 12-month proficiency process. The ACC 51C proficiency process includes a continuous cycle of training, assessment, and exercise as shown in Figure 1 (ACC 2019)

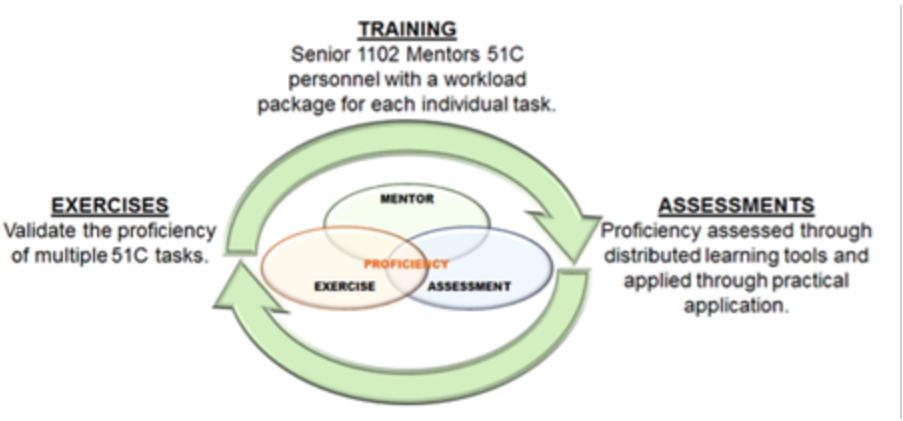

Figure 1. ACC 51C Proficiency Process. Source: ACC (2019).

Since the shift from the PGA to the more detailed Job Aid, the assessment method for task proficiency remained relatively unchanged. In the Army, military personnel transfer from their operational MOS to the acquisition corps. In the acquisition corps, military personnel either become a MOS 51A program manager or a MOS 51C contracting officer. An ACC unit consists of both civilian, nomenclature 1102, and military personnel, MOS 51C. Contracting civilian personnel specialize in contracting immediately. In contract, military Army personnel start their careers in the operational military and then transition to contracting around seven to ten years into their careers. By contrast, the Air Force does not require military contracting officers to transition later in their career. Much like the civilian contracting force, Air Force contracting officers immediately start their career specializing in contracting. As shown in Figure 1, the Army contracting training process required senior military contracting personnel and senior civilian contracting personnel to access the proficiency of the contracting workforce.

B. CONTRACT MANNING ISSUES

Due to the inherent challenges in military manning (Reed 2010) and available time for contract training (Rendon et al. 2012), one may think that contracting expertise and leadership should reside in the civilian workforce. Although civilians have more experience and may be best suited to be in ACC leadership positions, civilian contracting specialists have little to no desire to transition to the position of contracting officers

(Robinson 2012). Senior Service College student, Undra Robinson (2012), assessed civilian contracting specialist's desire to become contracting officers. Without a steady growth of replacement contracting officers, retirements can leave disparities in the experience and leadership of the contracting workforce. Through quantitative and qualitative analysis, Robinson was able to present statistics and feedback affirming that contracting specialists generally prefer not to become contracting officers. Of the 50% of respondents who were qualified to become contracting officers, one in every four preferred to decline their warrant to become contracting officers. The study found the top three reasons civilian contracting specialists declined to become a contracting officer included "thankless" work, the job required more hours at work, and the lack of trained specialists (Robinson 2012, 26). The military accounts for less than 8% of the acquisition corps workforce, while the civilian workforce accounts for 92% (USAASC 2019). Robinson provides great insight into how the Army can improve its Job Aid Proficiency model that depends on the civilian workforce to train and mentor junior contracting personnel.

Debra Abbruzzese (2012) published a report for the DAU Senior Service College Fellowship titled "Today's Crisis in Contracting." Ms. Abbruzzese wrote the report two years after ACC HQ adopted the 51C proficiency guide assessment (PGA). ACC leaders assumed soldiers would receive training on-the-job under an experienced 1102, civilian contracting personnel. She found that there are not enough 1102 contracting personnel available to complete the current workload and train the workforce. Abbruzzese explored the possibility of offloading the workload from 1102s by hiring some lesser qualified, easier to hire workers to take on some tasks. This would afford 1102s more time. She asserted that Army contracting organizations had difficulties hiring enough properly skilled civilian workers. By extension, there was a lack of qualified 1102s to mentor and train newly assessed 51C contracting soldiers. Abbruzzese concluded that the ACC needs qualified trainers to identify training gaps as well as train newly transitioned 51C contracting soldiers.

To improve efficiency and increase job satisfaction among the civilian contracting workforce (Robinson 2012), the Army should consider assigning qualified contracting personnel with the right skills (Abbruzzese 2012) in the right positions. Timothy Reed

(2010) composed a report that sought to define the composition and size requirements of a contracting organization (Reed 2010). Reed questioned if DoD contracting organizations developed models that appropriately measured the contracting workload and adequately assigned the right number of soldiers to the organization. Reed compared the different models across the DoD. He challenged the assumptions DoD services made to develop models as well as the validity of the services' methods (Reed 2010). For instance, the Army managed personnel through Tables of Organization Equipment (TOE) and Tables of Distribution Allowance (TDA). This only allowed management of the force by slated personnel instead of contracting skill level. There was a disconnect between force structure numbers and the contracting skill level of the personnel filling those slots. Reed stated (2010) due to this disparity, acquisition leaders made force structure decisions on a macro-level as opposed to subordinate organizational level needs. He concluded that the contracting community must consider both the workload and competency level of soldiers in its methods for determining unit size and composition (Reed 2010). Reed suggested to evaluate the actual skill level of an individual contracting soldier and place him or her in the appropriate slot.

C. COMPETENCY AND PROFICIENCY ISSUES

Contract Management is not just a problem in the Army; it is a problem that exists across the DoD. Dr. Rene Rendon and U.S. Navy LCDR Timothy Winn highlighted issues with DoD contract management processes (2017). The authors emphasized that contracting professionals need to have the requisite skills to meet the modern challenges that will impact the current acquisition workforce. The authors reviewed and compared four competency models to include the DoD contracting competency framework, the National Contract Management Agency's (NCMA) Contract Management Body of Knowledge (CMBOK) model, the Federal Acquisition Institute (FAI) Competency framework, and the National Institute for Government Purchasing (NIGP) Competency framework. The authors compared all four competency models and looked for differences between the models. The DoD, FAI, and NIGP models focused on the contracting process, tasks, and activities from the buyer's perspective. There are minimal hierarchical relationships that align each competency with the process, job task, and sub-tasks contracting personnel

would perform. Federal and DoD uses the DoD and FAI competency model, while state and local government uses the NIGP. The NCMA CMBOK has an extensive hierarchical relationship between primary competencies, job tasks, and job sub-tasks. Unlike the DoD, FAI, and NIGP, the NCMA CMBOK includes concise and detailed contracting competencies both from the buyer and seller perspective. The NCMA CMBOK model is one that commercial industries used to determine the efficiency of its workforce. The authors suggested the DoD make improvements to the contracting competency model by addressing deficiencies through employing aspects from the CMBOK competency model (Rendon and Winn 2017). The CMBOK model provides detail for each contracting task as opposed to the DoD competency model that provides a nominal relationship between tasks. Much like the DoD Contracting Competency model, the 51C Proficiency Process model views contracting only from the government's or buyer's perspective. There are benefits for Army contracting personnel to understand contracting from both the government's perspective as the buyer and the private sector as the seller.

As Rendon and Winn (2017) affirmed, the new contracting competency model may increase proficiency among the contracting workforce but may require new training models to align to competency models. In follow-on work, Rendon addressed concerns about contracting professional education and competency. This work highlighted training concerns across the DoD and identified a significant disparity in the structure, scope, and supporting documentation associated with each respective service's training framework (Rendon 2019). He found a disparity in the emphasis that each service framework places on different phases of the contract life cycle. Rendon's research inquired if the training provided by the DoD services truly reflected what the DoD contracting workforce needed (Rendon 2019). The author recommended contracting organizations develop new hierarchical structure competency models that align job tasks with competency processes, emphasizing granularity for each contract competency, expanding contracting competencies to include industrial processes, and emphasizing continuous learning (Rendon 2019). This capstone study attempted to identify competency and contracting training issues across the Army contracting workforce. Our study used Rendon's research

to formulate a traceability matrix to identify training requirements in each contracting environment.

To get the right set of skills, the government could acquire subject matter skill sets necessary to train and improve the proficiency among the contracting workforce (Scott and Thompson 2019). Congress established the Congressional Section 809 panel in 2016 to review acquisition procedures and regulations in the DoD to improve the efficiency and effectiveness of the acquisition corps (Scott and Thompson 2019). The panel proposed improvements to amend the hiring process for critical skill gaps, adequately fund and manage workforce development, and create a permanent personnel system just for the acquisition workforce. Daryl Scott and Dina Thompson (2019) reviewed recommendations from a Congressional Section 809 panel concerning professional development and acquisition workforce readiness. They recommended improved training competency models, "using specific, mission-related tasks" that require a supervisor to provide feedback, which would help identify training gaps (Scott and Thompson 2019, 24). Our capstone study attempted to identify training differences using the actual tasks performed by environment to identify the training requirements suited for an environment's mission.

Even if training were perfect, it does not appear that there is a way to measure the effectiveness of that training in terms of contracting outcomes. In 2017, the GAO examined the extent to which Army leaders evaluated the contracting workforce efficiency and effectiveness of contracting operations. The GAO indicated that leaders conducted contracting reviews but did not establish methods to evaluate the effectiveness of contracting operations. Contracting organizations must adhere and be able to measure cost, schedule, and performance in order to determine the effectiveness and efficiency of contracting operations. The GAO concluded that contracting leaders focused more on contracting mandates to include funds obligations before fund expirations, competition rates, and small business participation goals, but failed to create meaningful metrics (Mak 2017). As a result, Army leaders did not have the quantitative data to determine if they had enough qualified contracting workforce to operate efficiently and effectively. The GAO recommended leaders develop systematic timelines of contract award, cost savings attributed to contracting activities, and quantity of contractor products and services (Mak

2017). The GAO also suggested for the Army to create a training program that would address untrained skills in the workforce. By collecting meaningful historical data from the workforce, Army leaders could develop training programs that address untrained skills in the workforce. This capstone study used the data from BAD to determine the tasks required for each contracting environment to inform Army contracting training programs.

Unfortunately, training shortfalls in the contracting workforce are not new. The DoD published a strategic plan in 2016 and a workforce plan in 2017 to address acquisition workforce competency, but neither established clear workforce training requirements and proficiency objectives (DiNapoli 2019). The DoD has yet to conduct competency assessments to determine where the department needs to modernize its workforce. Our capstone study will help inform the understanding of the proficiency gaps in the workforce to help identify training requirements.

Rendon, Uday Apte, and Aruna Apte, also addressed training gaps in DoD services contracting. They analyzed DoD-wide trends, challenges, Army-unique issues regarding training gaps, and how these gaps contributed to poor services contract management. They conducted an empirical study using data collected in surveys from the Army, Navy, and Air Force to analyze how the services are managing acquisition. The surveys focused on contract characteristics, acquisition management methods, project-management approach, service acquisition leadership, and other management issues. Based on the results from the survey, respondents did not believe Defensive Acquisition University (DAU) training alone was adequate to train the contracting workforce. The authors recommended that the DoD increase the availability of training as well as provide more appropriate training "in the form of experiential or on-the-job training, and localized coaching and mentoring in contracting procedures, as opposed to additional formal Defense Acquisition University classroom training" (Rendon, U. Apte, and A. Apte 2012, 24). The authors concluded that traditional training might familiarize the trainee with contracting tasks, but the DoD workforce cannot achieve proficiency through online and classroom training alone. Our capstone study will conduct the initial analysis to evaluate the training requirements for contracting soldiers in each contracting environment.

D. DIFFERENCES BETWEEN HOME-STATION AND DEPLOYED CONTRACTING ENVIRONMENTS

In 1993, Kelly Campbell, an NPS graduate, conducted an academic review on contingency contracting issues in the Army. Campbell used "contingency" to refer to deployed contracting environments. He identified the differences in the duties of contracting officers in home-station to duties of contracting officers in the contingency environment. Campbell identified instances where contracting officers lacked the prerequisite skills and training needed to support deployed Army units effectively. The author recalls a poignant example of operations in Grenada during fiscal year 1983 where contracting officers deployed "were ineffective, through no fault of their own" (Campbell 1993, 16). Contracting officers attended formal training; however, the officers did not have any on-the-job contracting experience. Campbell's observations highlighted the gap in skills needed in different contracting environments as well as lack of experience in contracting duties. Our capstone study utilized Campbell's work to formulate our thesis that home-station training does not prepare contracting officers for deployed contracting tasks.

While Campbell (1993) asserted the skills and experience needed in home-station are significantly different than those skills needed in deployment and may not prepare a contracting soldier for the demands required in deployment because the skills and tasks are fundamentally different. In a 1993 NPS thesis, United States Air Force (USAF) Captains Jon Tigges and Thomas Snyder detailed the challenges experienced by Air Force and Army contracting officers involved in Operation Desert Storm (ODS) during fiscal year 1991. The theme of the thesis was that contracting officers were not fully prepared for ODS deployments. They surveyed contracting officers in organizations responsible for conducting training and interviewed heads of contingency contracting planning. They concluded that formal training courses did not adequately prepare contingency contracting officers to support requirements for deployment to ODS. This was due to the lack of instruction on contingency contracting, lack of on-the-job training, and lack of realism of deployment exercises. The survey questions focused on contracting officer's opinions about training improvements. The survey also revealed that the tasks performed in

deployment were different than those performed at home-station. The authors recommended adopting a formal contracting officer training course that would address training requirements for each environment (Tigges and Snyder 1993). This capstone study utilized the 51C Job Aid to evaluate training tasks against the tasks contracting personnel performed in each environment. The work of Tigges and Snyder help shape our methodology in that we evaluated the differences between the tasks performed in each environment against the work accomplished in home-station.

In 2000, United States Marine Corps (USMC) Captain Chester McMillon conducted a comparative analysis in contingency contracting within the DoD. He contends an organization must recognize that home-station assignments will not prepare contracting officers for oversea contracting. McMillon compared the contingency contracting regulations, organizational structure, contingency support plans, and training requirements and duties between the Air Force, Army, Navy, and Marine contracting officers. McMillion used the Army Federal Acquisition Regulation (AFARS) to analyze the Army contingency contracting workforce. He observed that the Army had not established a contingency contracting training program, which prevented contracting personnel from gaining valuable information and experience prior to deployment. McMillon identified tasks that a contracting officer completed in a contingency environment were significantly different from the tasks completed at home-station. McMillion found that home-station assignments are not perfectly suited to prepare contracting soldiers for overseas assignments (McMillon 2000). While McMillon based his analysis on the AFARS, this capstone study based its analysis on the Job Aid.

In a 2007 Department of the Army (DA) report, the Secretary of the Army established an independent commission to identify lessons learned in expeditionary operations and provide recommendations for future expeditionary missions. The Secretary of the Army's goal was to achieve a force with greater effectiveness and efficiency (DA 2007). The commission stated that the institutional Army does not provide the skills necessary for acquisition personnel to respond and sustain contracting requirements in an expeditionary operation. The commission found that the Army acquisition workforce lacked the training, personnel, and structure to meet the needs in a deployed environment,

only 53% of civilians and 56% of military personnel met certification requirements for their current positions (DA 2007). The commission stated the Army needed an increase in the training and experience of 51Cs to be effective in expeditionary environments. To balance the increase in demands, the commission recommended an increase in General Officer positions for Acquisition Professionals, to treat contracting skills as a "core competence," and develop a solution to remediate disparity between civilian and military task capabilities in an expeditionary environment. (DA 2007). The commission stated that there are not enough 51C contracting General Officers to make operational decisions to advocate for ACC to influence contracting in expeditionary locations. Also, asserted that the Army does not incentivize civilian personnel well enough to fill expeditionary roles. The commission stated organizations should provide incentives to the civilian workforce appropriately (DA 2007). Simultaneously, the Army community was not able to fill inherently governmental roles fast enough because of a shortage within the workforce. This report stated expeditionary contracting should never be the first assignment for a new 51C contracting soldier and doing so is "the equivalent of teaching someone how to swim by throwing them in the water" (DA 2007, 5). The commission found five areas the Army Acquisition workforce needed improvement. A 51C contracting soldier could expect a seven-fold increase of deployed workload compared to workload in home-station. The commission concluded that the Institutional Army should recognize contracting as a key capability. There are almost as many contractors in deployed environments as there are military personnel; therefore, Army leadership should recognize the impact contracting has on operations in theater. The overall Army acquisition force needs adequate training, manning, and empowerment. Finally, contracting should be a core competency (DA 2007). The DA report provided this capstone study the evidence to support our hypothesis that home-station training alone does not prepare a contracting soldier for tasks required in a deployed environment.

Roxanne Barbaris and Christine Callanan (2008) detailed some challenges in contingency contracting. They provided a snapshot in time for the existing conditions during the formation of the ACC in 2008. The authors highlighted a skills gap based on "an influx of new contracting personnel" (Barbaris and Callanan 2008, 25). They

investigated how the Army improved its contingency contracting process to meet the demands of its wartime mission and acknowledged the Army's inability to meet increased customer demands and workloads in a contingency environment. Barbaris and Callanan found evidence that there are insufficient numbers of contracting professionals, and those that are in the workforce have to face more complex requirements. They stated that the increased complexity of work resulted in increased error rates. The operational tempo in a contingency environment differed from operations in home-station. They also concluded that contracting personnel operating in a contingency environment must be able to formulate solutions quickly to meet the demands of an Army at war.

In a Naval Postgraduate School thesis, Major Sara Kimsey, documented the strain on the ACC to provide trained professionals according to the Joint Publication 4-10 *Operational Contract Support* (OCS) (2015). She cited that "a significantly resource-constrained environment puts more pressure on ACC/ECC to determine how best to enable contracting support across multiple organizations" (Kimsey 2015, 62). Kimsey stated that each DoD service department needed to create comprehensive procedures for contingency contracting. The services relied too heavily on contracting officers' basic awareness of OCS procedures. Understanding OCS procedures will help the organization define Army doctrine and structures. The Army needs to understand the current OCS issues to develop appropriate training models (Kimsey 2015, 94). Kimsey suggested a balanced development of OCS planning, proper resourcing, and integration of contracting across various Army disciplines (2015). Kimsey's thesis provides qualitative research that the operating procedures in each environment are different as well as training requirements for deployment are different than home-station.

Taken together, this literature review has shown that ACC may need to address several aspects of the acquisition workforce, regulation, and training programs to prepare contracting personnel. Rendon (2019) noted that formalized classroom training is not adequate to prepare contracting personnel for contracting in deployment environments. The Army acquisition workforce is undertrained and not meeting the certifications outlined in DAWIA (Reed 2010; Abbruzzese 2012). The Army does not have an effective incentive program to encourage personnel with the expertise and experience to take on leadership

positions (Robinson 2012). There are possible flaws in the Army's competency model and the ACC could benefit by establishing metrics to measure and assess the contracting workforce (Rendon and Winn 2017; Rendon 2017; Scott and Thompson; Mak 2017; DiNapoli 2019; Rendon et al. 2012). Finally, the Army should consider developing an effective training program to prepare contracting personnel for contracting in a deployment environment (Kimsey 2015).

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III. METHODOLOGY

The methodology section describes the process the capstone study took to address the three research questions. The capstone study evaluated ACC Business Analysis Division (BAD) quantitative data against the Job Aid training tasks. The study determined the best method to analyze the data to answer the issues addressed in the problem statement and research questions. The BAD data included contracting actions in all three environments covering the from 2008–2018. The data contains 298,344 home-station records, 5,578 short-duration deployment records, and 42,441 long-duration deployment records. The following section will address the detailed process.

A. DATA OVERVIEW

This capstone study utilized data from 546,364 Contract Action Report (CAR) with obligations totaling $22.4 billion. The CAR is a mandatory report to congress from the contracting officer due after any contractual obligation. The data spans from fiscal years 2008 to 2018: the start of ACC up to the most recent complete fiscal year.

B. ENVIRONMENT DEFINITIONS

The capstone study based the environment definitions on deployment duration and flow of forces to and from each respective environment, as shown in Table 1. The capstone study used Department of Defense Activity Address Codes (DODAAC) to identify and group organizations into one environment location: home-station, short-duration deployment, and long-duration deployment listed in Appendix B. The capstone study defined the home-station environment as locations that soldiers deploy from such as the Army bases in the U.S., Germany, and Italy. The capstone study defined short-duration deployment and long-duration deployment environments as DODAAC locations soldiers deploy to from home-station. The capstone study defined a short-duration deployment environment as a deployment duration of less than nine months. An example of a short-duration deployment would include Environment Security Cooperation Program (TSCP) operations or Humanitarian Assistance Disaster Relief (HADR). Short-duration deployment DODAACs were from short-duration exercises in the INDOPACOM,

SOUTHCOM, AFRICOM, and EUCOM regions. The long-duration deploymment time was greater than nine months and is also a location staffed on a rotational basis 365 days a year. The long-duration deployment environment includes locations such as Camp Buehring, Kuwait and Regional Contracting Center (RCC) Afghanistan.

The capstone study developed the definitions in Table 1 based on a cumulative seven years of contracting experience as well as background research.

Table 1. Contracting Environment Definitions

Operating Environments	Assignment Type	Duration	Characteristics
Home Station	PCS	2-4 years	- Includes locations in CONUS, AK, HI and parts of Europe - Long-term established contracting operations not in direct support of a named operation or deployed forces - Where KOs PCS "from"
Short Duration Deployment	TDY	< 9 months	- Short duration exercises in the INDOPACOM, SOUTHCOM, AFRICOM and EUCOM regions - Less established operation with minimal/unimproved infrastructure - Where KOs deploy "to"
Long Duration Deployment	PCS or TDY	> 9 months	- Includes overseas locations such as Kuwait, Iraq and Korea - Generally in support of a named operation or allied defense - Enduring effort with established improved/infrastructure - Where KOs deploy "to"

C. MATRIX

The capstone group primarily utilized two tools that would enable a functional decomposition and statistical analysis of the contracting data: R and the traceability matrix in Figures 2 and 3. The study presumed that all deploying contracting personnel would need to be proficient with the Job Aid tasks to maximize their mission effectiveness. Also, all contingencies and operations have unique support requirements. The contracting battalion commander must ensure the training of its subordinate organizations and ensure these units are ready to execute contracting tasks upon arrival in the deployed environment. To conduct realistic, effective training, commanders must understand the historical data to better plan and prepare for future contingency operations.

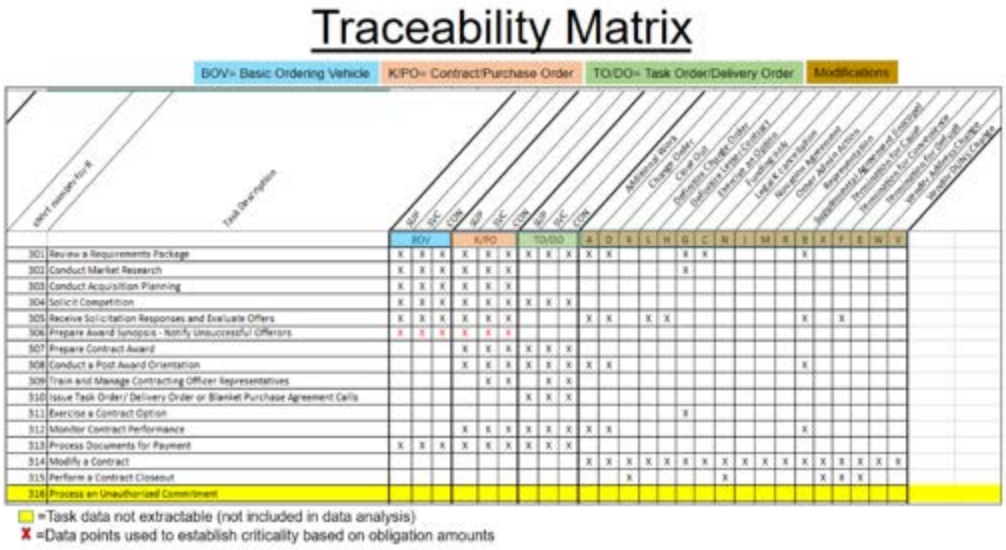

Figure 2. Traceability Matrix between Job Aid Tasks and BAD quantitative data (R Short Numbers 301 and 316). Adapted from ACC (2019)

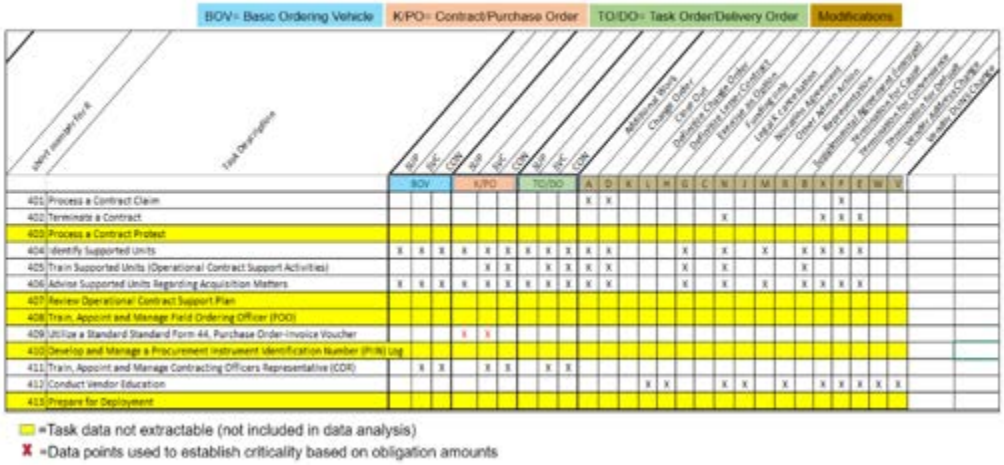

Figure 3. Traceability Matrix between Job Aid Tasks and BAD Quantitative Data (R Short Numbers 401 to 413). Adapted from ACC (2019).

The traceability matrix is the foundation of all data analysis for this capstone. The matrix allows us to determine which individual task contracting personnel performed for each contract action. The columns on the matrix identify all contract actions grouped categorically by contract type. These contract types consisted of four major categories,

which include Basic Ordering Vehicle, Contract/Purchase Order, Task Order/Delivery Order, and Modifications. The rows for the matrix list the 300- to 400-level tasks from the Job Aid.

Using the Job Aid as a guide, the capstone study linked contracting actions to tasks contracting personnel performed. There were six Job Aid tasks that the capstone study could not map to a specific contract action because the distributing agency did not record the tasks clearly in the CAR record. The capstone study highlighted these six tasks in yellow on the matrix. The capstone study's detailed assumptions and justifications for the traceability matrix is in Appendix C.

D. SYSTEM ENGINEERING TOOLS AND ANALYSIS TECHNIQUES

The capstone study accomplished the analysis by using the R software. R is a language and environment for statistical computing and graphics (R Foundation n.d.). The capstone study sorted the data by environment, associated task and transaction type, and manipulated R to providedetailed charts and outputs to answer the research questions.

The capstone study used the Pearson's chi-squared test to determine if the environments were different. The test allowed us to test the hypothesis that all actions contracting professionals performed and conducted across the environments were equal repetition. The capstone study performed the chi-squared test on all three environments then performed the chi-squared test on all three possible combinations of environments: home-station versus long-duration deployment, home-station versus short-duration deployment, and long-duration deployment versus short-duration deployment. The capstone study used the likelihood that a contracting professional performed the task in each environment to compare the differences between environments. We calculated the likelihood by counting the times a task occurred in each environment and dividing those counts by the total number of actions performed in that environment. This represented the chance a soldier would perform the given task in the given environment. Then, we subtracted the short-duration deployment and long-duration deployment odds from the home-station odds to calculate the differences. If the results were positive, those tasks were more likely to occur in the home-station environments. If the results were negative, those

tasks were more likely to occur in the contingency environments. Negative differences represent potentially under-trained tasks: tasks that a soldier is more likely to perform in a contingency environment than in home-station. In other words, a task in which soldiers have less experience or exposure.

The capstone study explored the intra-environment variation using box plots. Each DODAAC in the environment produced an odds ratio for tasks that represented a sample of the population of possible odds ratios for that specific task for that environment. The R software produced box plots representing the distribution of the odds ratios for the tasks. The shape of the box plots represented the variability of the task performance odds. The larger boxes had more variation, while smaller had less variation.

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IV. RESULTS AND ANALYSIS

The capstone study was able to answer the research questions successfully. In the problem statement, the team wished to detect potential training gaps that result from different task performance in the home-station environment compared to deployed environments. This study was not able to measure training gaps directly but was able to use the task occurrence frequency. A contracting officer frequently performing a task in an environment leads to increased task proficiency. Any tasks that were less likely to occur in the home-station environment compared to the deployed environments represented potential training gaps.

A. ARE THE OPERATING ENVIRONMENTS (HOME-STATION, SHORT-DURATION, LONG-DURATION) DIFFERENT?

The capstone study found that the tasks performed in the different environments are not the same. We performed a chi-square test of independence to determine if there was a difference in the frequency of tasks between environments. The relation between these variables was significant, χ^2 (42, N = 546,363) = 45,654, $p < .0001$. The team also performed the chi-square test of independence for each of the combinations of two environments. The relation between the variables was significant for each pair. For home-station compared with short-duration, χ^2 (21, N = 546,363) = 3,025.8, $p < .0001$, for home-station and long-duration, χ^2 (21, N = 546,363) = 42,813, $p < .0001$, and for short-duration and long-duration, χ^2 (21, N = 546,363) = 4009.6, $p < .0001$.

B. IF THE TASKS PERFORMED ARE DIFFERENT IN EACH ENVIRONMENT, THEN WHAT WERE THE TASK FREQUENCY DIFFERENCES?

Table 2 summarizes the likelihood for each task by the environment in descending order from most frequently to least frequently performed. The total contracting actions for each environment were 298,344 for home-station, 5,578 for short-duration, and 242,441 for long-duration. To calculate the likelihood, we divided the count of performed tasks by those contracting environment totals and converting the results to a percentage.

The capstone study sorted Table 2 by the left-most green column, which ranks the tasks from one to 22. The next six columns contain the data for each of the three contracting environments in pairs with the task name and then the likelihood of that task. The likelihood represents the chance a contracting worker would perform that individual task for any given contracting action based on the historical occurrence of that task's performance in the given environment. The home-station environment data is in the black and grey columns, the short-duration environment data in the blue columns, and the long-duration environment data in the orange columns. The order of tasks is different for each environment because no two share the same rank order for task likelihood.

Table 2. Task Likelihood Ranked in Descending Order by Environment

Rank	Home-Station	Likelihood (%)	Short-Duration	Likelihood (%)	Long Duration	Likelihood (%)
1	4.6 Advise WRT Acq Matters	84	4.6 Advise WRT Acq Matters	93.1	4.6 Advise WRT Acq Matters	96.6
2	3.1 Review Req Packet	75.6	4.4 ID Supported Unit	86.1	4.4 ID Supported Unit	94.2
3	4.4 ID Supported Unit	74.9	3.1 Review Req Packet	80.5	3.1 Review Req Packet	69.1
4	3.8 Post Award Orientation	59.8	3.8 Post Award Orientation	67.1	3.8 Post Award Orientation	63.9
5	3.15 K Closeout	54.3	3.15 K Closeout	61.1	3.15 K Closeout	59.9
6	3.14 Modify K	52.3	3.4 Solicit Competition	58.9	3.4 Solicit Competition	58.3
7	3.4 Solicit Competition	47.7	3.13 Process Payment	58.9	3.13 Process Payment	58.3
8	3.13 Process Payment	47.7	3.5 Evaluate Offers	58.1	3.7 Prepare K Award	57.1
9	3.7 Prepare K Award	46.6	3.7 Prepare K Award	52	3.14 Modify K	41.7
10	4.5 Train OCS Activities	39.7	3.12 Monitor K Performance	51.3	3.5 Evaluate Offers	36.6
11	3.12 Monitor K Performance	36.7	4.5 Train OCS Activities	47.1	3.2 Conduct Market Research	31.6
12	3.5 Evaluate Offers	33.9	3.2 Conduct Market Research	43.8	3.3 Conduct Acq Planning	29.7
13	3.10 Issue TO/DO	27	3.3 Conduct Acq Planning	42.9	3.10 Issue TO/ DO	28.5
14	3.9 Train/Manage COR	25.6	3.14 Modify K	41.1	4.5 Train OCS Activities	27.1

Rank	Home-Station	Likelihood (%)	Short-Duration	Likelihood (%)	Long Duration	Likelihood (%)
15	3.2 Conduct Market Research	25.3	3.9 Train/Manage COR	40	3.12 Monitor K Performance	26
16	3.3 Conduct Acq Planning	20.7	3.6 Notify Unsuccessful Offers	27.2	3.9 Train/ Manage COR	21
17	3.6 Notify Unsuccessful Offers	13.1	4.9 Utilize SF44	22.7	3.6 Notify Unsuccessful Offers	20.9
18	4.9 Utilize SF44	12.4	3.10 Issue TO/ DO	16	4.9 Utilize SF44	20.4
19	4.1 Process Claims	5.67	4.1 Process Claims	10.1	4.1 Process Claims	5.18
20	3.11 Exercise Option	4.59	4.12 Educate Vendors	1.51	3.11 Exercise Option	1.87
21	4.12 Educate Vendors	1.18	4.2 Terminate K	1.31	4.12 Educate Vendors	0.579
22	4.2 Terminate K	1.02	3.11 Exercise Option	0.95	4.2 Terminate K	0.483

C. INTRA-ENVIRONMENT DIFFERENCES

Figures 4, 5 and 6 show the home station, short-duration deployment, and long duration deployment boxplots for each of the 22 tasks. The box plot shows the range of likelihood for each environment sampling by DODAACs. The box represents the middle 50 percent of the data from the 25th to the 75th percentiles. The horizontal line in each box is the median for that task. Tasks with the least amount of skew have horizontal lines closest to the center of the box. The chart illustrates outliers with red circles. A shorter box plot with a centered horizontal line indicates there is less variation in the likelihood across DODAACs. The differences in the sizes of the plots represent on which tasks differ the most across the different contracting offices represented by the DODACs. We produced plots for all three environments to explore the intra-environment variability. For example, in the home-station plot, Figure 4, tasks 3.1 and 3.14 have very similar likelihoods across the home-station offices, whereas task 4.5 has more variation in the likelihood observed in the home-station DODAACs.

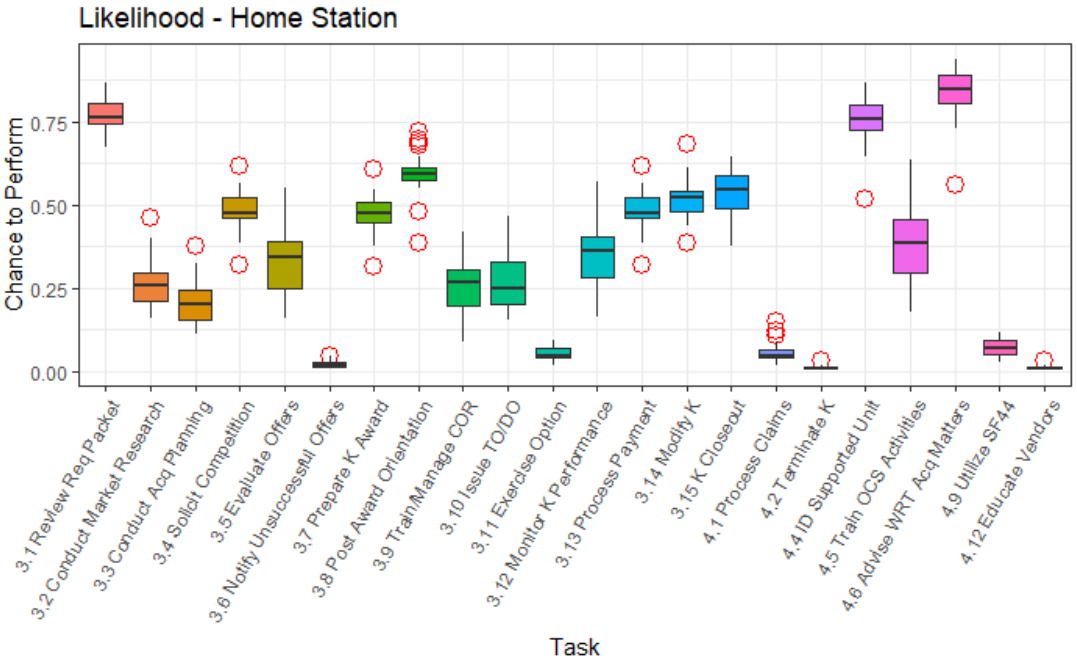


Figure 4. Likelihood to Perform Tasks in Home-station Environment

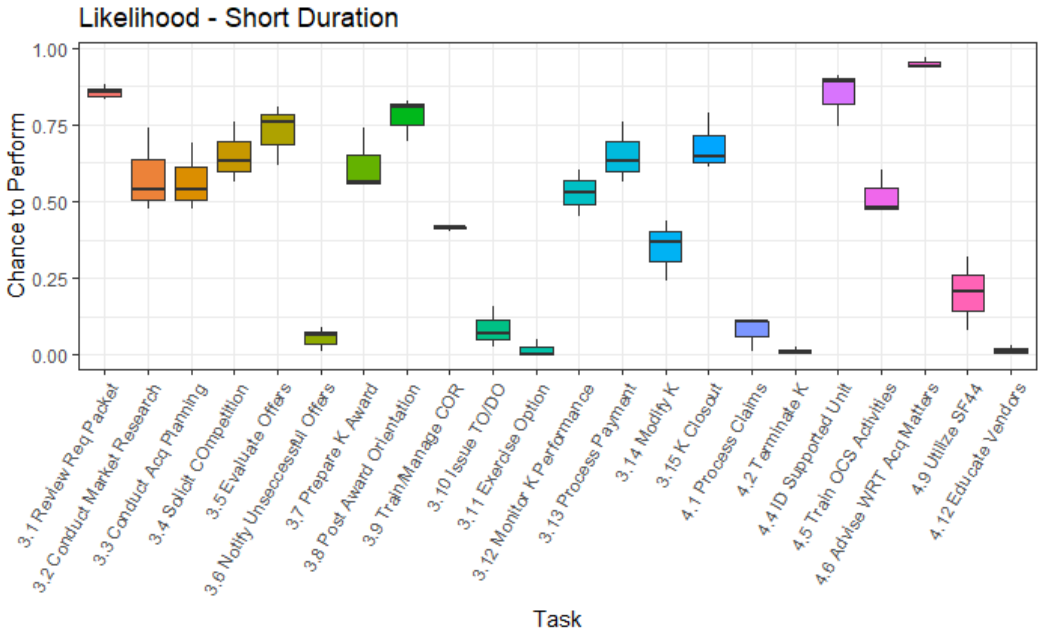


Figure 5. Odds to Perform Tasks in Short-Duration Environment

Figure 5 shows the short-duration boxplots for each of the 22 tasks. The box plot shows the range of likelihoods for the short-duration environment using its DODAACs as samples. This environment had the least likelihood variation and also the fewest DODAACs.

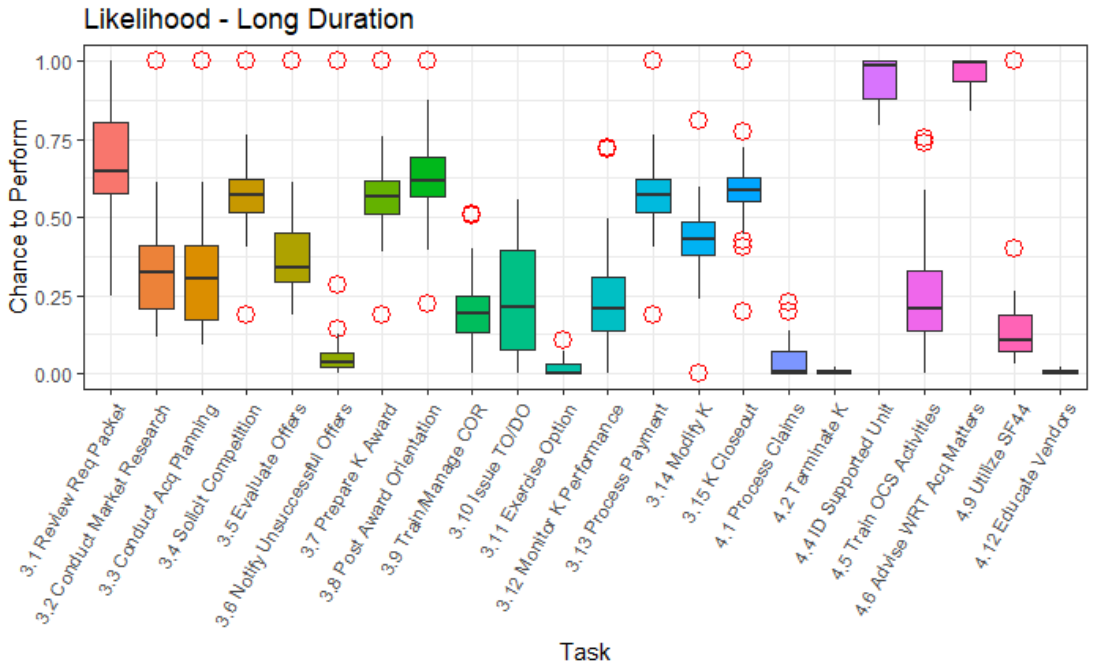
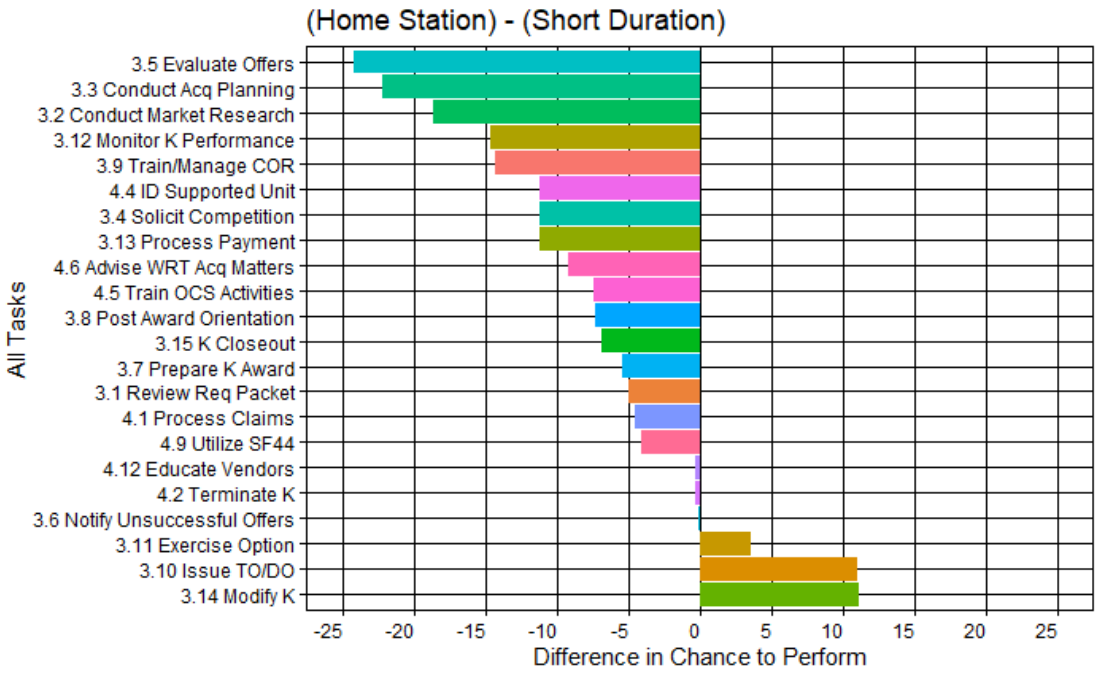


Figure 6. Likelihood to Perform Tasks in Long-Duration Environment

Figure 6 shows the long-duration boxplots for each of the 22 tasks. The box plot shows the range of odds for the long-duration environment. This environment had the most likelihood variation and the second largest set of DODAACs. The team did not thoroughly examine the reason for a large amount of variation. A possible explanation is the long-duration environment data had the largest amount of geographic diversity covering Korea, Kuwait, and Afghanistan.

Figure 7 illustrates the differences between home-station and short-duration environment likelihoods to perform a contracting task. We subtracted the home-station likelihood from the short-duration likelihoods. Negative numbers indicate tasks that are potentially undertrained because soldiers are less likely to perform that task as frequently

in home-station as compared to a short-duration deployment. Positive numbers indicate tasks that soldiers are more likely to be proficient because they are more likely to perform the task at home-station than on the short-duration. These results show that a soldier would execute task 3.5 Evaluate Offers about 25% more of the time while deployed. The results also show that a soldier would perform task 3.14 Modify a Contract about 10% more often while at home-station. There are two plausible explanations for this result. First, because competition is the quickest way to make contract awards, it follows that evaluating offers would happen more often in a short-duration environment since there is less time available to explore noncompetitive acquisition strategies compared to home-station. Second, modifications were less likely during short-duration because those contracts did not last long enough to require as many modifications as multiyear home-station contracts.



Negative number indicates a potentially undertrained task.

Figure 7. Difference between Short-Duration and Home-Station Environments

Figure 8 illustrates the differences between home-station and long-duration environment likelihoods to perform a contracting task. The negative and positive numbers represent the same training differences as the short-duration graph. These results show that soldiers executed task 4.4 Identify Supported Unit about 20% more of the time while deployed and that they performed task 4.5 Train Operational Contracting Support (OCS) Activities more than 12% more often while at home-station. The task 4.4 Identify Supported Unit likelihood difference made intuitive sense to the team given the rotational nature of contracting and supported units during long-duration deployments compared to the more fixed home-station support relationships. The task 4.5 Train OCS Activities likelihood difference also made sense given that contracting soldiers train supported units before deployments to prepare those units to execute OCS activities in theater.

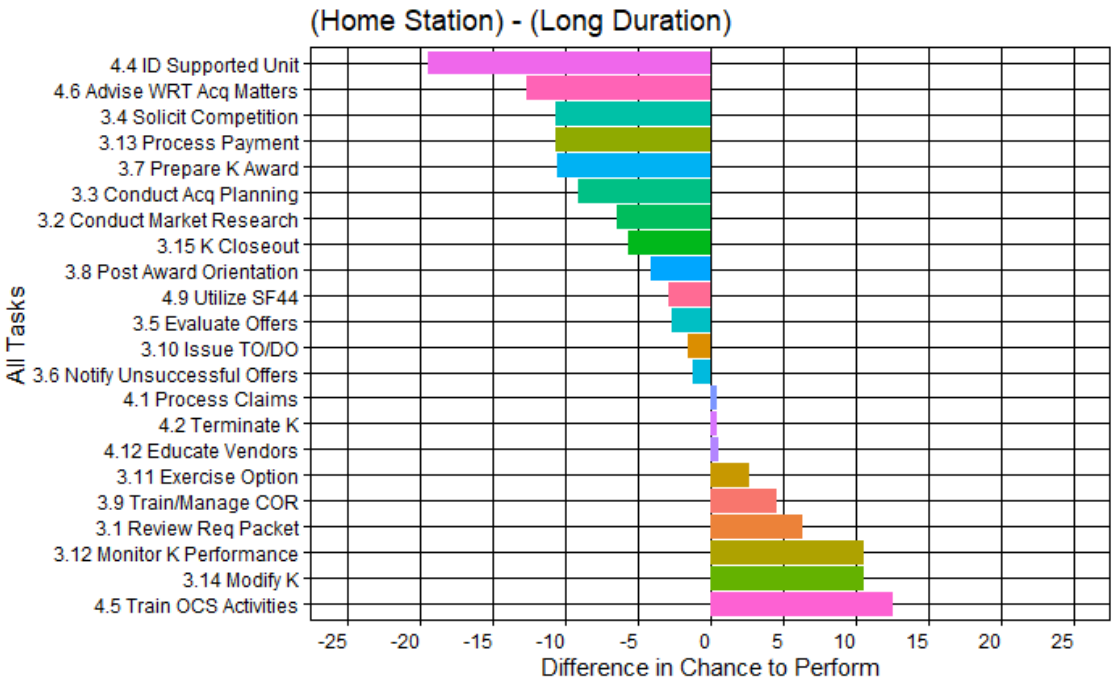


Figure 8. Difference between Home-Station and Long-Duration Environments

D. HOW CRITICAL ARE THE DIFFERENCES?

The capstone team examined criticality in five different ways. Each examination used dollars as a proxy for criticality. The more dollars obligated when a task occurred made that task more expensive and, therefore more critical. The team labeled the resulting units task obligations and then ranked all 22 tasks in descending order based on the task's percentage of task obligations. The relative task obligations examination was a global method because it used the data from all three environments at the same time. Figure 9 displays the results with the most critical tasks highest on the figure.

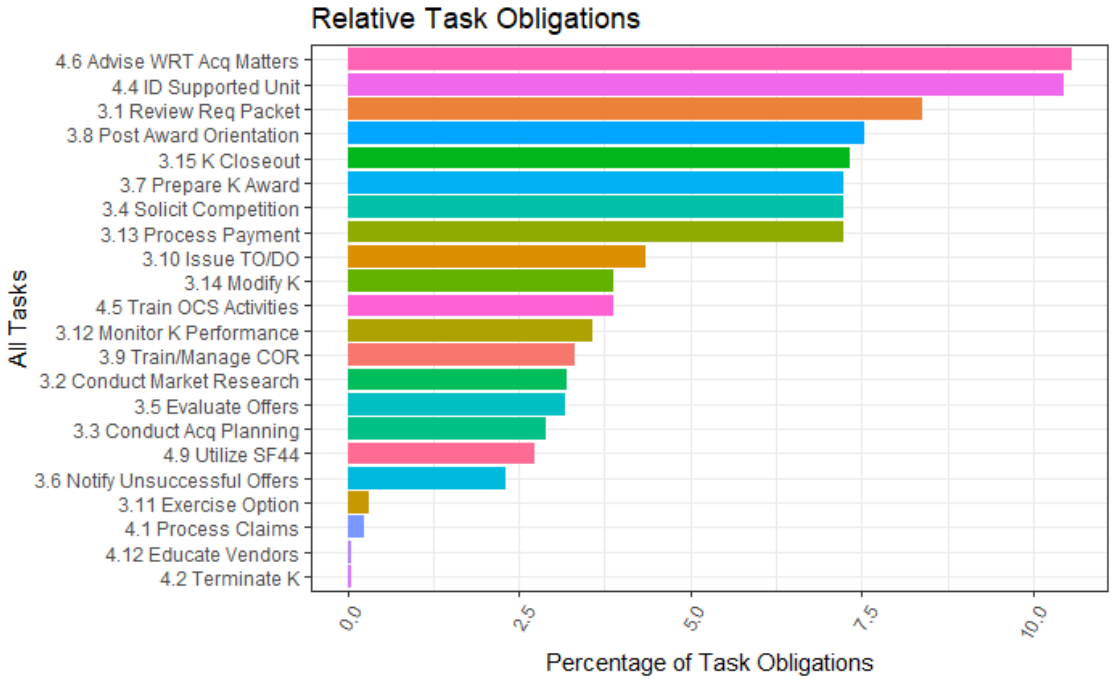


Figure 9. Relative % of Obligations for Short-Duration and Long-Duration Environment

For the second examination, the team calculated a spend percentage for each task. The capstone study calculated the spend percentage by dividing the sum of obligated dollars when the given task occurred by the total number of obligated dollars in the contracting environment. The spend percentage represented the number of dollars spent when the given task occurred as a part of the total dollars spent in the environment. The

spend percentages were not universal. The capstone study used each obligation from one contracting environment were once. Figure 10 displays the results of the spend percentage for the short-duration deployment environment, and Figure 11 displays the results for the long-duration deployment environments.

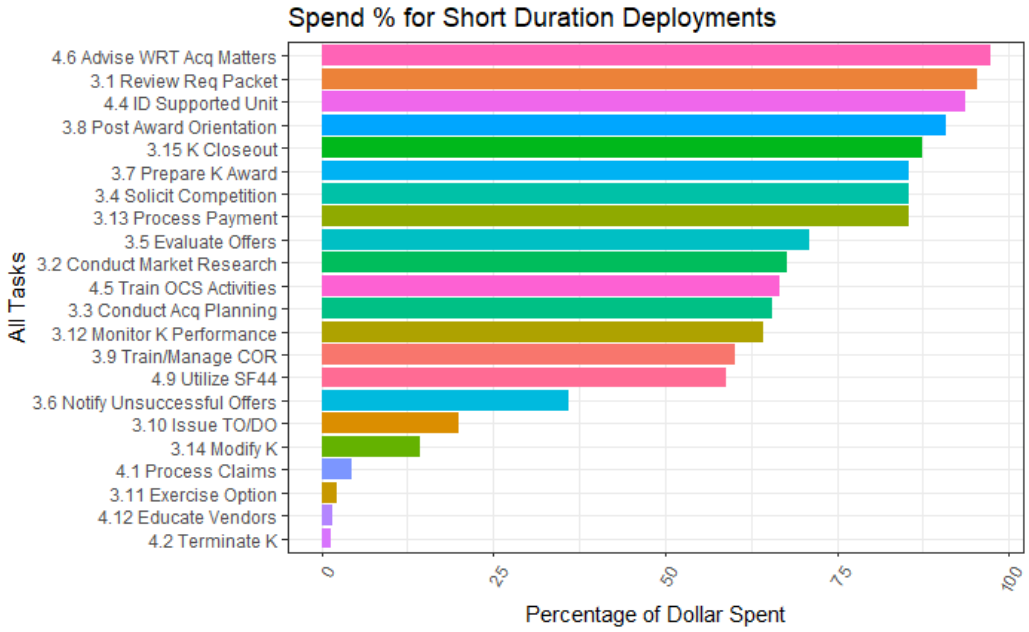


Figure 10. Spend % of Short-Duration Deployment Environment

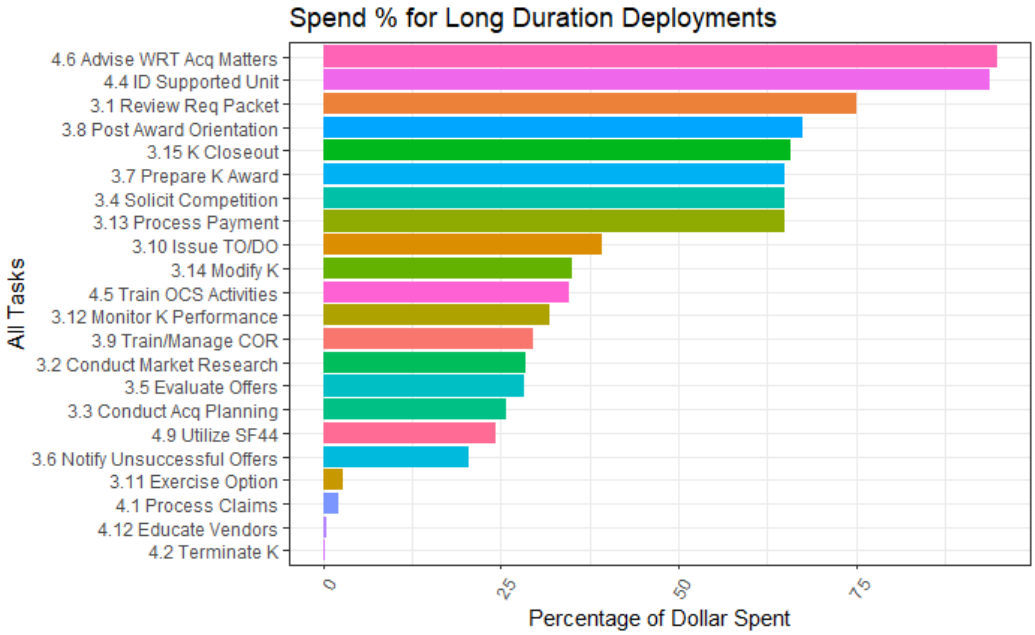


Figure 11. Spend % of Long-Duration Deployment Environment

The third examination the capstone conducted for criticality was a spend percentage gap analysis. This examination compared the difference in spend percentages in home-station with the short and long-duration deployed environments; Figures 12 and 13 display the results of the examination. The negative numbers represented the largest gaps between home-station and deployed spend percentages.

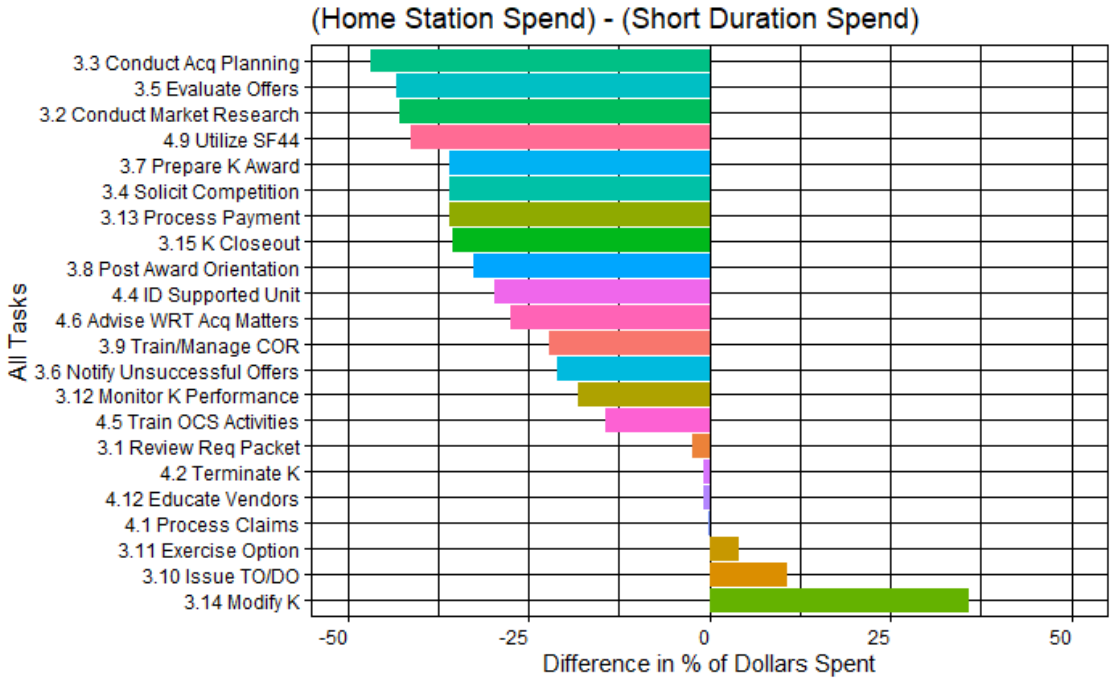


Figure 12. Spend % Gap between Home-Station and Short-Durations

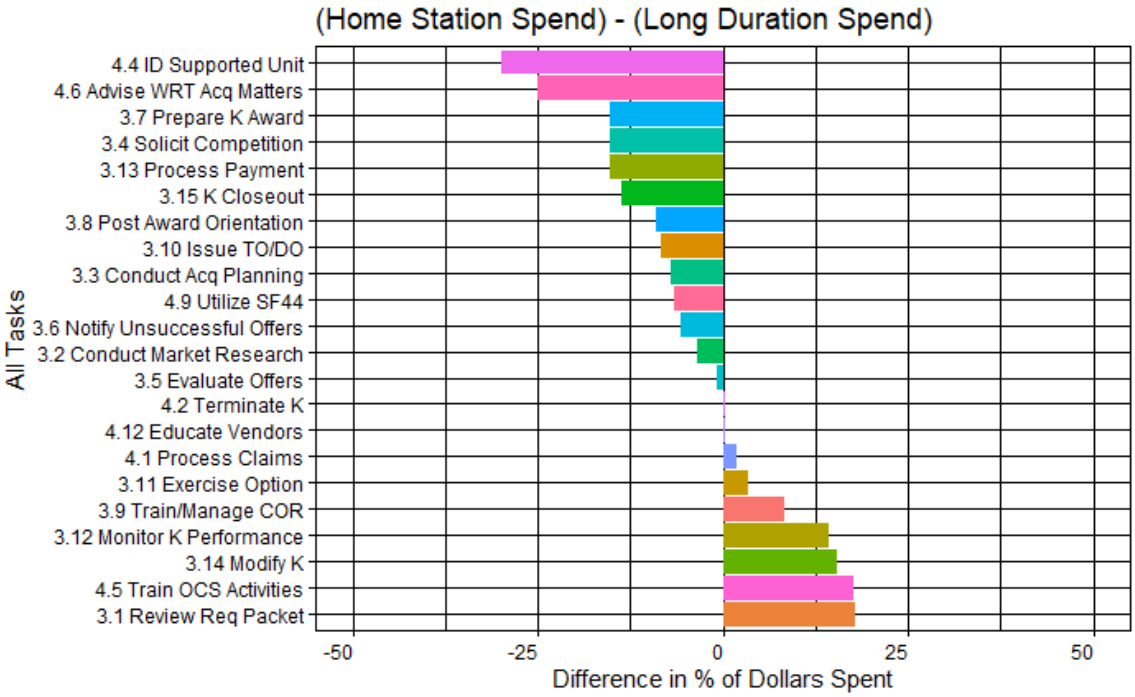


Figure 13. Spend % Gap between Home-Station and Short-Durations

The team's fourth examination of criticality was to summarize the five different criticality rankings: relative task obligations, short-duration spend percentage, long-duration spend percentage, short-duration spend percentage gap, and long-duration spend gap. Table 3 contains the summary results in descending order of importance. The team used the mode of the five rankings to order the summary table. The team selected the modal ranking over the mean rankings because some tasks ended up with the same mean ranking. Table 3 shows that the most critical tasks are tasks 4.6, Advise with Respect to Acquisition Matters, and 4.4, Identify Supported Unit, which is plausible because the majority of contracting actions will involve contracting soldiers working with their supported units. The least critical tasks in the list are 4.12, Educate Vendors, and 4.2, Terminate Contract, which reveal some potential shortcomings of using dollars as the proxy for criticality. Contract termination was not very expensive based on the capstone team's measures, which does not match the team member's experience where every contract termination was very critical. The capstone team decided that the criticality question required additional research to answer completely, but the capstone report would continue with the dollars as a proxy because of the time available for the project.

Table 3. Summary of Criticality Rankings

Task	Mode Rank	RTO Rank	SD Spend %	LD Spend %	SD Spend Gap	LD Spend Gap
4.6 Advise WRT Acq Matters	1	1	1	1	11	2
4.4 ID Supported Unit	2	2	3	2	10	1
3.1 Review Req Packet	3	3	2	3	16	22
3.8 Post Award Orientation	4	4	4	4	9	7
3.15 K Closeout	5	5	5	5	8	6
3.4 Solicit Competition	6	6	6	6	6	4
3.7 Prepare K Award	7	7	7	7	5	3

Task	Mode Rank	RTO Rank	SD Spend %	LD Spend %	SD Spend Gap	LD Spend Gap
3.13 Process Payment	8	8	8	8	7	5
3.10 Issue TO/DO	9	9	17	9	21	8
3.14 Modify K	10	10	18	10	22	20
4.5 Train OCS Activities	11	11	11	11	15	21
3.12 Monitor K Performance	12	12	13	12	14	19
3.9 Train/Manage COR	13	13	14	13	12	18
3.2 Conduct Market Research	14	14	10	14	3	12
3.5 Evaluate Offers	15	15	9	15	2	13
3.3 Conduct Acq Planning	16	16	12	16	1	9
4.9 Utilize SF44	17	17	15	17	4	10
3.6 Notify Unsuccessful Offers	18	18	16	18	13	11
3.11 Exercise Option	19	19	20	19	20	17
4.1 Process Claims	20	20	19	20	19	16
4.12 Educate Vendors	21	21	21	21	18	15
4.2 Terminate K	22	22	22	22	17	14

The capstone team's fifth and final criticality examination was to check for low likelihood high expense tasks. These tasks would relate to or spend more money than expected based on the frequency of their occurrence in the records. The capstone team created four scatter plots to complete the analysis. Two scatter plots compared the likelihood of a given task compared to the global relative task obligation in Figures 14 and 15.

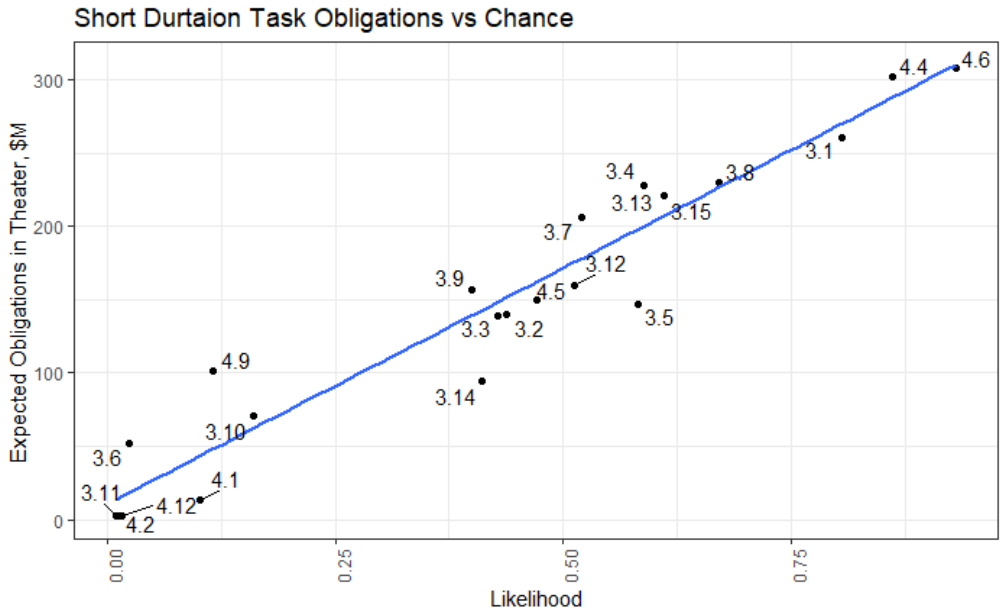


Figure 14. Scatter Plot of Short-Duration Task Obligations versus Tasks Odds

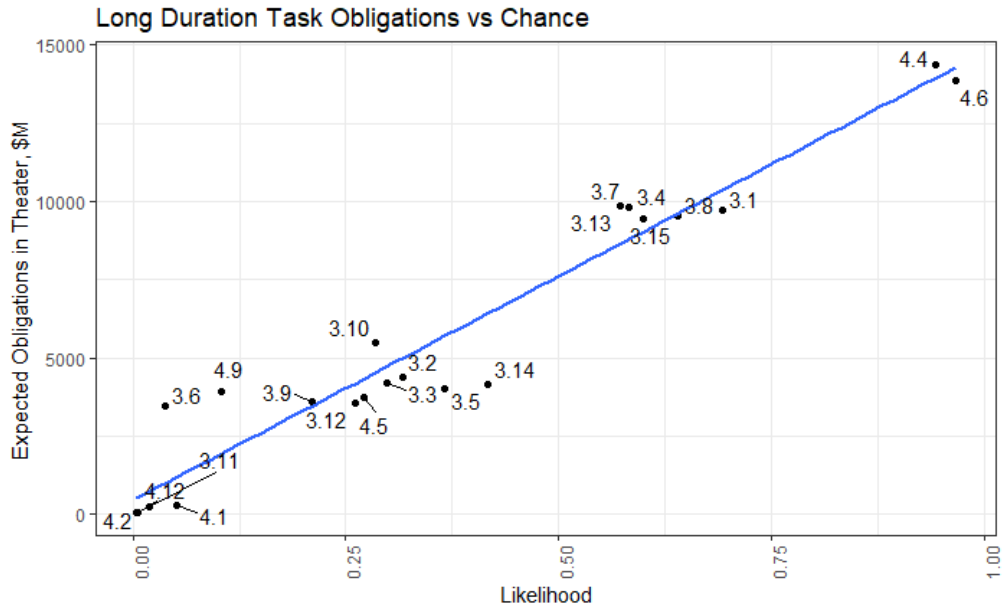


Figure 15. Scatter Plot of Long-Duration Tasks Obligations versus Odds

The next two scatter plots compared the likelihood of a given task to the spend percentage for that given task. Figures 16 and 17 display the results for the short and long-duration deployment environments.

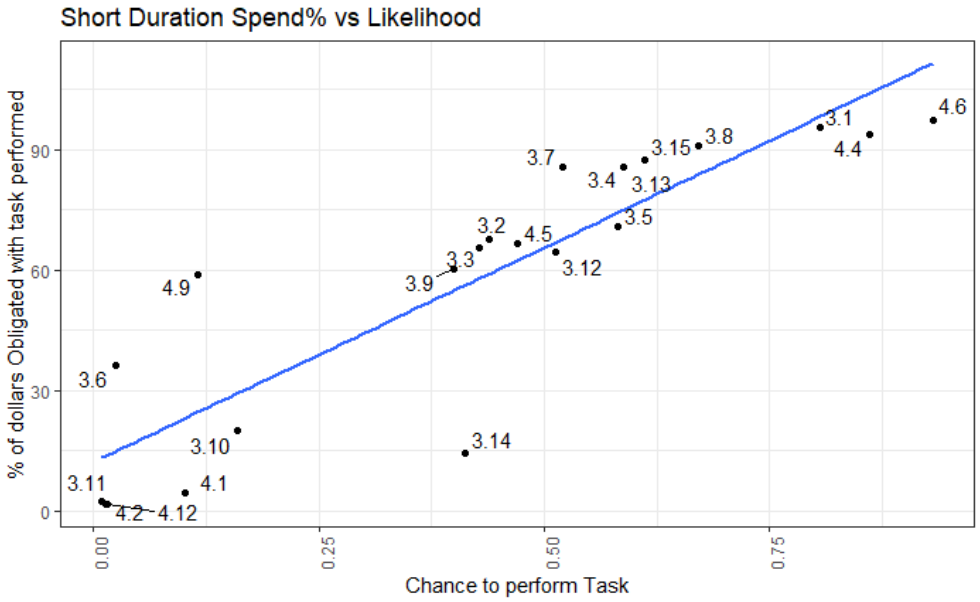


Figure 16. Scatter Plot of Short-Duration Spend % versus Likelihood

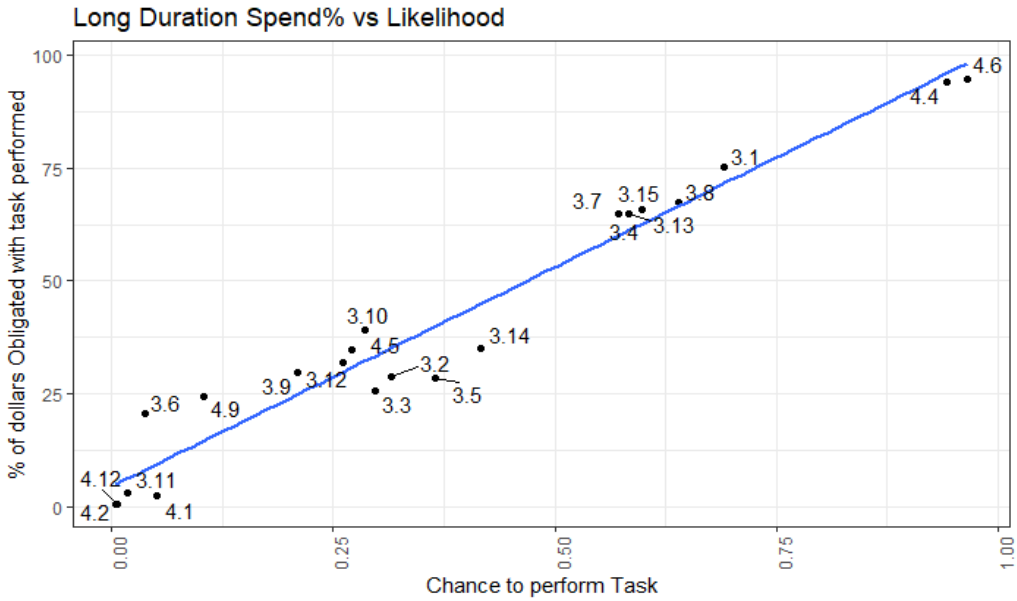


Figure 17. Scatter Plot of Long-Duration Spend % versus Likelihood

For each scatter plot, those tasks that plotted in Figure 17 the blue trend line warranted further investigation as they were more expensive than predicted by their likelihood. The capstone team was not able to draw strong conclusions from the scatter plot

examination because it was not clear about how far a task would need to be from the trend line to be of concern. For instance, task 4.9 in Figure 17 indicated that a lot of cheap actions are associated with a large amount of money spent. This issue will require additional research to determine the concern boundary. Absent further research, criticality and likelihood appear to be decently linearly related with most tasks close to the trend line.

In conclusion, the team was able to answer all three research questions to different confidence levels. The team confidently concluded that the three contracting environments are not the same. The team measured the differences between the environments and compared them using likelihood percentages to answer how different each environment was. The capstone was less confident in answering the third research question because of the limitations of the dollars proxy for criticality.

V. CONCLUSION AND RECOMMENDATIONS

The capstone study was able to reach a conclusion for each of the three research questions to varying confidence levels. From those conclusions, the study decided on three recommendations and five areas for follow on research.

A. CONCLUSION

The operating environments are different. The capstone study confidently concluded that the environment matters concerning frequency of contract tasks performed. We proved this with the chi-square test of independence as noted in Chapter III of this study. The study was able to confidently reject the null hypothesis that the environments were the same, allowing the study to accept the alternate hypothesis that the environments are different with respect to the frequency of contracting tasks performed.

The study considered what makes the environments different. The type of contracting action performed dictates which tasks contracting personnel performed. Each environment had a different contract action distribution. Contract modifications and task orders occurred more frequently in the home station environment, while new contracts and purchase orders were more likely in the deployed environments. Multiyear contracts, those requiring the task "exercise and option" were more likely to occur in the home station environment as well.

The insight from this conclusion challenges the assumption in the Job Aid that one year in a home station environment is sufficient to prepare a soldier for deployment without a considerable training effort. The work in home-station is not the same as the work in the short duration deployment or long-duration deployment environments. Historical data indicated that short duration and long duration deployments should have a different training plan. Units preparing for deployment would need to incorporate additional training to supplement home station training.

The capstone study found that tasks performed in each environment is different. The tasks occurred at different frequencies in the three environments. The largest difference in task likelihoods between home station compared to the short duration

deployment environment was 25%. The largest difference between task likelihoods in the home station compared to the long duration deployment environment was 20%. The average differences for tasks soldiers were more likely to perform in the short duration deployment environment compared to the home station was 10%, and the average differences for the long duration deployment environment was 7.5%.

The insight from this conclusion is the majority of contracting tasks occurred more frequently in the short duration deployment and long duration deployment environments compared to the home station. The likelihoods alone are not enough to prove a training deficiency, but they offer areas warranting exploration. ACC will need to conduct future research to define significance based on the size of the gap. The capstone study was only able to measure the size of the gap but could not, for example, determine if a 20% gap mattered more than a 5% gap. The gaps are likely conservative because soldiers perform a larger percentage of contracting work in deployed environments.

The capstone study found that the difference between task occurrence between the environment does matter in each environment. We allocated each obligated dollar against each task performed to create a relative obligation percentage. The study assumed that those tasks that have the highest relative obligation percentage to be the most critical tasks as noted in Table 3. The tasks with the highest obligation percentages were 4.6 Advise with Respect to Acquisition Matters and 4.4 Identify Support Unit. The study used the relative obligation percentage to price the tasks and then displayed the results three ways: as a bar chart, as a composite table, and as scatter plots.

The insight from this finding is that relative obligation percentage is not a good proxy for criticality. The principal failure for relative obligation percentage as a metric is that not all of the tasks actually obligate dollars. By treating all tasks as though they obligated money lead to results that do not stand up to academic scrutiny. For example, task 3.13 Process a Payment measured a relative obligation percentage of 7.2% meaning that the study determined that the task responsible for that percentage of the money obligated. This result is illogical because contracting officers do not obligated funds while processing a payment. Logically, all priced contract actions much more than 7% will involve processing a payment. In hindsight, the study realized that the relative obligation

percentage did not make sense because allocating obligations to tasks that do not obligate funds lead to nonsensical results. The tasks with the largest frequency gaps are tasks that require more training; thus, these are critical tasks.

B. RECOMMENDATIONS

The capstone study has two audiences for recommendations which includes contracting commanders and future researchers. The study has one recommendation for commanders. The recommendations to commanders are changes to the current training model that can help better prepare soldiers for deployments. The study has three recommendations for future studies. We list future work in the following sections.

(1) Recommendations to contracting commanders

The capstone study recommends that commanders produce deliberate training plans to address the differences between environments. In the absence of additional data, the study recommends using the differences in task likelihood from this report as a basis. The Job Aid training strategy calls for one year in home-station to gain experience and proficiency under the mentorship of a senior warranted 1102 prior to a soldier's first deployment (ACC 2019). The results of this study can better inform which areas a soldier should focus on based on which environment they expect to deploy. This additional information can help to maximize the first year in home-station while reinforcing those tasks that are uncommon in home-station but frequent in short-duration deployment or long-duration deployment environments.

(2) Areas for future study

Based on the 22 tasks from the Job Aid, what do commanders perceive to be tasks that require the most training emphasis per environment? The capstone study recommends validating the Traceability Matrix in Figure 2 with contracting commanders. Acquiring the perception from contracting commanders, would validate and further inform the requirements needed in different contracting environments. A future capstone study should explore the difference in contracting environments with the input from PCC commanders as well as the difficulty to perform the tasks.

How many times would a contracting officer need to repeat a task in order to be proficient? The Army found that the acquisition workforce lacked the training, personnel, and structure to meet the needs in a deployed environment, only 53% of civilians and 56% of military personnel met certification requirements for their current positions (DA 2007). The DA stated the Army needed an increase in the training and experience of 51Cs to be effective in expeditionary environments (DA 2007). Future studies could explore the issues of training decay and what types of tasks features a soldier would need to complete to gain proficiency that would transfer to theater.

How do you incentivize the civilian workforce to take on leadership roles? Abbruzzese concluded ACC needs qualified trainers to identify training gaps as well as train newly transitioned 51C contracting soldiers. The lack of qualified personnel has contributed to competency issues in ACC (Abbruzzese 2012). Of the 50% of respondents who were qualified to become contracting officers, one in every four civilian contracting specialists preferred to decline their warrant to become contracting officers (Robinson 2012). Future capstone studies can conduct the analysis of alternatives to determine the best incentives to grow and retain contracting officer trainers.

In summary, contracting organizations can use analyzed contracting data to assists with more effective training planning. Prior to this study, previous research was only able to utilize qualitative data through surveys and observations perceptions to support similar conclusions. This study can lead to a new trend in developing training models for Army contracting units considering all researched data was unique to the Army Contracting Command's units. This study developed a tool that contracting leaders can use to determine the top critical tasks for their unit. The tool from this study is modular and tailorable, and one can update the training tool to reflect new training guidance. This study showed it is possible to use contracting data from ACC's Business Analytics Department to analyze training differences, task criticality, and tasks likelihood by theater. From this, a leader can determine training gaps by DODAAC using historical data. Future training models can use actual contracting data to develop training plans. The results would provide contracting commanders a rank order of tasks that contracting officers need to complete to be effective in a specific contracting environment.

APPENDIX A. 51C JOB AID

Table 4. 51C Job Aid. Adapted from ACC (2019).

ACC-70-3-4883-01	Review a Requirements Package
ACC-70-3-4883-02	Conduct Market Research
ACC-70-3-4883-03	Conduct Acquisition Planning
ACC-70-3-4883-04	Solicit Competition
ACC-70-3-4883-05	Receive Solicitation Responses and Evaluate Offers
ACC-70-3-4883-06	Prepare Award Synopsis - Notify Unsuccessful Offerors
ACC-70-3-4883-07	Prepare Contract Award
ACC-70-3-4883-08	Conduct a Post Award Orientation
ACC-70-3-4883-09	Train and Manage Contracting Officer Representatives
ACC-70-3-4883-10	Issue Task Order/ Delivery Order or Blanket Purchase Agreement Calls
ACC-70-3-4883-11	Exercise a Contract Option
ACC-70-3-4883-12	Monitor Contract Performance
ACC-70-3-4883-13	Process Documents for Payment
ACC-70-3-4883-14	Modify a Contract
ACC-70-3-4883-15	Perform a Contract Closeout
ACC-70-3-4883-16	Process an Unauthorized Commitment
ACC-70-4-4883-01	Process a Contract Claim
ACC-70-4-4883-02	Terminate a Contract
ACC-70-4-4883-03	Process a Contract Protest
ACC-70-4-4883-04	Identify Supported Units
ACC-70-4-4883-05	Train Supported Units (Operational Contract Support Activities)
ACC-70-4-4883-06	Advise Supported Units Regarding Acquisition Matters
ACC-70-4-4883-07	Review Contract Support Integration Plan
ACC-70-4-4883-08	Train, Appoint and Manage Field Ordering Officer (FOO)
ACC-70-4-4883-09	Utilize a Standard Form 44, Purchase Order-Invoice Voucher
ACC-70-4-4883-10	Develop and Manage a Procurement Instrument Identification Number (PIIN) Log
ACC-70-4-4883-11	Train, Appoint and Manage Contracting Officers Representative (COR)
ACC-70-4-4883-12	Conduct Vendor Education
ACC-70-4-4883-13	Prepare for Deployment

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APPENDIX B. ARMY CONTRACTING UNIT DODAAC LIST

Table 5. Army Contracting Unit DODAAC. Adapted from BAD (n.d.).

Awarding Contracting Office ID	Awarding Contracting Office Name	Environment
W912PG	409TH CSB: RCO BAMBERG	Home-station
W912PB	409TH CSB: RCO BAVARIA	Home-station
W912PA	409TH CSB: RCO BENELUX	Home-station
W912PE	409TH CSB: RCO SCHWETZINGEN	Home-station
W91WFU	409TH CSB: RCO STUTTGART	Home-station
W912CM	409TH CSB: RCO WIESBADEN	Home-station
W564KV	409TH CSB: TCC-KAISERSLAUTERN	Home-station
W912PX	410TH CSB: RCO KEY WEST	Home-station
W91QEX	410TH CSB: RCO MIAMI	Home-station
W912D0	413TH CSB: RCO ALASKA	Home-station
W912CN	413TH CSB: RCO HAWAII	Home-station
W912CZ	413TH CSB: RCO RICHARDSON	Home-station
W912PF	414TH CSB: RCO ITALY	Home-station
W911S6	MICC - DUGWAY PROVING GROUND	Home-station
W911SG	MICC - FORT BLISS	Home-station
W911RZ	MICC - FORT CARSON	Home-station
W91151	MICC - FORT HOOD	Home-station
W9115U	MICC - FORT HOOD	Home-station
W9124B	MICC - FORT IRWIN	Home-station
W9124E	MICC - FORT POLK	Home-station
W911RX	MICC - FORT RILEY	Home-station
W911S8	MICC - JOINT BASE LEWIS-MCCHORD	Home-station
W9124Q	MICC - WHITE SANDS MISSILE RANGE	Home-station
W9124R	MICC - YUMA PROVING GROUND	Home-station
W90AF2	409TH CSB: PARC OFFICE	Short-duration deployment
W91QVP	413TH CSB: PARC PACIFIC	Short-duration deployment
W58D2M	414TH CSB: AFRICA REACHBACK	Short-duration deployment

Awarding Contracting Office ID	Awarding Contracting Office Name	Environment
W56PFY	414TH CSB: RCO AFRICA	Short-duration deployment
W912SR	409TH CSB: RCO KOSOVO	Long-duration deployment
W912CL	410TH CSB: RCC AMERICAS	Long-duration deployment
W912QM	410TH CSB: RCO SOTO CANO	Long-duration deployment
W91QEK	408TH CSB: SWA-PARC	Long-duration deployment
W91253	409TH CSB: JCC BOSNIA (INACTIVE)	Long-duration deployment
W91QVN	411TH CSB: PARC OFFICE	Long-duration deployment
W912D1	408TH CSB: RCC-KUWAIT	Long-duration deployment
W56KGZ	408TH CSB: RCC-OIR	Long-duration deployment
W912D2	408TH CSB: RCC-QATAR	Long-duration deployment
W913FT	410TH CSB: RCO BOGOTA	Long-duration deployment
W91WRZ	410TH CSB: RCO GTMO	Long-duration deployment
W90VN8	411TH CSB: RCO CASEY	Long-duration deployment
W90VN9	411TH CSB: RCO DAEGU	Long-duration deployment
W90VN7	411TH CSB: RCO KUNSAN	Long-duration deployment
W90VN6	411TH CSB: RCO OSAN	Long-duration deployment
W56SGK	ACC AFG: CAPITAL	Long-duration deployment
W56JSM	ACC AFG: CASBC (INACTIVE)	Long-duration deployment
W91B4N	ACC AFG: EAST	Long-duration deployment
W56KJD	ACC AFG: QATAR	Long-duration deployment
W91JA4	ACC AFG: RCC CAPITAL (INACTIVE)	Long-duration deployment

Awarding Contracting Office ID	Awarding Contracting Office Name	Environment
W919QC	ACC AFG: RCC DELARAM II (INACTIVE)	Long-duration deployment
W5K9UR	ACC AFG: RCC DWYER (INACTIVE)	Long-duration deployment
W91B4K	ACC AFG: RCC FENTY (INACTIVE)	Long-duration deployment
W91B4M	ACC AFG: RCC KABUL (INACTIVE)	Long-duration deployment
W919QA	ACC AFG: RCC NORTH (INACTIVE)	Long-duration deployment
W91B4P	ACC AFG: RCC SALERNO (INACTIVE)	Long-duration deployment
W90YVD	ACC AFG: RCC SHANK (INACTIVE)	Long-duration deployment
W90U42	ACC AFG: RCC SHARANA (INACTIVE)	Long-duration deployment
W5K9FH	ACC AFG: RCC SOUTHWEST (INACTIVE)	Long-duration deployment
W5KA4N	ACC AFG: RCC WEST (INACTIVE)	Long-duration deployment
W91B4L	ACC AFG: SOUTH	Long-duration deployment
W56JSL	ACC AFG: TCC QATAR (INACTIVE)	Long-duration deployment

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APPENDIX C. TRACEABILITY MATRIX TASK JUSTIFICATION

- Task 301 Review Requirement Packet
    - **Basic Ordering Vehicle (BOV):** Yes, FAR Part 7 & 11 as reviewing a packet is part of agency support and planning.
    - **Contract/ Purchase Order (K/PO):** Same as above.
    - **Task Order/ Delivery Order (TO/DO):** Same as above.
    - **Modification (MOD):** Yes, FAR Part 11. Contracting officer do not conduct acquisition planning as modifications are based on existing contracts.
- Task 302 Conduct Market Research
    - **Basic Ordering Vehicle (BOV):** Yes, as required in FAR part 10.
    - **Contract/ Purchase Order (K/PO)**: Same as above.
    - **Task Order/ Delivery Order (TO/DO):** No as per FAR part 10.01(v) because TO/DOs are an existing requirement, and contracting officers only need to conduct market research for non-commercial items (which is not an OCS requirement).
    - **Modification (MOD)**: Yes, as per FAR part 17.203, determining fair & reasonable pricing when exercising options.
- · Task 303 Conduct Acquisition Planning
    - **Basic Ordering Vehicle (BOV):** Yes, as FAR 7 requires it.
    - **Contract/ Purchase Order (K/PO):** Same as above.
    - **Task Order/ Delivery Order (TO/DO):** Not required, as per FAR part 7.102
    - **Modification (MOD):** Same as above.
- · Task 304 Solicit Competition
    - **Basic Ordering Vehicle (BOV):** Yes, FAR Part 6 requires competition unless authorized in FAR Part 6.2 or 6.3.
    - **Contract/ Purchase Order (K/PO):** See above.
    - **Task Order/ Delivery Order (TO/DO):** Yes, see above. Solicit Competition requires that you do the work for a competitive solicitation for services, supply, and construction. From the data, it is impossible to tell if a contract is a sole source; therefore, the capstone study will count all TO/DO contracts as competitive.
    - **Modification (MOD):** No, FAR Part 6 does not list it as a requirement in FAR Part 43.9000.

- Task 305 Receive Solicitation Response and Evaluate Offers
    - **Basic Ordering Vehicle (BOV):** Yes, as per FAR part 13.106-2 for Simplified Acquisition Threshold (SAT) procurement and FAR part 15 requires it.
    - **Contract/ Purchase Order (K/PO):** Same as above
    - **Task Order/ Delivery Order (TO/DO):** From our data, we are going to assume every order is a single task award contract. There is no second

round of Competition. From the data, the capstone cannot tell who is competitive or not.

- **Modification (MOD):** FAR Part 43.103 supports all types of modification responses below. All types with "yes" responses are bilateral and require response by the contractor and evaluation by the contracting activity.
  - additional work (yes)
  - change order (yes)
  - closeout (no)
  - definitize change order (yes)
  - definitize letter contract (yes)
  - Exercise an Option (no)
  - Funding Only (no)
  - Legal K cancellation (no)
  - Novation Agreement (no)
  - Other Admin Action (no)
  - Representation (no)
  - Supplemental Agreement (yes) some contracting actions will need, and others will not. For this capstone study, we will assume all supplemental agreements will require.
  - Termination for Cause (no)
  - Termination for Convenience (yes)
  - Termination for Default (no)
  - Vender Address Change (no)
  - Vendor DUNS Chane (no)

- Task 306 Prepare Award Synopsis – Notify Unsuccessful Offerors
  - **Basic Ordering Vehicle (BOV):** FAR 15 states that the government only has to notify if over the Simplified Acquisition Threshold (SAT). The capstone will assume the SAT is $150,000 for all years, although the SAT has changed.
  - **Contract/ Purchase Order (K/PO):** same as above
  - **Task Order/ Delivery Order (TO/DO):** none
  - **Modification (MOD):** none

- Task 307 Prepare Contract Award
  - **Basic Ordering Vehicle (BOV):** None
  - **Contract/ Purchase Order (K/PO):** Yes
  - **Task Order/ Delivery Order (TO/DO):** Yes
  - **Modification (MOD):** None

- Task 308 Conduct a Post Award Orientation
    - **Basic Ordering Vehicle (BOV):** None
    - **Contract/ Purchase Order (K/PO):** Yes. According to the Job Aid, an organization will determine if it needs an organization.
    - **Task Order/ Delivery Order (TO/DO):** Yes, same as above
    - **Modification (MOD):** It depends
        - additional work (yes)
        - change order (yes)
        - closeout (no)
        - definitize change order (no)
        - definitize letter contract (no)
        - Exercise an Option (no)
        - Funding Only (no)
        - Legal K cancellation (no)
        - Novation Agreement (no)
        - Other Admin Action (no)
        - Representation (no)
        - Supplemental Agreement (yes)
        - Termination for Cause (no)
        - Termination for Convenience (no)
        - Termination for Default (no)
        - Vender Address Change (no)
        - Vendor DUNS Chane (no)

- Task 309 Train and Manage Contracting Officer Representatives
    - **Basic Ordering Vehicle (BOV):** A BOV is not a contract, and by law, a COR only exists when there is a contract. A BOV is an agreement.
    - **Contract/ Purchase Order (K/PO): Y**es, for service and constructions.
    - **Task Order/ Delivery Order (TO/DO):** Yes, service, and construction.
    - **Modification (MOD):** None. The COR already exists under the original contract.

- Task 310 Issue Task Order/Delivery Order or Blanket Purchase Order
    - **Basic Ordering Vehicle (BOV):**
    - **Contract/ Purchase Order (K/PO):**
    - **Task Order/ Delivery Order (TO/DO):**
    - **Modification (MOD):**

- Task 311 Exercise a Contract Options
    - **Basic Ordering Vehicle (BOV):** none

- **Contract/ Purchase Order (K/PO):** none
- **Task Order/ Delivery Order (TO/DO):** none
- **Modification (MOD):** Yes, only for exercised a contract option.

- Task 312 Monitor Contract Performance
  - **Basic Ordering Vehicle (BOV):** There is no performance on an agreement.
  - **Contract/ Purchase Order (K/PO):** Yes.
  - **Task Order/ Delivery Order (TO/DO):** Yes
  - **Modification (MOD):**
    - additional work (yes)
    - change order (yes)
    - closeout (no)
    - definitize change order (no)
    - definitize letter contract (no)
    - Exercise an Option (no)
    - Funding Only (no)
    - Legal K cancellation (no)
    - Novation Agreement (no)
    - Other Admin Action (no)
    - Representation (no)
    - Supplemental Agreement (yes)
    - Termination for Cause (no)
    - Termination for Convenience (no)
    - Termination for Default (no)
    - Vender Address Change (no)
    - Vendor DUNS Chane (no)

- Task 313 Process Document for Payment
  - **Basic Ordering Vehicle (BOV):** Yes
  - **Contract/ Purchase Order (K/PO):** Yes
  - **Task Order/ Delivery Order (TO/DO):** Yes
  - **Modification (MOD):** No. The capstone study will assume each contract has one instance of payment. With the limited information on the data, there is no telling how many payments

- Task 314: Modify a contract
  - **Basic Ordering Vehicle (BOV):** No
  - **Contract/ Purchase Order (K/PO):** No
  - **Task Order/ Delivery Order (TO/DO):** No

- **Modification (MOD):** Yes, any contract modified performed under all tasks under modification contract.

- Task 315: Perform Contract Closeout
  - **Basic Ordering Vehicle (BOV):** No
  - **Contract/ Purchase Order (K/PO):** No
  - **Task Order/ Delivery Order (TO/DO):** No
  - **Modification (MOD):** The capstone study will assume the contract closeout will only. The team counted the data multiple times for one action.
    - additional work (no)
    - change order (no)
    - closeout (yes)
    - definitize change order (no)
    - definitize letter contract (no)
    - Exercise an Option (no)
    - Funding Only (no)
    - Legal K cancellation (yes)
    - Novation Agreement (no)
    - Other Admin Action (no)
    - Representation (no)
    - Supplemental Agreement (no)
    - Termination for Cause (yes)
    - Termination for Convenience (yes)
    - Termination for Default (yes)
    - Vender Address Change (no)
    - Vendor DUNS Chane (no)

- Task 316: Process an Unauthorized Commitment
  - **The data set does not support to identify by simply evaluating a contract when contracting personnel perform an organization task.**

- Task 401: Process a Contract Claim
  - **Basic Ordering Vehicle (BOV):** None
  - **Contract/ Purchase Order (K/PO):** None
  - **Task Order/ Delivery Order (TO/DO):** None
  - **Modification (MOD):** Claim is only existing contracts and not against a new contracting action. A KO would modify a contract to perform a claim.
    - Additional work (yes), not always. The Capstone Study will count all; therefore, there will be an overcount.

        - change order (no)
        - closeout (no)
        - definitize change order (no)
        - definitize letter contract (no)
        - Exercise an Option (no)
        - Funding Only (no)
        - Legal K cancellation (no)
        - Novation Agreement (no)
        - Other Admin Action (no)
        - Representation (no)
        - Supplemental Agreement (no)
        - Termination for Cause (no)
        - Termination for Convenience (yes) required to make the contractor whole.
        - Termination for Default (no)
        - Vender Address Change (no)
        - Vendor DUNS Chane (no)

- Task 402: Terminate a Contract
    - **Basic Ordering Vehicle (BOV):** None
    - **Contract/ Purchase Order (K/PO):** None
    - **Task Order/ Delivery Order (TO/DO):** None
    - **Modification (MOD):** To terminate a contract, a KO must do a modification.
        - additional work (no)
        - change order (no)
        - closeout (no)
        - definitize change order (no)
        - definitize letter contract (no)
        - Exercise an Option (no)
        - Funding Only (no)
        - Legal K cancellation (yes)
        - Novation Agreement (no)
        - Other Admin Action (no)
        - Representation (no)
        - Supplemental Agreement (no)
        - Termination for Cause (yes)
        - Termination for Convenience (yes)
        - Termination for Default (yes)
        - Vender Address Change (no)
        - Vendor DUNS Chane (no)

- Task 403: Process a Contract Protest
    - There is not enough data to support when a KO experiences a protest with the data set. Whenever there is a new contracting action, there is a possibility for a protest.

- Task 404: Identify Supported Units
    - **Basic Ordering Vehicle (BOV):** Every time a KO does a contracting action, a KO knows they have provided unit support.
    - **Contract/ Purchase Order (K/PO):** same as above
    - **Task Order/ Delivery Order (TO/DO):** same as above
    - **Modification (MOD):**
        - additional work (yes)
        - change order (yes)
        - closeout (no)
        - definitize change order (no)
        - definitize letter contract (no)
        - Exercise an Option (yes)
        - Funding Only (no)
        - Legal K cancellation (yes)
        - Novation Agreement (no)
        - Other Admin Action (yes)
        - Representation (no)
        - Supplemental Agreement (yes)
        - Termination for Cause (yes)
        - Termination for Convenience (yes)
        - Termination for Default (yes)
        - Vender Address Change (no)
        - Vendor DUNS Chane (no)

- Task 405: Train Supported Units
    - **Basic Ordering Vehicle (BOV):** None
    - **Contract/ Purchase Order (K/PO):** just for service and construction because you are going to have Contracting Officer Representative (COR) in the organization monitoring the contractor's performance.
    - **Task Order/ Delivery Order (TO/DO):** same as above
    - **Modification (MOD):**
        - additional work (yes)
        - change order (yes)
        - closeout (no)
        - definitize change order (no)
        - definitize letter contract (no)

        - Exercise an Option (yes)
        - Funding Only (no)
        - Legal K cancellation (yes)
        - Novation Agreement (no)
        - Other Admin Action (no)
        - Representation (no)
        - Supplemental Agreement (yes)
        - Termination for Cause (no)
        - Termination for Convenience (no)
        - Termination for Default (no)
        - Vender Address Change (no)
        - Vendor DUNS Chane (no)

- Task 406: Advise Supported Units Regarding Acquisition Matters
    - **Basic Ordering Vehicle (BOV):** KO advises units during the planning phase for operational and training missions. KO will maintain communication with the unit during contract development. All pre-award contracting actions.
    - **Contract/ Purchase Order (K/PO): same as above**
    - **Task Order/ Delivery Order (TO/DO): same as above**
    - **Modification (MOD):**
        - additional work (yes)
        - change order (yes)
        - closeout (no)
        - definitize change order (no)
        - definitize letter contract (no)
        - Exercise an Option (yes)
        - Funding Only (no)
        - Legal K cancellation (yes)
        - Novation Agreement (no)
        - Other Admin Action (yes)
        - Representation (no)
        - Supplemental Agreement (yes)
        - Termination for Cause (yes)
        - Termination for Convenience (yes)
        - Termination for Default (yes)
        - Vender Address Change (no)
        - Vendor DUNS Chane (no)

- Task 407: Review Operational Contract Support Plan

- The capstone team does not have enough data to support when the contracting tasks occurs. A KO may review several plans, but not all plans result in a contracting action.

- Task 408: Train, Appoint and Manage Field Ordering Officer (FOO)
  - The capstone team does not have enough data to support when the contracting tasks occurs.

- Task 409: Utilize a Standard Form 44, Purchase Order-Invoice Voucher
  - **Basic Ordering Vehicle (BOV):** none
  - **Contract/ Purchase Order (K/PO):** Only use for supplies and services capped at a certain dollar value. SF 44 is for one-time purchases and not done on other contract types. The capstone group will the micro-purchase threshold of $30,000 according to class deviation 2018-O0018 and FAR 13.201 (g). The contract action will only occur in long-duration deployment and short-duration deployment environments.
  - **Task Order/ Delivery Order (TO/DO):** none
  - **Modification (MOD):** none

- Task 410: Develop and Manage a Procurement Instrument Identification Number (PIIN) Log
  - The PIIN is the KOs internal tracker of contracting actions. There is not enough data to support when and if a KO is completing a PIIN log. There is no contract action that will correlate to Task 410.

- Task 411: Advise Supported Units Regarding Acquisition Matters
  - **Basic Ordering Vehicle (BOV):** A BOV is not a contract and by law a COR only exist when there is a contract. A BOV is an agreement.
  - **Contract/ Purchase Order (K/PO): Y**es, for service and constructions.
  - **Task Order/ Delivery Order (TO/DO):** Yes, service and construction.
  - **Modification (MOD):** None. The COR already exists under the original contract.

- Task 412: Conduct Vendor Education
  - **Basic Ordering Vehicle (BOV):**
  - **Contract/ Purchase Order (K/PO): same as above**
  - **Task Order/ Delivery Order (TO/DO): same as above**
  - **Modification (MOD):** A KO will require to educate the contractor in certain contracting action.
    - additional work (no)

        - change order (no)
        - closeout (no)
        - definitize change order (yes) Before the KO verifies the contract, the KO has to educate the contractor on expectations.
        - definitize letter contract (yes) same as above
        - Exercise an Option (no)
        - Funding Only (no)
        - Legal K cancellation (yes) The KO must explain the government contract cancellation process to contractor.
        - Novation Agreement (yes)When the contractor changes its company name, the KO must educate the business on the additional measures to complete the process.
        - Other Admin Action (no)
        - Representation (yes) When a contractor changes its business size and business category, the KO must educate the contractor on requirements to the government based on the category and size of the business.
        - Supplemental Agreement (no)
        - Termination for Cause (yes) The KO must educate the contractor whenever the government terminates a contract.
        - Termination for Convenience (yes)
        - Termination for Default (yes)
        - Vender Address Change (yes) KO must educate the contractor when it changes its address to ensure the contractor successfully completes all steps necessary.
        - Vendor DUNS Chane (yes) same as above

- Task 413: Prepare for Deployment
    - There is not enough information in the data set to determine when the action will occur.

APPENDIX D. R CODE

R version 3.6.1 (2019-07-05)

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Platform: x86_64-w64-mingw32/x64 (64-bit)

```
library(dplyr)

library(ggplot2)

library(reshape2)

library(stringr)

library(ggrepel)
```

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