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Civil Engineer Company Grade Officer Training Needs Analysis for Contingency Operations

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CIVIL ENGINEER COMPANY GRADE OFFICER TRAINING NEEDS ANALYSIS FOR CONTINGENCY OPERATIONS

THESIS

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Abstract

In terms of active duty personnel, the USAF is the smallest it has ever been since its creation in 1947. With fewer personnel to accomplish essential tasks, the training of Airmen is more important than ever. Outdated and irrelevant training can lead to gaps in the knowledge of trainees. The purpose of this research was to analyze the training needs of Civil Engineer (CE) Company Grade Officers (CGOs) in the contingency environment. This was done by first conducting a Job Analysis (JA). The JA resulted in a list of 36 critical tasks and 58 important Knowledge, Skills, and Abilities (KSAs). The tasks rated most critical were those associated with presenting information to superiors, project management, construction management, and operations and maintenance. The most important KSAs included the ability to work in teams, critical thinking, time and stress management, and leadership. These results were used to create a test instrument to assess contingency job knowledge in a sample of 64 CE CGOs. The lowest scoring areas of the test included Prime BEEF concepts, joint forces, enlisted CE AFSC knowledge, contingency construction standards, general construction activities, reach-back resources, deployed leadership, project scheduling, BOS-I and SAA, contingency base types, contract types, and construction inspection. The knowledge gaps represented the training needs for CE CGOs in the contingency environment. The career field should consider the findings of this research when making decisions regarding the content of future contingency training curriculums for CE CGOs.

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Brian S. Greszler

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I. Introduction

Background

The Importance of Force Development.

The foundational importance of human capital to the national security of the United States is a central theme in the United States Air Force (USAF) strategic document set. The USAF strategic document set is a collection of documents that define who the USAF is, what the USAF does, and where the USAF is going. The collection includes: *The World's Greatest Air Force – Powered by Airmen, Fueled by Innovation*; *Global Vigilance, Global Reach, Global Power for America*; *America's Air Force: A Call to the Future*; *The United States Air Force Strategic Master Plan*; and *The Air Force Future Operating Concept*. All five of these documents communicate and build upon distinct and important topics for the national security of the United States. While the underlying purpose of each document is different, all echo a similar message; Airmen are the key to airpower. Force Development (FD) is the tool used to ensure that Airmen continue to deliver the highest quality of airpower capabilities. Air Force Instruction (AFI) 36-2201, *Air Force Training Program*, offers a formal description of FD:

> Force Development (FD) is a function of education, training, and experience, which produces adaptive, creative, knowledge-enabled Airmen. Total FD is designed to be dynamic and deliberate. It depends on underlying processes that integrate and synchronize institutional requirements and senior leader perspectives. FD processes are facilitated by inputs from functional communities,

> commanders, and individual members, but must remain focused on delivering institutional Air Force (AF) requirements. (p. 6)

Under Air Force Policy Directive (AFPD) 36-26, *Total Force Development,* it is the policy of the AF to have a FD program that provides adaptive and innovative Airmen. The AF is tasked with the design and maintenance of a FD program that produces Airmen who are prepared to accomplish the AF mission and lead in a rapidly evolving global environment. Airmen are capable of tackling the challenges associated with the uncertainty of the 21st century of warfare when they receive the training needed to improve continuously, adapt, and innovate (Department of the Air Force, 2015d). Training is a key aspect of attaining the concept of operational agility as defined by *The United States Air Force Strategic Master Plan* (SMP) (Department of the Air Force, 2015d). Agility enables the USAF to adapt its capabilities and thinking to assess the dynamic threat environment, outmaneuver adversaries, and support its national security partners. The USAF uses a systematic process called Instructional Systems Development (ISD) to plan, design, and implement training programs.

The Instructional Systems Development (ISD) Process.

The ISD process is made up of five phases: analysis, design, development, implementation, and evaluation (Department of the Air Force, 1993). The analysis and evaluation phases of the ISD process are central to this research effort and thus are given a brief overview in this introductory chapter. The ISD process in its entirety is described in detail in Chapter II. Figure 1 displays the ISD model.

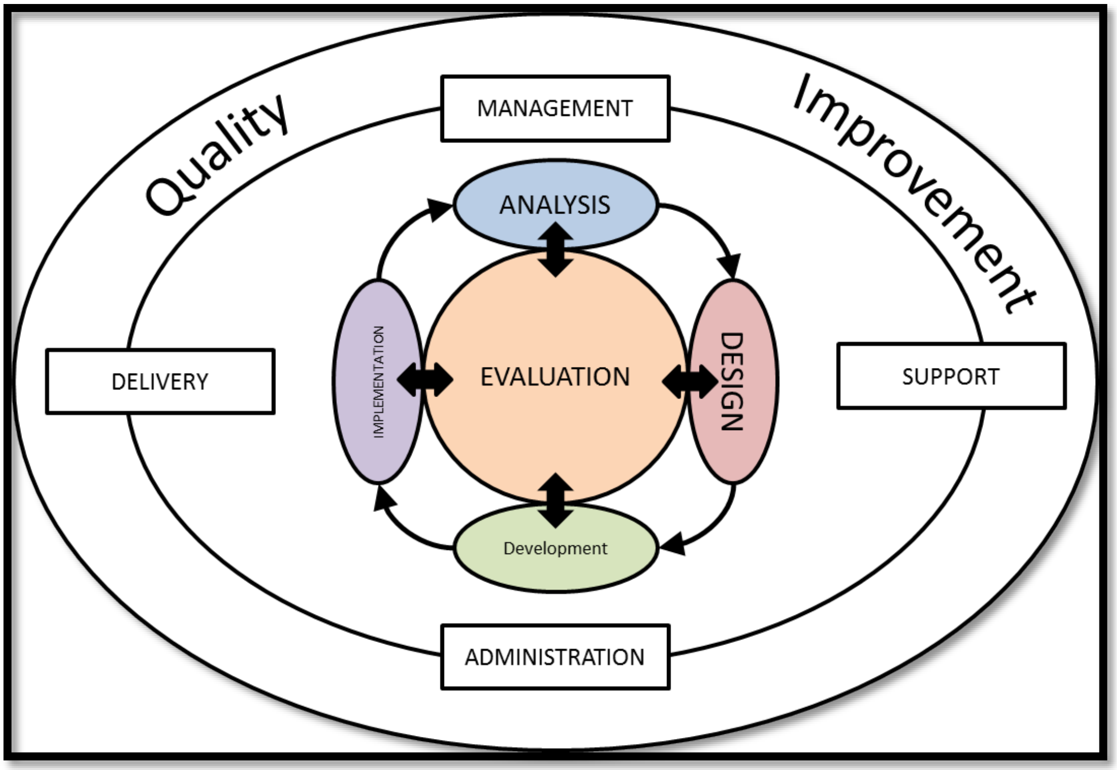


Figure 1: ISD Model

The ISD model suggests that the five phases of analysis, design, development, implementation, and evaluation are tightly coupled and that each phase is dependent on the phase that precedes it. The analysis phase is the first phase in the model; in this phase, the training requirements are defined through occupational, job, and task analyses. Moreover, a Training Needs Analysis (TNA) is conducted to determine training gaps by identifying discrepancies between the desired performance or knowledge and the current performance or knowledge (Department of the Air Force, 2002b). Evaluation is the fifth phase of the ISD model. It is important that evaluation be a central function that occurs continuously within each and every other phase of ISD. The evaluation phase seeks to enable continuous improvement to the quality of education and training. Conducting periodical personnel research such as TNA and occupational, job, and task analyses are examples of the evaluation phase being implemented throughout the lifecycle of a training system.

Personnel Research in the USAF.

Human Resource Management (HRM) is an organizational function used to maximize the effectiveness of its human capital; personnel research is a key component of HRM. HRM includes the analysis and design of work, planning of human resources, recruiting and hiring of potential employees, design of compensation and incentives, evaluation of job performance, and the design of training and personnel development programs (Noe, 2006). HRM will be discussed further in Chapter II.

USAF institutional force development research has been significantly reduced over the past 30 years. The Air Force Human Research Laboratory (AFHRL) was historically responsible for USAF force development research. AFHRL was disestablished in 1991 and its duties were transferred to the Air Force Research Laboratory (AFRL) Human Resources Directorate. The AFRL Human Resources Directorate was disestablished seven years later in 1998 (Sims, Hardison, Keller, & Robyn, 2014). Occupation specific analysis such as Job Analysis (JA) and TNA has traditionally been the responsibility of the Air Force Occupational Measurement Squadron (AFOMS). The AFOMS in its current form is organized under the Directorate of Intelligence, Operations, and Nuclear Integration/Occupation Analysis (AETC/A3/OA). The mission statement of the Air Force Occupational Analysis (OA) Program as defined by AFI 36-2623, *Occupational Analysis,* is:

> The mission of the Air Force Occupation Analysis Program is to facilitate decision-making on Air Force personnel and training programs by providing objective information concerning Air Force occupations. This is performed to optimize and support personnel utilization and training decisions, and in support of enlisted promotion decisions critical for effective employment of Airmen. (p. 2)

The organization responsible for the AF OA program has been downsized and realigned multiple times over the past two decades and its capabilities have been severely diminished. AETC/A3/OA performs evaluations of enlisted Air Force Specialties (AFS) on a three year cycle. Evaluations of officer AFSs are only performed upon special request from Air Force Career Field Managers (AFCFMs). Due to very limited resources, special requests for evaluations of officer AFSs rarely occur, instead the AFCFMs utilize their own methods to accomplish personnel research.

Data-driven personnel research such as JA and TNA has not been a priority of the USAF since the early 1990s as is evident from the elimination, downsizing, and defunding of personnel research organizations (Sims et al., 2014). In 2009, the USAF Director of Force Management Policy (AF/A1P) requested Research ANd Development (RAND) Project Air Force conduct a study to investigate if the personnel research needs of the USAF were being met. The report found that the current system of personnel research within the Air Force is lacking. It identified several issues including narrow organizational missions, inconsistent data-collection coordination, inconsistent data sharing, a lack of internal personnel research expertise, limited resources, reliance on contractors, and the potential duplication of effort (Sims et al., 2014).

Problem Statement

In terms of active duty personnel, the USAF is the smallest it has ever been since its creation in 1947 (Losey, 2014). With fewer personnel to accomplish job related tasks, the training of Airmen is more important than ever in order to maximize mission capabilities. The complexity and uncertainty of the contingency environment has never been greater as Airmen face fiscal constraints, unprecedented technological progress, and irregular threats. Unfortunately, the complex and evolving threats of the 21st century have outpaced training development (Tangney, 2012). Without a centralized AF organization conducting periodical personnel research for officers, the development of effective training programs relies on the ability of each career field to incorporate timely and relevant content into training curriculums. Outdated and irrelevant training leads to gaps in the knowledge of trainees in the execution of tasks related to their duties, both in-garrison and during contingencies. It is hypothesized that in the USAF Civil Engineer (CE) career field, Company Grade Officers (CGOs) are especially susceptible due to the volume of training received during early developmental years. Currently, the USAF does not utilize a systematic method for identifying the gaps in the contingency knowledge of CE CGOs.

Purpose and Significance

The development of the Total Force, officer, enlisted, and civilian, is a top priority of the USAF but few resources are allotted to conducting the data-driven personnel research that is critical for properly utilizing the ISD system. Force development risks being misguided and misaligned with career field needs without data-driven personnel research.

The purpose of this research is to meet the priorities and intent of the USAF Strategic Document Set and the USAF's most senior leadership by utilizing the ISD system to take a current look at the training needs of CE CGOs in the contingency environment.

Research Questions

The goal of this research is to provide verifiable and actionable recommendations for the improvement of the current mechanisms through which USAF civil engineer officers receive contingency training. The goal will be achieved by answering the following research questions:

1. **What are the most important and most frequent tasks performed by CE CGOs in the current contingency environment?**
2. **What Knowledge, Skills, and Abilities (KSAs) are needed for effective job performance in the current contingency environment?**
3. **What level of contingency job knowledge do CE CGOs possess?**
4. **What are the contingency job knowledge gaps in CE CGOs?**

Answers to the above questions will provide some evidence of the training needs of CE CGOs preparing to support a contingency mission.

Methodology

This research was conducted using a Training Needs Analysis (TNA). The TNA uses two distinct methodologies to answer the research questions.

The first methodology was a Job Analysis (JA) of CE CGOs in the contingency environment. The purpose of the JA in this research was to identify the tasks performed by a CE CGO in the contingency environment and the Knowledge, Skills, and Abilities (KSAs) related to the performance of those tasks. A Task Inventory (TI) was used for the JA. The basic steps involved in a TI are: (1) collect information about the job, (2) create a list of tasks and KSAs that are required to perform the job, (3) develop and administer a survey for Subject Matter Experts (SMEs) to rate the tasks and KSAs, and (4) perform statistical analysis to determine the most critical tasks and KSAs. The TI was conducted in two phases. Phase 1 was an open-ended questionnaire used to collect information about CE CGOs operating in the contingency environment. Phase 2 was a survey with Likert scaled items asking participants to assign ratings to the tasks and KSAs identified in phase 1.

The second methodology was the design, administration, evaluation, and analysis of a job knowledge test. The purpose of the test instrument in this research was to provide a measure of CE CGO's knowledge of contingency tasks, engineering, and operations. A test instrument was administered to a sample of CE CGOs meeting the requirements of the population of interest. The test instrument was analyzed for reliability and validity through the use of well-established empirical and statistical methods. Finally, the results of the test instrument were used to identify gaps in the knowledge of CE CGOs in relation to the results of the JA.

Assumptions, Limitations, and Scope

This research contains assumptions and limitations that are necessary for determining the boundaries of this research. The assumptions and limitations are identified and described in the following paragraphs.

Assumptions.

This research assumes that all CE CGOs have a similar level of job knowledge and recognizes that there are factors such as years of service and deployment experience that can influence levels of job knowledge. The research design will attempt to control for these contributing factors.

Limitations.

Job knowledge is only a single facet of effective job performance. This research will not seek to test other important facets of effective job performance such as psychomotor skills, cognitive ability, social skills, emotional traits, and job-related attitudes (Hunter & Hunter, 1984). Furthermore, the possession of knowledge does not guarantee successful performance (Goldstein, 1991). The test instrument did not seek to predict actual performance of a CE CGO in the contingency environment and any subsequent use of the same test instrument should not be used as such.

The task inventory and job knowledge test was exclusively administered in computer-based forms. Ideally, the task inventory and job knowledge test would be given in both computer-based and pencil-and-paper form to determine test equivalence between the administration methods (Kline, 2005). The comparison between computer-based and pencil-and-paper forms was not conducted during this research.

The process of developing and evaluating any psychological test is very time intensive. The most widely used assessments in academic, employment, clinical, and research settings have been continually evaluated and refined over the course of many years leading to high measures of validity and reliability. The amount of time available for the completion of this research placed a limit on the development and evaluation of the job knowledge test created for this research.

Scope.

In the contingency environment, engineer support to the commander, Air Force Forces (COMAFFOR) is primarily delivered through Prime Base Engineer Emergency Force (BEEF) and Rapid Engineer Deployable Heavy Operational Repair Squadron Engineer (RED HORSE) forces. The majority of deployment taskings for CE CGOs are in support of a Prime BEEF mission. This research will focus solely on the tasks performed by CGOs in support of a Prime BEEF contingency mission and the KSAs needed in the performance of those tasks.

The extent of the results of the job analysis and the test instrument are based on the availability of a sample that is representative of the target population. For the job analysis, the target population is subject matter experts with expertise in the area of contingency engineer operations. For the job knowledge test, the target population is CE CGOs, primarily those that have graduated from WMGT 101, *The Civil Engineer Basic Course*. The geographical location of this research was extended worldwide through the use of electronic communications for the distribution of the research instruments. The generalizability of this research was restricted to a current snapshot in time of the contingency environment and the training mechanisms used in the career field. This research does not attempt to be predictive of the nature of future conflicts that CE CGOs may be involved in or of any planned evolutions of the primary training mechanisms.

Summary

This introductory chapter provided a brief background of the problem, the problem statement, the purpose and significance of the research, and the specific research questions. The methodology was outlined, and the assumptions, limitations, and scope of this research were given. The rest of the thesis will be presented in a seven-chapter format. Chapter II will give a literature review of the CE mission, the contingency environment and how it has changed, previously accomplished research, current CE training mechanisms, Human Resources Management (HRM), the Instructional System Development (ISD) process, Training Needs Analysis (TNA), Job Analysis (JA), and psychological testing. Chapter III will describe the job analysis technique used and will be followed by analysis and results in Chapter IV. Chapter V will describe the job knowledge test used with the results and analysis of the test given in Chapter VI. Chapter VII will offer conclusions and recommendations.

II. Literature Review

Chapter Overview

The purpose of this chapter is to provide a review of the relevant literature pertaining to this research. First, the USAF strategic document set will be expanded upon from Chapter I. Next, an overview of Human Resource Management (HRM) will be given followed by an explanation of the Instructional System Development (ISD) model. After the ISD model is discussed, Training Needs Analysis (TNA) will be reviewed. A brief section discussing the concept of training will follow the review of TNA. The two primary components of the TNA used in this research, Job Analysis (JA) and psychological testing, will then be described. The role of the Air Force civil engineer will then be detailed followed by the previously completed research in the area of Air Force civil engineer training. Then, changes in the contingency environment for Air Force civil engineers will be discussed. Last, the current contingency training programs for Air Force civil engineer officers will be described.

The United States Air Force Strategic Document Set

As previously mentioned, the USAF strategic document set is a collection of five overarching documents that state who the USAF is, what the USAF does, and where the USAF is going. This set of documents can be grouped into three categories based on what is outlined in each document. The categories are vision, mission, and strategy. Each category will be briefly described in this section. Additionally, the specific content that is relevant to the development of human capital will be highlighted.

Vision.

The first document is *The World's Greatest Air Force – Powered by Airmen, Fueled by Innovation* (Department of the Air Force, 2013b). This document provides the USAF with a vision of global vigilance, global reach, and global power. It describes the importance of airpower to the national security of the United States and introduces the core missions of the USAF as: air and space superiority; intelligence, surveillance, and reconnaissance (ISR); rapid global mobility; global strike; and command and control. This document recognizes the power of Airmen and the criticality of education and training in the execution of the five core missions:

> Education and training are the foundation of our airpower advantage. To maintain this advantage in the future, we must safeguard and reinforce that foundation. All Airmen, whether teacher or student, have a role in ensuring that we remain the most technically proficient, best-educated, and best-trained air force in the world. (p. 1)

Mission.

The second document is *Global Vigilance, Global Reach, Global Power for America* (Department of the Air Force, 2013a), and this document further describes the core missions of the USAF and how the capabilities of its Airmen and weapon systems enable global vigilance, global reach, and global power. Air and space superiority is the ability to control air and space, freeing it from threats so that the joint forces can operate in the air, on the ground, and at sea. ISR utilizes manned and unmanned aircraft, satellites, and other technologies to collect, exploit, and disseminate information. Rapid global mobility is the ability to quickly deliver equipment and personnel and provide aerial refueling anywhere in the world. Rapid global mobility provides access to distant, remote, and austere locations both in peaceful and contested environments. Global strike is the ability for worldwide, rapid, and flexible direct combat strike. Global strike includes both nuclear and conventional strike and can be initiated from home soil or from forward operating locations. Lastly, command and control is how the other four core missions are coordinated and directed. Command and control is the ability to conduct operations using centralized command, distributed control, and decentralized execution. The critical importance of the Airman across these mission sets are again highlighted:

> The effectiveness of Air Force airpower comes directly from the power of Airmen. While it is natural to define the Air Force in terms of its aircraft, missiles, or satellites, in reality, the Service's unmatched capabilities exist only and precisely because of the imagination, innovation, and dedication of its people. (p. 3)

Strategy.

The third category of the strategic document set is strategy and includes three documents. These documents form a strategic framework for the future of USAF operations. The three documents are: *America's Air Force: A Call to the Future* (Department of the Air Force, 2014b); *The United States Air Force Strategic Master Plan (SMP)* (Department of the Air Force, 2015d); and *The Air Force Future Operating Concept (AFFOC)* (Department of the Air Force, 2015b).

America's Air Force: A Call to the Future highlights the national security challenges of the future and how they will be met by leveraging the capabilities of Airmen. A highly uncertain environment is noted as of the national security challenges in which the USAF operates. The USAF will combat this uncertainty with strategic agility and inclusiveness. Strategic agility includes all of the attributes of flexibility, adaptability, and responsiveness and applies equally to both how airpower is delivered, the weapon system, and who is delivering it, the Airmen. Inclusiveness speaks to the strengths derived from the necessity of teamwork. Teams in USAF are diverse in both culture and thought (Welsh, 2015). Diversity provides the opportunity for unique solutions to be proposed to solve unique problems and challenges. The ability of the USAF to develop its Airmen or human capital and encourage inclusiveness is imperative for successfully meeting the challenges of the future. Human capital is defined as the total inventory of skill, experience, knowledge, and capability found in an organization and its people (Department of the Air Force, 2015b). This direction of agile human capital is summarized in *America's Air Force: A Call to the Future* in the form of a strategic vector to ensure a full-spectrum capable, high-end focused force. This vector is given guidance, goals, and objectives in *The United States Air Force Strategic Master Plan (SMP).*

The SMP is a long-range strategic plan that provides direction for the strategic vectors identified in *America's Air Force: A Call to the Future*. The direction outlined in the SMP is given actions, initiatives, and priorities though the use of four annexes. Each annex provides actionable steps for achieving the USAF strategic vision. The Human Capital Annex (HCA) provides initial direction for functional leadership in the execution of force development by focusing on the Airmen and the organization. Specific objectives with near, mid, and far timeframes are described in the HCA. The objectives of the HCA are met by ensuring "that our human capital management programs are focused and integrated to resolve strategic human capital gaps related to emerging missions based on the changing characteristics of future warfare, and our effort to transition to a more agile Air Force" (p. A-6). The SMP reiterates the importance of education and training:

> Although the Air Force faces an extended period of drastically constrained resources, the imperative to train and employ combat power with agility and resolve remains paramount. Airmen will rise to these challenges when they receive the trust, training, and doctrinal flexibility needed to improve and innovate. (p. 16)

The last document in the strategic document set is *The Air Force Future Operating Concept (AFFOC)*. The purpose of this document is to provide the context for *America's Air Force: A Call to the Future* and the SMP by offering a snapshot of USAF operations in 2035. The AFFOC serves primarily as a force development concept that gives the SMP a goal to achieve. By describing what the future force should look like in 2035, a target is set and force development can be guided to achieve that outcome. The AFFOC identifies six trends that will shape the future force: (1) adversaries' acquisition and development of capabilities to challenge the U.S.; (2) increasing importance or frequency of irregular, urban, humanitarian, and intelligence operations; (3) increasing challenges to deterrence; (4) energy costs; (5) exploiting new technology opportunities; and (6) challenges of climate change. These trends are present within a future environment that is increasingly challenging, uncertain, and complex. The central concept for meeting the challenges of the future is agility. Agility is a function of flexibility, speed, coordination, balance, and strength. Agility is an attribute of systems but more importantly, of people. The readiness of Airmen remains the key enabler of airpower, even in 2035. The AFFOC closes with this statement:

> The current Air Force must design, plan and implement tangible decisions if it wishes to organize, train, equip, and provide future AF forces akin to those described in this concept. Airmen will accomplish this transformation iteratively through the strategy, planning and programming process, updating and revising their approaches and priorities as required. Along the way there will be surprises, course corrections, and emerging opportunities, but there is no time to lose: positive action is needed now. (p. 38)

Human Resource Management (HRM)

The Air Force must have an effective and robust Human Resource Management (HRM) program in order to develop agile Airmen capable of providing the necessary airpower to combat future threats. HRM is defined as the policies, practices, and systems that influence the behavior, attitudes, and performance of the members of an organization (Noe, 2006). HRM functional areas include job analysis, recruitment and selection, training and development, performance management, and compensation. The effective use of HRM directly relates to individual and organizational performance (P. M. Wright, 2002). This section will briefly describe each HRM functional area listed above. The analysis of jobs, training, and development will be given a more thorough review in subsequent sections of this chapter.

Job analysis is the process of getting detailed information about a job (Noe, 2006). Job analysis is a critical function of HRM because every other function utilizes the information that results from job analysis. The information obtained from a job analysis can be categorized as job descriptions or job specifications. A job description is a list of the tasks, duties, and responsibilities related to a job. A job specification is focused on the human attributes, in the form of Knowledge, Skills, and Abilities (KSAs), required to perform a job. While many different interpretations of knowledge, skill, and ability exist in the field of organizational psychology, Goldstein's (1991) formal definitions will be used for this research.

> Knowledge refers to an organized body of knowledge, usually of a factual or procedural nature, which if applied makes adequate job performance possible. Knowledge is the foundation upon which skills and abilities are built. (p. 531)

> Skill refers to the capability to perform job operations with ease and precision. Most often, skills refer to psychomotor activities. (p. 531)

> Ability refers to cognitive capabilities necessary to perform a job function. Most often, abilities require the application of some knowledge base. (p. 531)

Job analysis information can come from many different sources and many methods exist for getting this information. Job analysis will be discussed further in a subsequent section of this chapter.

Recruitment is any process or activity associated with finding candidates for potential employment. The goal of recruitment is to give an organization a large pool of reasonably qualified potential employees to select from. Selection is the process through which an organization identifies the employees that will be the best match for employment. Many selection methods exist, and the chosen method should be reliable, valid, generalizable, practical, and legal (Noe, 2006).

Training is a deliberate and planned effort to facilitate the growth of job-related KSAs. Effective training programs rely on the use of a systematic approach for their design. Instructional System Development (ISD) and the ADDIE model (Analysis, Design, Development, Implementation, and Analysis) are widely used processes to designing training. Often, a Training Needs Analysis (TNA) is the first step in the training design process. Training and the development of personnel, including ISD, the ADDIE model, and TNA will be described in later sections of this chapter.

Performance management is the method an organization uses to measure, evaluate, and develop performance. Measurement and evaluation differentiate between excellent, average, and poor performers. The goal of performance management is to ensure that employee output meets organizational goals. Another goal of performance management is to provide guidance for weak or average performers and encourage excellent performers to maintain their level of performance. Performance management can take place through official documented appraisals or informal feedback sessions. The purpose of performance management can be strategic, administrative, or developmental (Noe, 2006).

Compensation refers to how an employee is paid, rewarded, or otherwise benefits from employment. Employees are the largest cost for most organizations and the process of determining compensation should be given close attention. Compensation has also been shown to influence levels of motivation and workplace attitudes and is an important factor in overall job performance (Noe, 2006).

HRM is an evolving field that must keep pace with the changes of the work environment. The challenge that any organization faces when implementing HRM includes global economic development, global communication, the rapid immergence of new technology, growing trade, and the increasing availability of outsourced labor (Tarique & Schuler, 2010). The human capital of an organization is a key to overcoming the challenges of the 21st century work environment. Seventy-one percent of CEOs cite human capital as the source of their organization's sustained economic value (IBM, 2012). The HRM functions that an organization invests the most resources in should be aligned to grow human capital. Many HRM departments spend the majority of their time on day-to-day functions such as administrative tasks and recording keeping. The challenges of today necessitate HRM should shift its focus to functions with higher strategic value, especially those that directly grow human capital such as training and development (Noe, 2006).

Instructional System Development (ISD)

Instructional System Development (ISD) is the official methodology used by the United States Air Force for developing education and training programs. ISD is formally defined as a deliberate and orderly but flexible process for planning, developing, implementing, and managing instruction systems (Department of the Air Force, 1993). ISD is also identified as Instructional Systems Design (ISD), the Systems Approach to Training (SAT), and Instructional Design (ID) (Swain, 2005). This research will refer to the concept using the USAF's chosen nomenclature of Instructional Systems Development. The Air Force ISD model is made up of system functions, ISD phases, and quality improvement. The overall model can be found in Figure 1 (shown on p. 3). Each component of the Air Force ISD model will be described in this section using Air Force publications with support from other academic literature

The ISD system functions are management, support, administration, and delivery. Air Force Handbook (AFH) 36-2235v1, *ISD Executive Summary for Commanders and Managers*, gives a definition for each function. "Management is the function of directing or controlling instructional system development and operations" (p. 5). An example of management is the instructional leadership and staff involved in a training program. The activities of management include planning, organizing, coordinating, evaluating, and reporting. "Support is the function of maintaining all parts of the system" (p. 5). An example of support is the resources needed to keep tools and equipment functioning. The activities of support include supplying, maintaining, producing, constructing, and providing. "Administration is the function of day-to-day processing and record keeping" (p. 5). An example of administration is documentation, student assignments, and student records. The activities of administration include providing documents, maintaining records, processing students, scheduling resources, and monitoring resources. “Delivery is the function of bringing instruction to students” (p. 5). An example of delivery is instructors, computers, guides, training aids, instructions, and textbooks. The ISD system functions are essential to the overall instructional system and facilitate each phase of the ISD model. All phases of the ISD model occur within the bounds of the system functions.

ISD utilizes what is commonly referred to as the ADDIE model or framework (Bichelmeyer, 2004). The five phases of the ISD model are Analysis (A), Design (D), Development (D), Implementation (I), and Evaluation (E) (the inner circle of Figure 1). The first four phases of the ISD model build upon the outputs and are dependent on the completion of the preceding phase but feedback can occur between phases at any time. Feedback between phases is necessary to minimize the compounding of errors that could occur from one phase to the next. The fifth phase is evaluation and is what drives feedback throughout the ISD process (Department of the Air Force, 2002a).

The first phase of the ADDIE model is analysis and begins the instructional design process with various forms of occupational analysis. The purpose of the analysis phase is to determine if some sort of instruction is necessary. A Training Needs Analysis (TNA) is typically conducted during the analysis phase. A training or instructional need is a lack of the knowledge, skills, or abilities necessary to perform a task adequately (Department of the Air Force, 2002a).

The second phase of the ADDIE model is design. During the design phase, instructional designers determine what will be taught, how the material will be presented, and how learning will be measured. The design phase serves as a blueprint for the development of the training program by outlining the goals, objectives, and evaluation tasks (Hodell, 1997).

The third phase of the ADDIE model is development. In this phase, the training program begins to be realized in physical form. Major elements of the development phase include the preparation of training materials, lesson plans, and assessments. The development phase should produce a course syllabus or plan of instruction. At the end of the development phase, the instructional content of a course is checked for quality and final adjustments are made.

The fourth phase of the ADDIE model is implementation. The implementation phase is when the training program becomes operational. All previous phases are put into action and progress through the program is tracked. The system functions of ISD are especially important during the implementation phase to ensure the course is being executed effectively and as designed.

The final phase of the ADDIE model is evaluation. As previously stated, evaluation occurs during every phase and throughout the life of a training program. Evaluation can be formative, summative, or operational (Department of the Air Force, 1993). Formative evaluation occurs during the initial development of a training program and is focused on the individual components of each phase of the ADDIE model. Summative evaluation occurs during the first couple of iterations of a training program implementation and is focused on performing a check on how well the entire system is working together. Operational evaluation occurs when a training program has been implemented for some period of time and is focused on continuous improvement of the program. Operational evaluation can occur internally or externally. Internal evaluation occurs within the context of the school environment. External evaluation takes a look at how effective the training program is in relation to actual job performance (Department of the Air Force, 1993).

The last component of the ISD model is quality improvement. Quality improvement is defined as the continuous, organized creation of beneficial change to the system (Department of the Air Force, 1993). Quality improvement encompasses the entire process to signify that it takes place constantly and permeates every aspect ISD. Quality improvement comes from the structured and organized evaluation of each phase of the ISD process. Quality is determined by the individuals being trained with the ultimate goal of producing effective job performance. A valuable tool for evaluation and quality improvement is the Training Needs Analysis (TNA) which will be described in the next section.

The ISD model is not without criticism. The ISD model is more than 40 years old and many have questioned its utility in the 21st century. Hannum (2005) argues that most criticisms stem from the implementation of the model rather than the model itself and that those who are unsuccessful with the ISD model do not understand its underlying principles. Those critical of the ISD model describe it as too linear and not flexible enough for today's complex work environment. Hannum likens this approach of ISD to "painting by numbers" which doesn't produce art any more than a rigid view of ISD produces effective training programs. The optimal way to view the ISD model is not as a flowchart but as a framework that facilitates a dynamic, flexible, and multifaceted way of thinking about the instructional design process (Hannum, 2005). Another criticism of the ISD model is the necessity of expert users who have been trained and have experience using ISD in order for the model to produce high-quality training. Hannum accepts this as a valid concern and is a weakness of ISD, especially in a resource constrained environment. Many say that ISD is too slow and time consuming to meet fluid job demands. Hannum argues that timeliness issues stem from the previously mentioned rigid view of the ISD process. The ISD model is not an all or nothing approach to instructional design. The ISD model does not have to be executed by the book and can be tailored to fit the constraints of an organization. Hannum highlights the usefulness of an abbreviated job analysis or needs analysis that produce considerable amounts of information that still meet the intent of ISD. Despite the concerns with ISD, it is still widely used today by many organizations including the United States Army and USAF. The ISD model remains a valid means for guiding the development of educational and training programs if used appropriately (Hannum, 2005).

Training Needs Analysis (TNA)

Training needs are defined as the difference between the desired level of performance or knowledge and the present level of performance or knowledge (Wright & Geroy, 1992). TNA is the systematic process of identifying these gaps or needs. Additionally, TNA seeks to determine if the needs of an organization should be addressed by a training program or some other intervention (Arthur, Bennett, Edens, & Bell, 2003). The goal of a TNA is to increase the effectiveness of training and optimize the benefits of limited training resources (Department of the Air Force, 2002b). The importance of TNA is not debated; TNA is an essential component to all instructional design models including the ISD process adopted by the USAF (Kraiger, 2003; Salas & Cannon-

Bowers, 2001). Many organizations successfully initiate training programs without a TNA but the available evidence and wide-spread use of TNA suggests that it is a beneficial undertaking (Kraiger, 2003).

A TNA often occurs before a training program is designed but can occur at any time throughout the lifespan of the training program. Conducting a TNA after a training program has been implemented demonstrates a key aspect of the ISD model; the ability to return to any phase of the model for evaluation purposes. The timing of the TNA is usually dependent on the immediacy required to address the perceived need. A need can be immediate and in that case the training is remedial. Ideally, TNA should be conducted proactively (Wright & Geroy, 1992). A need can be less immediate and the purpose of the TNA is to update and maintain a certain level of knowledge. A need can also be anticipatory of some future change in the organization and the TNA will conducted when resources allow (J. Brown, 2002). There are many reasons that a TNA might be necessary including: reduction in work force, new employees, new supervisors, reassignments, promotions, performance problems, production problems, safety problems, inspection deficiencies, new technology, new equipment, mission changes, new laws or regulations, higher performance standards, business growth, or lack of basic skills (J. Brown, 2002; Noe, 2006).

The most widely used TNA process involves three types of analyses; the organizational analysis, the job/task analysis, and the individual analysis (Noe, 2006). The comprehensiveness of the TNA is largely up to the organization (Arthur et al., 2003). A TNA can consist of each analysis performed in sequence or a single analysis that makes up the entirety of the TNA. Each analysis answers different questions essential for the design of an effective training program. The USAF TNA process works within this framework of analyses but applies a generic five step model that includes determine purpose, identity data requirements, determine data collection method, collect and analyze data, and report findings (Department of the Air Force, 2002b). Other models exist, such as McClelland's (1993) eleven-step approach or Barbazette's (2006) why, who, how, what, and when approach, but are very similar to the USAF's five-step model.

The organizational analysis determines the business appropriateness of training (Noe, 2006). The overall purpose of the organizational analysis is to identify system level organizational components that affect the outcome of a training program (Salas & Cannon-Bowers, 2001). The organizational analysis focuses on factors such as organizational goals, strategic direction, available resources, constraints, and managerial support. The organizational analysis should also include outside factors that could change the direction of the organization such as changes in the demographics of the labor pool or changes in laws and regulations (J. Brown, 2002).

The job/task analysis identifies the tasks performed on the job, the conditions in which the task are performed, and the KSAs necessary to perform those tasks (Salas & Cannon-Bowers, 2001). There are four basic steps in job/task analysis. First, the job of interest needs to be selected. Second, a preliminary list of tasks is created. Third, the preliminary list of tasks is validated by subject matter expects (SMEs). Last, the KSAs necessary for job performance are identified. Job/task analysis will be discussed in detail in a later section of this chapter.

The individual analysis is concerned with the performance of employees. The data necessary for this analysis can be obtained through interviews, questionnaires, performance appraisals, or tests (J. Brown, 2002).

Training

Training can be defined as the systematic acquisition of attitudes, concepts, knowledge, and skills (Goldstein, 1991). A training program is a planned training activity or collection of activities related to the work environment. Training can occur in the classroom, on-the-job, or in a simulation that replicates actual job environments (Goldstein, 1991). The purpose of training is to increase the job performance of individuals, teams, or organizations. In doing so, training facilitates the achievement of short-term and strategic organizational goals (J. Brown, 2002). Training is not a panacea for organizational problems and should not be used as a reward or performance incentive. Training programs should be designed and implemented with a clear view of how the training will benefit the individual, team, or organization. Training is a significant financial investment for organizations. The USAF is estimated to have spent 3.3 billion dollars on training and recruiting in 2015 (Office of Management and Budget, 2015). Most organizations do not assess training in terms of financial benefits, making it difficult to understand the value of training (Aguinis & Kraiger, 2009). An organization can recognize the value of training by gaining an understanding of the elements of training that will lead to an effective program. The design of training, the delivery of training, and the evaluation of training are all factors that can influence the effectiveness of training (Aguinis & Kraiger, 2009).

The design of training includes ISD, needs analysis, and understanding factors influencing training motivation. ISD and training needs analysis are discussed in other sections of this chapter. Colquitt et al. (2000) conducted a meta-analysis and produced a model of factors that influence training motivation. The model included individual characteristics as well as work environment characteristics. Individual characteristics included trainability, cognitive ability, basic skills, self-efficacy, attitude, job involvement, organizational commitment, career exploration, personality, conscientiousness, goal orientation, anxiety, and age. Work environment characteristics included organizational climate, opportunity to perform, organizational justice, and the context of teams. Both individual and work environment factors were found to affect training efficacy.

The term delivery of training refers to the instructional methods used to conduct training. The specific methods for training vary widely from traditional classroom instruction to computer based self-study. An increasingly common method for training is computer based and is reflective of the pervasiveness of technology in the majority of jobs today. Regardless of the specific method chosen, instructional methods for training should: (1) present relevant information or concepts; (2) demonstrate why the KSAs need to be learned; (3) provide opportunity to utilize new knowledge and practice new skills; (4) provide opportunities to observe and interact with others; (5) encourage and aid the commitment of training content to memory; (6) are properly coordinated and arranged; and (7) provide feedback during and after training (Kraiger, 2003; Noe, 2006).

The evaluation of training has historically followed Kirkpatricks's four levels of evaluation but more modern methods for training evaluation have been developed

(Kraiger, 2003). The common characteristic of most training evaluation methods is the focus on outcomes. Training outcomes can be cognitive based, skill based, affective based, specific results based, or financially based (Noe, 2006). Cognitive-based outcomes are a measure of acquisition of knowledge. Skill-based outcomes are a measure of behavior or skills. Affective-based outcomes are a measure of motivation, attitude, or commitment. Results based outcomes are a direct measure of job data such as reduction in errors, rework, or accidents. Financially based outcomes are a measure of return on investment, typically in the form of cost-benefit analysis (Noe, 2006). In order to evaluate the effectiveness of training, an organization must determine which training outcomes best represent its strategic priorities.

Job Analysis (JA)

Job analysis plays a critical role in HRM and is a key source of information for every function of HRM, including the training and development of personnel (Noe, 2006). It is important to first define what a job is before discussing job analysis. In the context of this research, a job is a collection of tasks, responsibilities, and duties that are sufficiently similar to be covered by a single job title (Harvey, 1991). This is in contrast to an occupation which is the summation of jobs that a person does. Job analysis is then, at the most basic level, the process of getting detailed information about jobs (Noe, 2006). Job analysis has been further defined in numerous ways. The Society for Human Resource Management (SHRM) defines job analysis as, "the systematic process of gathering and examining and interpreting data regarding the specific tasks comprising a job" (p. 60). The U.S. Office of Personnel Management (OPM) offers a similar definition, "job analysis is the systematic method for gathering, documenting, and analyzing information about the content, context, and requirements of a job" (p. 39). For the purposes of this research, job analysis will be used as a general term that describes a wide range of activities involving the systematic study of work activities and worker attributes (Sackett & Laczo, 2003). The purpose of this section is to provide an overview of job analysis by describing the facets of job analysis, the value of job analysis to training development, and discuss the most popular methodologies for conducting a job analysis.

The Facets of Job Analysis.

There are generally four facets of all job analyses: (1) the type of information to be collected, (2) the source of job information, (3) the method of collecting information, and (4) the level of detail to be observed in the analysis (Sanchez & Levine, 2001).

The type of information collected can be classified as either work-oriented or worker-oriented. Work-oriented job analysis focuses on the observable, behavioral aspects of a job. Work-oriented job analysis seeks to describe job activities and the work environment (Sanchez & Levine, 2001). Worker-oriented job analysis focuses on the characteristics of the people performing the work. Worker-oriented job analysis seeks to identify the Knowledge, Skills, and Abilities (KSAs) required for successful job performance.

The information for a job analysis usually comes from either job incumbents or supervisors, both of whom have extensive experience with the job of interest. Other sources of information include customers, job analyst specialists, psychologists, or published literature. Sources of job information should be selected based on the qualification of being a Subject Matter Expert (SME). The basic minimum conditions for being a SME is that the person should have direct, relevant, and timely experience with the job so that they are familiar with the majority of the tasks involved (Harvey, 1991).

Many methods for collecting job information exist including direct observation, interviews, literature review, questionnaires, and focus groups. The method for the collection of information is determined based on the resources available to the researcher. Very little research has been done that compares the different methods of collecting job information but it is generally accepted that the use of multiple methods within a single analysis is preferred (Morgeson & Dierdorff, 2011). The level of detail given by the job analysis can also vary.

The most common level of detail is a job description or job specification. Job descriptions define the job tasks, responsibilities, functions, equipment, conditions, and/or relationships involved in a job (Sanchez & Levine, 2001). Job specifications define the human attributes required to execute the tasks and duties of a job. Job specifications can include educational, experience, or professional requirements. The level of detail in a job analysis can describe a single job or multiple jobs. A job analysis can be descriptive of a job as it is currently performed or prescriptive of how a job should be performed.

The Value of Job Analysis to Training Development.

The overall purpose of a job analysis is to build a foundation for all of the human resource functions, including the development of training programs and objectives (Royer, 2009). The results of a job analysis can provide instructional designers with the tasks performed in the job. By knowing the tasks performed in the job, the training program can be designed to prepare job incumbents to perform the job effectively (Noe, 2006). The most prominent uses of job analysis in training are in curriculum development and needs assessment. The programmatic benefits of a job analysis in the area of training include better assessed needs, more relevant courses or curriculum, and targeting the right population for training (Edward L. Levine, Sistrunk, McNutt, & Gael, 1988).

Job Analysis Methodologies.

The methodologies for conducting a job analysis vary widely and must be chosen to suit the needs of the organization conducting the job analysis. There are a number of job analysis methodologies available today, many that have evolved with the processing power of modern computers. It cannot be understated how important the intended use of job analysis data is to the method chosen. Job analysis is not a "…mechanical, off-the-shelf, routine activity. Neither is it a one-size-fits-all activity…" (p. 23) (Sackett & Laczo, 2003). A comprehensive evaluation of job analysis methods was completed in 1983 by Levine, Ash, Hall, and Sistrunk to assess the quality and practicality of available job analysis methods. The study found that the job analysis method chosen should be a function of organizational purposes and practical considerations. Three methods were identified as superior in eleven organizational purpose categories and eleven practicality categories. The three best performing methods were the Functional Job Analysis (FJA), the Position Analysis Questionnaire (PAQ), and the Task Inventory (TI) (Levine, Ash, Hall, & Sistrunk, 1983). The purpose of this section is to provide an overview of the PAQ, FJA, and TI including the benefits and criticisms of each.

Functional Job Analysis (FJA).

The Functional Job Analysis (FJA) was developed by Fine in 1948 and is primarily a work-oriented (i.e., observable aspects of a job) method that aims to create a list of structured task statements related to a job. The FJA was initially developed as a method for use in employee placement, counseling, and reporting (Fine, 1980). In the FJA method, the task is the fundamental unit of job design, job performance, and job management. The FJA defines a task as:

> A task is an action or action sequence grouped through time, designed to contribute a specified end result to the accomplishment of an objective and for which function levels and orientation can be reliably assigned. The task action or action sequence may be primarily physical (such as operating an electric typewriter), or primarily mental (such as analyzing data), or primarily interpersonal (such as consulting with another person). (p. 65-66)

The structured task statements all include the same elements. The five elements found in FJA task statements are: the action performed, the object or person on which the action is performed, the purpose or product of the action, the tools or equipment required to complete the action, and whether the task is directed or at the discretion of the worker (Cadle, 2012). An example of a structured task statement in a FJA for a registration clerk would be (Moore, 1999):

> Greets patient, briefly explains the need for information, reads question, paraphrasing if necessary, listens to answers, writes answers in appropriate place on initial or revisit interview form, rephrases if necessary to fit blanks on form, uses patients' clinic and hospital records if applicable, in order to record identifying information on forms. (p. 47)

A set of structured task statements is used to fully describe a particular job. Each set of task statements is then rated by SMEs on a number of scales according to worker functions, general educational development, and responsibility. The worker functions scale rates the level of interactions with people, data, and things. The general educational development scale rates the level of development needed to perform the tasks according to reasoning, mathematics, and language. Finally, the tasks are rated on the level of responsibility according to freedom of choices and consequences of human error (Moore, 1999).

The benefit of the FJA is that it provides very concise descriptions of the tasks associated with a job, making it a great option for use in many HRM functions. Criticisms for the FJA include the difficulty of writing the structured task statements and the large amount of time and effort required to be done correctly. Furthermore, it is recommended that FJA be conducted by highly trained job analysts, which can costly for many organizations (Cadle, 2012).

Position Analysis Questionnaire (PAQ).

The Position Analysis Questionnaire (PAQ) is a standardized questionnaire that was first developed by McCormick, Jeanneret, and Mecham in 1969. The PAQ utilizes a list of 194 worker-oriented job elements that characterizes a large portion of human behaviors found in the work environment (McCormick, Jeanneret, & Mecham, 1969). The PAQ is a popular job analysis methodology because it can be used to analyze most types of jobs or positions (McCormick, Mecham, & Jeanneret, 2001). The PAQ is organized into six divisions of worker-job interactions. Table 1 identifies, gives a brief description of each division, and provides an example of a job element.

Table 1: PAQ Overview

Division	Description	Example of Job Element
Information Input	Where and how a worker obtains the information required to perform a job.	Use of Written Materials
Mental Processes	The mental activities required to perform a job.	Coding/Decoding
Work Output	The types of responses or actions involved in a job.	Use of Keyboard Devices
Relationships w/ Other Persons	The relationships with other people required to perform a job.	Interviewing
Job Context	The physical and social environment.	Working in High Temperatures
Other Job Characteristics	All other activities, conditions, and characteristics.	Irregular Hours

Each of the job elements is rated on different measures of relevance to the job such as importance, amount of time required, extent of use, possibility of occurrence, applicability, and difficulty (Sanchez & Levine, 2001). The PAQ is scored on 32 dimensions such as use of various senses, decision making, using machines, tools, or equipment, personally hazardous job situations, regular or irregular work schedule, and technical related activities. A job profile is created from the resulting scores giving a basis for HRM decisions.

The PAQ has been extensively researched and continually updated. The PAQ is typically a reliable instrument for the purpose of employee selection and level of compensation. Criticism of the PAQ includes the need for trained job analysts to complete the questionnaire and the abstract characterizations of the job profile (Noe, 2006). The PAQ does not offer specific information on the tasks involved with a job since it is a generalized list of job elements. For this reason, the PAQ is generally not used in the development of training programs (McCormick et al., 2001).

Task Inventory (TI).

The Task Inventory (TI) is the most common method for performing a job analysis (Raymond, 2001). The TI methodology was initially developed by Cristal in collaboration with the Air Force Human Resource Laboratory (AFHRL). The TI is primarily a work-oriented (i.e., observable tasks) methods of collecting information about a job but can also incorporate worker-oriented (i.e., KSAs needed to accomplish tasks) components. In this way, the TI is a hybrid approach to performing job analysis. The TI provides detailed information about the tasks performed and can also suggest the KSAs necessary to perform those tasks (Noe, 2006). Although several different specific methods for conducting a TI exist, all follow the same general process which will be described in this section.

. The TI begins by collecting information about the job from literature review, observations, interviews, job descriptions, questionnaires, focus groups and other relevant sources. Job information can be collected from SMEs, supervisors, or job incumbents. An initial list of tasks and KSAs are prepared from the information collected. The list of tasks and KSAs are formatted into a survey and rated according to a variety of attributes including frequency, importance, time spent performing, difficulty to learn, difficulty to do, necessity upon job entry, and consequence of error (Manson, Levine, & Brannick, 2000). The task statements on the TI generally follow a form of verb or action and then the object on which the action is performed. While the TI task statements should be somewhat uniform, the task statements do not follow the rigid structure found in FJA.

The task statements can vary in level of detail, depending on how fluid a job is (Sanchez & Levine, 2001). The next step in the TI is to analyze the results of the survey. Descriptive statistics are derived for each task and KSA. If the tasks were rated using multiple attributes, a combined rating may be used (Raymond, 2001). Lastly, the ratings associated with the tasks and KSAs are rank ordered to determine which tasks and KSAs are most critical in the performance of the job.

The benefits of the TI are numerous. The TI is cost and time efficient, especially with the use of web-based content. The TI is relatively straightforward and does not require a professionally trained job analyst to perform. The results of the TI lend themselves to the development of test plans and blueprints (Raymond, 2001). The TI is also an appropriate method when the organizational purpose of the job analysis is the development of training (E. L. Levine et al., 1983). The TI also has criticisms. The task statements on the TI could be open to misinterpretation. Additionally, some scales used to rate the different attributes of tasks and KSAs can be highly subjective such as importance, difficulty, or necessity. Lastly, the key output of the TI is discrete and observable tasks. It has been argued that the TI ignores unobservable knowledge, cognitive skills, professional judgement, and other human performance related dimensions. The exact TI methodology used for this research will be described in detail in Chapter III.

Psychological Testing

Psychological assessment is concerned with the measurement of knowledge, skills, abilities, behaviors, and other qualities of human beings (Gerrig & Zimbardo, 2002). Assessments can take many forms including observations, examinations, demonstrations, surveys, questionnaires, and tests. This section will discuss the effective design and evaluation of a test as the form of psychological assessment. The steps of effective test design will be summarized and the techniques available in the evaluation of a test will be described. Measurement theory will be briefly discussed. The specific methodology used to create the test instrument utilized in this research will be detailed in Chapter V.

Design.

Constructing or designing a test instrument should follow a development process. The test development process should be systematic and well organized. The effective development of a test will help ensure that results of the test will lead to reliable, valid, and useful inferences (Downing, 2006b). The steps in this process include: identifying the purpose of the test, determining the content of the test, determining the specifications of the test instrument, designing, constructing, and writing the test items, assembling the test instrument, and pilot testing the instrument. Each step will be summarized in this section.

The first step in the design of a test instrument is to identify the purpose of the test. In identifying the purpose of a test, the construct that is being measured must be defined. A construct is another way to describe a psychological concept or synthesis of ideas that are related in a meaningful way (Kline, 2005; Patten & Bruce, 2007). Providing a definition of the construct is essential because without a definition, the construct can be interpreted differently by different people. After defining the construct, the specific purpose of the test should be determined. A test can be used for a large number of purposes including to diagnose strengths and weaknesses, measure achievement, measure aptitudes, determine readiness, or determine placement into some program or curriculum (Cohen, Manion, & Morrison, 2003).

The next step is determining the content of the test. The content of the test should be directly related to the purpose identified in the first step. The content of the test is important in demonstrating the validity of any inferences made from the results of the test. The methods for determining the content of a test can vary depending on the stated purpose. Determining the content can be a simple judgement made by the test designer or the content can stem from some other research or analysis such as task or job analysis (Downing, 2006b). The test designer must be able to defend the content that is included in the test. In general, the amount of time and resources dedicated to determining the content of a test is proportional to the consequences of any decisions made from the results of the test (Downing, 2006b).

Determining the specifications of the test is the next step in the test development process. The specifications of the test include the format of the test, the total number of test items, the number of test items for each major and minor topic within the construct, and the rules used for scoring. The format of the test can be the physical form of the test as well as the form of test items. The physical form of the test could be paper and pencil or computer based. The form of the test items could be open-ended such as essay or short answer, or selected-response such as multiple-choice, matching, or true and false. The number of total test items and the number of test items for each topic within the construct are subjectively determined by the test designer. The test needs to be long enough to adequately assess each topic within the main construct. The number of test items may also be limited by the amount of time available to test takers and administrators (Kline, 2005). The rules for scoring could be binary, weighted, or partial credit. The key that the tests are scored against should be free of error and scoring should be applied with perfect accuracy.

The next step is the design, construction and writing of the test items. Test items should be designed to meet the purpose, content, and specifications of the test as determined in previous development steps. Test item design should be some-what systematic but not so much that the test strays from the original purpose. The test items should reflect the content as determined in the second step of the development process. The content should come from a review of the relevant literature but can come from other sources as well, such as other tests, surveys, questionnaires, or from SMEs (Kline, 2005). The primary goal in constructing and writing test items is to produce effective and clear items. There are basic guiding rules to the construction and writing of test items that aid in this endeavor. Many books, articles, and web content have been written that offer information on how to write effective and clear test items. The overall quality of test items is often a result of the resources available to the test designer. These resources can be professional training, review, or editing. A lack of resources can result in poor-quality, flawed, or low cognitive level test questions (Downing, 2006b). The design, construction and writing of test items is a challenging task but one that is essential for the overall utility of the test instrument.

After the test items have been written, they need to be compiled and arranged in a logical manner and according to the format determined in the specifications step. The position and location of the correct answer is important to consider when assembling the test items. A relatively equal frequency of correct response options should be used with no distinguishable pattern to the actual correct response (Downing, 2006b). The incorrect or distractor responses should be plausible and similar in structure to the correct responses and the other distractors (Kline, 2005).

The final step in the design of the test instrument is pilot testing. Pilot testing provides important information to the test designer about the test instrument. The information gained from pilot testing includes item clarity, test duration, and other feedback about the overall format, structure, and presentation of the test instrument. A pilot test gives the test designer the opportunity to modify the test instrument before it is administered (Kline, 2005).

Evaluation.

The evaluation of a new test instrument involves determining reliability and validity. This section will describe methods for determining reliability and validity. Additionally, the effects of ethics and bias on reliability and validity will be discussed.

Reliability.

Reliability of a test is concerned with the extent that the test results are stable, or consistent. Reliability can be assessed in a number of ways including over time (test-retest reliability), across test items (internal consistency), or across raters (inter-rater reliability). All measures of reliability express the level of stability or consistency through reliability coefficients. Reliability coefficients are correlation coefficients used to describe reliability (Patten & Bruce, 2007). Correlation coefficients are a standardized representation of covariance. Correlation coefficients must range from negative one to positive one. A value of negative one represents a perfectly inverse relationship between variables where as a value of positive one represents a perfectly positive relationship between variables. The Person product-moment correlation coefficient, represented by the symbol r, is the most widely used correlation coefficient but there are other correlation coefficients for parametric and non-parametric sets of data (Field, 2007).

Test-retest reliability is concerned with the consistency of test scores over time. In order to assess test-retest reliability, the exact same test instrument must be given to the exact same group of participants at two different times. The variance in scores from the test and retest are used to create a correlation coefficient that describes how reliable the instrument is over time.

Internal consistency is an assessment of the responses across the items and not the total scores of a test. Internal consistency compares the responses for an item or group of items to the responses for another item or group of items. Internal consistency utilizes the responses of all participants for a single administration of the test instrument. There are many different methods for finding the internal consistency of a test instrument and each varies based on the specific type of test items, availability of analysis software, and if the data is parametric or non-parametric. Cronbach's alpha (α) is the most widely used measure for internal consistency of a scale and is seen as almost synonymous with reliability (Kline, 2005).

Inter-rater reliability is concerned with the stability or consistency of responses or ratings across individuals. The simplest form of inter-rater reliability is an agreement percentage. The inter-rater agreement percentage is just the percentage of raters that gave the same response to a particular item. Another simple way of determining inter-rater reliability is to find the Pearson correlation among the response for each item (Kline, 2005). As with internal consistency, there are many different methods for determining inter-rater reliability and the method chosen is dependent on the specific circumstances and details of the test instrument.

Validity.

Validity of a test is concerned with the extent that a test measures what it is designed to measure. Validity is also concerned with determining if the inferences made from a test can be used in the area of interest (Kline, 2005). Validity is not an absolute quality; it should be seen more as a quality that exists to a degree or to a certain level (Cohen et al., 2003). Validity can be assessed externally and internally.

External assessment of validity is broken down into content and criterion methods of assessment. Generally, external assessment of validity is concerned with demonstrating the degree to which the results of a test can be generalized to some larger topic (Cohen et al., 2003). Content validity is a subjective assessment of how well a test covers the construct of interest. Face validity is a common method for determining content validity. Face validity asks test takers and SMEs to determine if the test appears to ask questions that are relevant to the construct of interest. Content validity comes from face validity and the careful construction of the test instrument by the test designer.

Another method of assessing external validity is criterion validity. Criterion validity is the degree to which the results of a test compare with some other known measure related to the construct. Criterion validity utilizes objective statistical methods to conduct the comparisons necessary to examine the relationships between the test scores and the construct of interest (Kline, 2005). Predictive validity is a form of criterion validity that aims to demonstrate that the results of a test predict another measure. An example of predictive validity would be a test designed to measure job performance. The results of the test would be compared to a real-world measure of job performance to determine the predictive validity of the test.

The other form of criterion validity is concurrent validity. Concurrent validity compares the results of two tests taken at the same time. The results obtained from the newly developed test would be compared to the results from another test that measures the same construct. Both tests are taken concurrently or with a minimal passage of time between administrations (Patten & Bruce, 2007). Predictive and concurrent validity utilize a validity coefficient to show the level of relationship between the measured variables. A validity coefficient is a form of correlation coefficient that is also utilized in measures of reliability. Correlation coefficients were described in the previous section on reliability. Correlation coefficients for measures of validity typically range from zero to positive one but could also be negative (Patten & Bruce, 2007).

Internal assessment of validity is focused on the item-to-item relationships within a test whereas external assessment of validity is primarily focused on the test as a whole (Kline, 2005). Internal assessment of validity is concerned with a number of methods that fall into the category of construct validity. Construct validity relies on both subjective and objective methods (Patten & Bruce, 2007). Construct validity utilizes a number of different techniques to assess the internal structure of a test (Kline, 2005). The objectively demonstrated internal structure of a test should be congruent with the intended or designed structure of the test.

Validity must be taken as a whole, as in a trial conducted in a court of law, the preponderance of evidence should suggest that the inferences made from test scores are valid (Kline, 2005). The evidence for validity can come from external or internal assessment. The assessment methods can be subjective or objective. The total sum of validity evidence collected about a test instrument should provide a convincing argument in order for the test instrument to be useful for the intended purpose.

Ethics and Bias.

The reliability and validity of a test can be threatened by unethical behavior and bias. It is important that the test designer maintain high ethical standards and minimize the possibility of bias throughout the entire process of designing, constructing, evaluating, administering, and analyzing a test instrument. Many organizations utilize a set of professional standards and guidelines that ensure the ethical conduct of testing and research. These professional standards and guidelines discuss a variety of ethical issues involving the test taker, the test administrator, and the testing environment (Kline, 2005). The test administrator should ensure that participants understand the purpose of the test, what the scores mean, any implications of the scores, who will use the scores, and how privacy, anonymity, and confidentiality of the scores will be maintained (Kline, 2005).

Measurement error is any variance in a measure that is not due to differences in the construct of interest. Measurement error can be random or systematic. Random error is any measurement variance that occurs due to random factors. Random error introduces variance into a test score but does not affect the mean scores (Trochim, 2006). Systematic error is any measurement variance that can be contributed to factors shared by groups of participants. Systematic error does affect mean scores. Systematic error is generally seen as a larger threat to validity because it provides an alternative explanation to the differences in a measure besides the construct of interest (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003).

Bias is a form of systematic error that is introduced by encouraging one outcome over another, either consciously or subconsciously (Merriam-Webster, n.d.). Bias can come from a large number of different sources and can vary depending on the type of research or measurement instrument. The types of bias relevant to testing include design bias, sampling bias, method bias, and reporting bias. It is important to note that group differences in test scores do not always indicate bias (Kline, 2005). In order to be useful, a test instrument should be reasonably reliable, reasonably valid, created with sound ethics in mind, and relatively absent of bias.

Measurement Theory.

Classical Test Theory (CTT), also termed True Score Theory, is a widely used and well-researched form of measurement theory. The central principle of CTT is that a raw or observed test score (X) is a summation of its true component (T) and its random error component (E). The true component of a test score is the theoretical mean score that an individual would get if the test were taken an infinite number of times. The true component represents a theoretical perfect measurement of the construct of interest. Realistically, a test cannot be administered an infinite number of times and there are no perfect measurements and that is why several assumptions must be made when using CTT. Domain sampling theory is the assumption that the test items on an instrument are only a small sample of the total universe of possible test items that could be written. Another assumption of CTT is that the random error component (E) is normally distributed with a mean of zero when found over an infinite number of test iterations and that the random error component is non-systematic or correlated with the true component (T) in any way. This assumption simplifies the central equation of CTT, which is essential to determining the item of interest, the true component (T). The simplified equation is the variance of the true component (T) is equal to the raw or observed test score (X) multiplied by the reliability of the test instrument. The reliability of the test instrument can be estimated through methods as previously described (Kline, 2005).

Modern test theory is generally referred to as Item Response Theory (IRT). IRT is a powerful but resource intensive way of analyzing test instruments. IRT seeks to address the limitations of CTT through the use of robust statistical computations and analyses (Kline, 2005). IRT differs from CTT mainly by focusing on the item-to-item relationships and response patterns of a test. The central concept of IRT is that an individual response to a given test item is related to some characteristic of the test taker that is attempting to be measured by the test. A number of IRT models exist and are used for a variety of different purposes.

The Air Force Civil Engineer

Joint Publication (JP) 3-34, *Joint Engineer Operations*, is the joint doctrine document that gives authoritative guidance on the planning, command and control, execution, and assessment of joint engineer operations. JP 3-34 describes the fundamentals of joint engineering including the role of engineer support in joint operations, engineer support throughout the range of military operations, and the three primary engineer functions.

The role of engineer support in joint operations is to facilitate the freedom of action necessary to meet mission objectives. Freedom of action occurs from the modification, maintenance, understanding of, and protection of the physical environment.

Engineer support is needed throughout the range of military operations including major operations, engagement, cooperation, and deterrence operations, security cooperation, forward presence and force protection, nuclear operations, homeland operations, crisis response, foreign humanitarian assistance, and other contingency operations. A large number of forces are required to conduct these operations, which necessitates infrastructure, lines of communication (LOCs), and bases to support these forces, all of which require engineer support.

Engineer support is provided through three primary engineer functions: combat engineering, general engineering, and geospatial engineering. Combat engineering is the capabilities and activities related to the maneuver and close support of land combat forces. General engineering is the capabilities and activities related to the modification, maintenance, and protection of the physical environment. Geospatial engineering is the capabilities and activities related to the understanding and portrayal of geographic locations and characteristics (Department of Defense, 2011). Figure 2 gives an example of the activities associated with each primary engineer function.

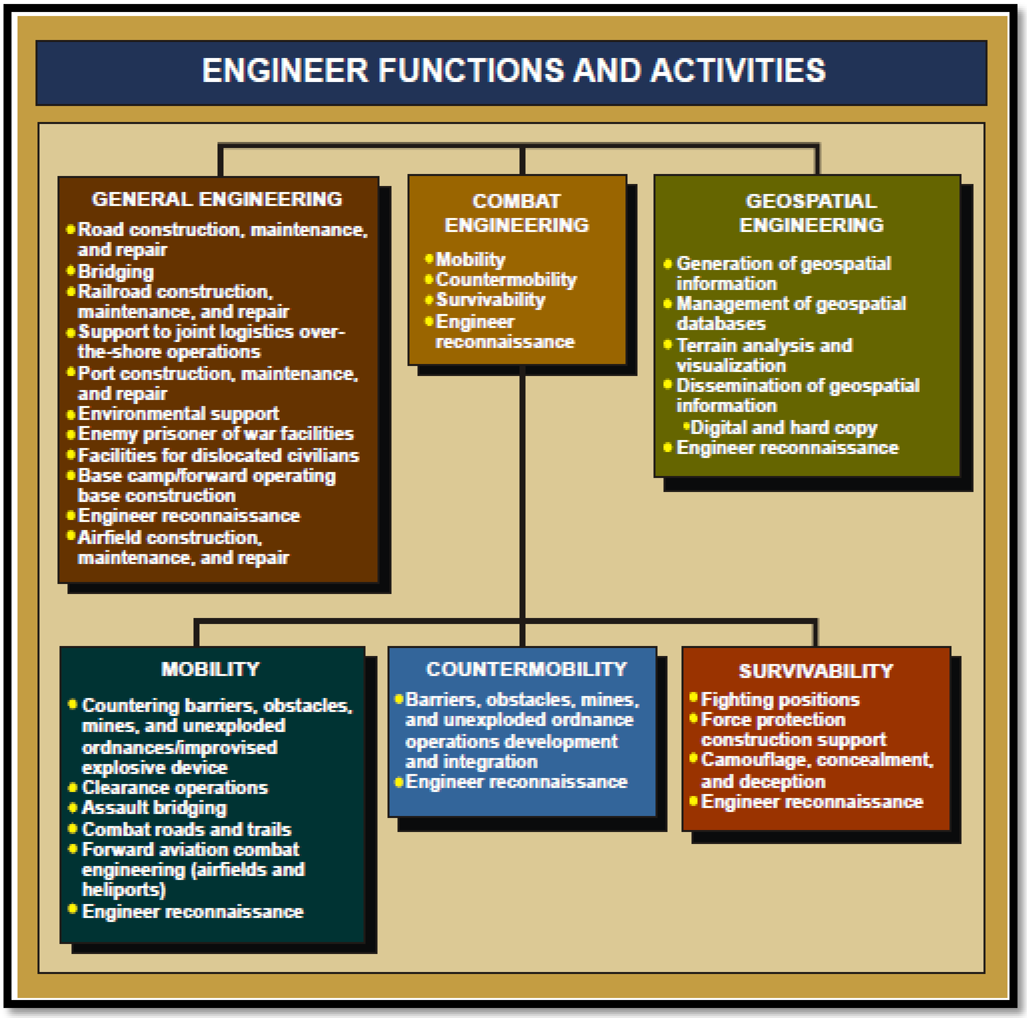


Figure 2: Military Engineer Functions and Activities as shown in JP 3-34

JP 3-34 describes the functions performed by each Service component. The primary role of the Air Force civil engineer is to enable rapid global mobility for airlift, bombers, fighters, and to support other manned or unmanned aerial weapon systems (Department of Defense, 2011). The Air Force engineer's expertise is primarily in general engineering and geospatial engineering but can perform some combat engineering activities (Department of the Air Force, 2014a). The role of the Air Force engineer, specifically in the contingency environment, will be discussed in this section.

The United States Air Force (USAF) civil engineer provides a vast array of installation and expeditionary engineering support functions for the Air Force and joint units, both home station and in the contingency environment. In the contingency environment, engineer support to the commander, Air Force forces (COMAFFOR) is primarily delivered through Prime Base Engineer Emergency Force (BEEF) and Rapid Engineer Deployable Heavy Operational Repair Squadron Engineer (RED HORSE) forces. Prime BEEF and RED HORSE forces have different core competencies, with RED HORSE forces being the smaller and more specialized organization. RED HORSE is a self-sufficient, mobile heavy construction unit capable of rapid response and operations in a variety of environments (Department of the Air Force, 2014a). Prime BEEF teams are capable of responding to worldwide contingencies and provide the full range of engineering support. Prime BEEF teams can be organized in Expeditionary Civil Engineer Squadrons (ECES) or Expeditionary Prime BEEF Squadrons (EPBS). Currently, a hub-and-spoke configuration is utilized to support operations beyond the perimeter of a forward base (Department of the Air Force, 2014a). An Expeditionary Prime Beef Group (EPBG) is the central element if no expeditionary RED HORSE squadron (ERHS) is attached; otherwise the central element is the Expeditionary Civil Engineer Group (ECEG). See Figure 3 for a depiction of the hub-and-spoke concept.

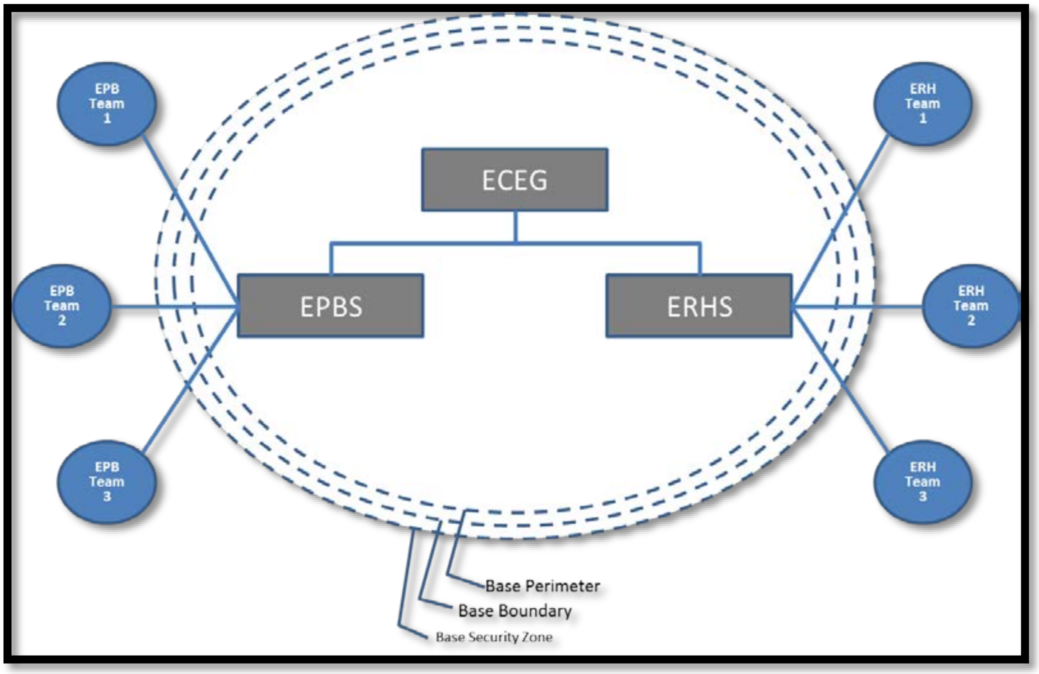


Figure 3: The Hub-and-Spoke Concept as shown in AF Doctrine Annex 3-34

The Prime BEEF mission is characterized by two core competencies, expeditionary engineering and emergency services. Expeditionary engineering is made up of the tasks associated with the establishment, sustainment, and recovery of main operating bases (MOBs), forward operating bases (FOBs), and other contingency locations throughout the operational area. Emergency services include fire and emergency services (F&ES), explosive ordnance disposal (EOD), and emergency management (EM). Air Force Doctrine Annex 3-34, *Engineer Operations*, describes expeditionary engineering and emergency services:

> Expeditionary engineering focuses on force beddown, facilities and utilities construction, repair, modification, maintenance, and operation. Forces provide expertise in facilities engineering and management, water purification, operation and maintenance of mobile or fixed aircraft arresting systems, airfield lighting, heavy equipment operations, road repair and construction, force protection design and construction, light horizontal and vertical construction, shelter erection, pest

> management, environmental management, and bare base master planning, design, and contract support. (p. 14)
>
> Emergency services includes emergency management (EM), hazardous materials response, firefighting, unexploded ordnance (UXO) safing, removal and defeat of improvised explosive devices (IEDs), weapons of mass destruction (WMDs), and chemical, biological, radiological, and nuclear (CBRN) threats. (p. 19)

Additionally, Prime BEEF teams conduct base recovery after attack (BRAAT), to include airfield damage repair (ADR) and repairs to facilities or infrastructure systems.

Previously Completed Research

Previous research at the Air Force Institute of Technology (AFIT) has investigated the role of training within the Air Force Civil Engineer career field but has not done so in over a decade. The topics that previous research has covered include Prime BEEF training programs, training for enlisted AF civil engineers, training for specific areas within CE, readiness, and force protection. This section will provide an overview of previously completed research. This section will demonstrate the novelty of this research by suggesting that none of the previously completed research addresses the current training needs of Air Force civil engineer CGOs nor have previous researchers developed comprehensive test instruments.

In 1980, Kohlhass and Williams performed an investigation of the perceived adequacy of the contingency training program for civil engineering Prime BEEF teams. The primary objective of their research was to determine the contingency training requirements for Prime BEEF teams following the creation of new regulations, a new mission set, and realignment of the Prime BEEF organizational structure. Kohlhass and Williams developed and administered a questionnaire to a sample of USAF civil engineers. They concluded that the contingency training program for Prime BEEF teams was inadequate and unrealistic because the training programs that were in place did not reflect wartime taskings or cover the range of tasks that were involved with wartime contingences. Additionally, they found that training was not given a high priority or allotted the necessary amount of resources. The research conducted by Kohlhass and Williams was the first among many studies that have been concerned with training in the CE career field.

In 1984, Smith conducted research focused on the Prime BEEF Home Station Training (HST) program. Smith utilized a questionnaire to determine how much time was spent on the HST program and the method that training was delivered. Smith's research found that less than three percent of an individual's time was spent on HST and that the primary delivery method for training was hands-on.

Also in 1984, Correll performed an analysis of training needs for CE superintendents and formen. Correll's research is the first example given of a training needs analysis being performed for the CE career field. Correll used a questionnaire to collect data on the managerial skills needed for CE superintendents and formen. Factor analysis was then used to group sets of skills into a model that could be used in the development of a training program.

In 1985, Morris took another look at the perceived adequacy of Prime BEEF training. Morris again used a questionnaire to collect data from both officers and non-commissioned officers (NCOs). Morris's findings were mostly inconclusive but did determine that Prime BEEF training was perceived as adequate by the majority of the respondents. Morris noted that officers rated the training they received lower than the enlisted engineers surveyed.

Another study in 1985 conducted by Wilson looked at the perceived competence of junior CE CGOs. Wilson used a survey to collect opinion and attitudinal information from both CGOs and their supervisors on the preparedness of CGOs in the performance of job related tasks. Wilson found that time in service, source of commission, and the number of CE School courses attended significantly affected perceived competence. Additionally, Wilson's research highlighted that supervisors rated a CGO's competence significantly higher than the CGO rated their own competence.

In 1988, a pair of studies was conducted on civil engineer training. Griffin examined the training requirements specifically for effective air base battle damage assessment and repair. Griffin utilized a methodology that combined interviewing and surveying a number of SMEs. Griffin offered recommendations for future training air base battle damage assessment and repair courses. During the same time frame, Cannan completed a study on CE wartime training. Cannan focused on the knowledge gap that was compounded by the dissimilarity between peacetime and wartime tasks and the reliance on a Prime BEEF training program that was in competition with constant in-garrison operations. Cannan proposed a solution that included increased use of Indefinite Delivery, Indefinite Quantity (IDIQ) contracting mechanisms, stating their use would free up enough time for adequate levels of Prime BEEF training.

Almost a decade later, in 1997, Lawrence examined the readiness training perception levels and task self-confidence of Prime BEEF personnel. Lawrence built upon previous research on perceived self-efficacy and hypothesized that training perception levels affected task performance. Lawrence used a survey to gather data on perceived readiness and task confidence at both the individual and unit level. Lawrence's research came to the conclusion that there was a moderate correlation between training perception levels and task confidence. Again, it was found that CE officers rated readiness and task confidence lower than CE enlisted members.

Also in 1997, Gleason completed a research paper on the preparedness of Prime BEEF forces to conduct operations in the full spectrum of military operations. Gleason used interviews in addition to a literature review to conclude that contingency training adequately prepared Prime BEEF forces for both war and Military Operations Other Than War (MOOTW) but that contingency training still had room for improvement. Gleason also provided recommendations for improvement that included updating HST and Silver Flag training.

In 2001, Vaira sought to bring the CE training research stream into the 21st century with an analysis of CE officer contingency training. Vaira looked at the quantity, realism, priority and quality of the contingency training that was offered for CE officers at the time. Vaira collected opinion and attitudinal data on the three primary mechanisms for CE training, HST, Silver Flag, and the CE School, using a Likert scaled questionnaire. The timing of Vaira's research was unfortunate; the focus was on contingency operations that did not directly support a combat mission. Vaira did not know that later in 2001, the US would enter into a Global War on Terrorism (GWOT) and the contingency environment would change drastically.

In 2005, Richards completed an assessment of force protection knowledge in CE officers. Additionally, Richards performed an evaluation of the training mechanisms for teaching force protection to CE officers. Richards developed and administered a test instrument that assessed force protection knowledge and solicited attitudinal data about a number of force protection topics including training effectiveness. Richard's results suggested that the training mechanisms available did not adequately impart force protection knowledge upon CE officers.

The research completed in the area of training in the CE career field spans more than 25 years. The primary methodology for analyzing training has been the attitudinal and opinion based survey with a focus on perceived levels of knowledge, ability, or skill. It has been more than a decade since a comprehensive study has been completed on contingency training for CE officers. In the time since the last study was completed, the contingency environment has significantly changed.

Changes in the Contingency Environment

The United States has been undeniably successful at waging traditional wars. Traditional warfare is characterized as in Air Force Doctrine Document 1-1 as, "a violent struggle for domination between nation-states or coalitions and alliances of nation-states" (p. 40). Traditional wars can be further characterized by large force-on-force engagements that have a finite campaign. Winning a traditional war is defined by the defeat of adversarial military forces and the gaining and control of enemy territory (Clancy & Crossett, 2007). The United States has a large military that is well trained and equipped to fight a traditional war and has been dominant because of those capabilities. However, military conflict of the last 15 years has been more irregular than traditional. Irregular warfare is defined in AF Doctrine Document 1-1 as "a violent struggle among state and non-state actors for legitimacy and influence over the relevant populations" (p.40). Irregular warfare differs greatly from traditional warfare and presents unique and difficult challenges, especially when preparing forces to operate in a contingency environment. It is important to understand that traditional and irregular warfare are not mutually exclusive and that both types of warfare can exist in the same conflict (Department of the Air Force, 2015e). The Airmen of today need to be ready for the full spectrum of contingencies, including traditional warfare, irregular warfare, and civil support and stability operations. This section will provide a historical overview of how the contingency environment has changed for Prime BEEF engineers.

The Creation of the Prime BEEF Program.

The Prime BEEF program was created in late 1964 after the USAF was directed to develop a force capable of restoring an air base to operational levels after an emergency. This direction came after a significant shortfall of air base contingency engineering support from United States Army (USA) engineers was felt during the Korean War in the 1950s (Green, 2014). In 1965, Prime BEEF forces were deployed in support of military operations for the very first time. The first Prime BEEF contingency mission consisted of establishing beddown facilities in the Dominican Republic in support of military airlift (Hartzer, 2014). In August of the same year, Prime BEEF teams were mobilized for the first wartime deployment in Vietnam; their mission was to construct desperately needed steel and earth revetments to protect aircraft. During the Vietnam War, Prime BEEF teams would perform a number of different engineering tasks including construction of parking aprons, roads, utility systems, and a range of expeditionary facilities (Waggoner & Moe, 1985). During the same time period, Prime BEEF teams also supported disaster relief efforts in Florida and Alaska.

Pre-Gulf War.

The rollout of Prime BEEF demonstrated the USAF's ability to respond to world-wide contingencies with an engineering force focused on home base recovery and deployed force beddown (Waggoner & Moe, 1985). In the decade that followed the Vietnam War, the opportunity for Prime BEEF forces to support real-world contingencies severely declined. Prime BEEF was restructured in 1979 and again in 1983 in order to better provide the necessary wartime capabilities. The new Prime BEEF was organized to augment engineering staffs at deployed locations, provide home base support and recovery, provide rapid runway repair, provide firefighting capability, and provide bare base beddown using base support kits. Prime BEEF was rarely utilized in support of wartime contingencies during the 1980s as the United States entered into a period of Cold War. Contingency readiness was maintained during this time by participating in foreign military assistance missions and responding to natural disasters (K. Brown, 2008). Additionally, field training sites were established to train Prime BEEF teams in Base Recovery After Attack (BRAAT), Rapid Runway Repair (RRR), basic tent erection, revetment construction, emergency airfield lighting, and base denial. In 1986, the USAF created Readiness Challenge, an Air Force wide competition aimed at testing the abilities of Prime BEEF teams in the areas of RRR, revetment erection, and general construction (Hartzer et al., 2014). The creation of this competition displayed the focus of the contingency mission during the 1980s.

The Gulf War.

The contingency environment changed once again after the Gulf War started in 1990 and the Soviet Union collapsed in 1991. Prime BEEF teams were tasked with bare base beddown at locations in Saudi Arabia, where a vast tent city was quickly erected. At the same time, Prime BEEF forces were preparing bases in Turkey in support of combat operations being conducted in Iraq. Between the years of 1990 and 1991, 5,000 tents were erected and 300,000 square feet of expeditionary facilities were built (Hartzer, 2007). The experiences and lessons gained from the Gulf War heavily influenced contingency training and readiness for the CE career field in the 1990s (Hartzer et al., 2014).

Post-Gulf War.

After the Gulf War, the United States adopted a new National Military Strategy that focused U.S. military readiness on multiple, simultaneous regional conflicts rather than the large-scale conflicts of the Cold War era. Prime BEEF forces were deployed in support of a number of Military Operations Other Than War (MOOTW). During operations in Somalia, Bosnia, and Kosovo, Prime BEEF engineers were primarily used for the beddown of forces. This departure from RRR and base recovery was a result of the changes seen in the contingency environment during the 1990s and ultimately lead to the restructuring of Prime BEEF teams to reflect the focus on bare base beddown (Hartzer et al., 2014). In 2000, the first Civil Engineer Strategic Plan was published and provided five Mission Essential Tasks (METs). Among the METs was the task to provide expeditionary engineering. The Civil Engineer Strategic Plan described expeditionary engineering as:

> Engineers will organize, train, equip, provide, sustain, protect, and recover combat ready forces to support expeditionary aerospace forces requirements. These forces will beddown, provide, sustain, defend, recover, transition, reconstitute engineer capabilities, and execute base denial activities to support global aerospace power. (p. 425)

This formal description of the requirements of expeditionary engineering represented the tasks that AF civil engineers were expected to perform in a contingency environment.

The Global War on Terrorism.

The terrorist attacks by Al Qaeda operatives on September 11, 2001 began a new era of warfare for the United States. The United States immediately responded to the attacks with OPERATION Noble Eagle (ONE). ONE safeguarded the United States with air patrols ready to respond to any follow-on attacks. Additionally, ONE involved the direct recovery from the aftermath of the attacks on the World Trade Center (WTC) and the Pentagon. Prime BEEF teams were involved with both aspects of ONE. Across the country, Prime BEEF teams constructed additional force protection and operated mobile aircraft arresting systems (MAAS) for the increased number of sorties associated with the air patrols. At the WTC and Pentagon, teams offered engineering, fire, and emergency services (Hartzer et al., 2014).

The first real changes to the contingency environment came with OPERATION Enduring Freedom (OEF) and later by OPERATION Iraqi Freedom (OIF). Collectively these named operations in addition to the current operations in Southwest Asia are called Overseas Contingency Operations (OCO) but are more commonly referred to as the Global War on Terrorism (GWOT). Less than a month after the events of 9/11, the Department of Defense (DOD) published the Quadrennial Defense Review (QDR). The QDR is a mandatory review and re-balancing of the DOD strategies, capabilities, and forces and seeks to provide a way to address the Nation's threats and challenges of the present and future (Department of Defense, n.d.). Former Secretary of Defense Donald Rumsfeld's forward to the 2001 QDR described the emerging contingency environment:

> The attack on the United States and the war that has been visited upon us highlights a fundamental condition of our circumstances: we cannot and will not know precisely where and when America's interests will be threatened, when America will come under attack, or when Americans might die as the result of aggression. We can be clear about trends, but uncertain about events. We can identify threats, but cannot know when or where America or its friends will be attacked. We should try mightily to avoid surprise, but we must also learn to expect it. We must constantly strive to get better intelligence, but we must also remember that there will always be gaps in our intelligence. Adapting to surprise - adapting quickly and decisively - must therefore be a condition of planning. (p. III)

The contingency environment dictated that much of the fighting occur from forward operating bases (FOBs) where decisions and effects could be made swiftly to adapt to the uncertainty. Additionally, aircraft would need to be located where strike capabilities would exist from within and beyond the theater of operations (Hartzer et al., 2014). Throughout the GWOT, Prime BEEF forces would aid in the construction of the FOBs as well as the beddown of forces in Afghanistan, Iraq, and the surrounding countries. Engineers found two types of airbases in the region. Those in the Arabian Peninsula had decent airfields but lacked the real estate for bedding down troops and the construction of other military aircraft support facilities. The existing airbases in Afghanistan were unmaintained, damaged, and had little to no support facilities. The construction of runways, taxiways, parking ramps, sheltered maintenance areas, hangars, and other airfield support facilities was primarily carried out by RED HORSE engineers while Prime BEEF engineers built up the tent cities necessary to support the growing number of personnel involved in the GWOT.

After the initial build-up, Air Force civil engineers would sustain and support all types of contingency locations around the region, both through troop construction and by overseeing large construction contracts. As the GWOT went on, an increasing number of Air Force civil engineers would deploy as direct support to a sister service. These types of deployments were initially known as "in lieu of" taskings but would later be designated as Joint Expeditionary Taskings (JETs). The term "in lieu of" was descriptive of how Air Force civil engineers would fill capability gaps in sister service units, primarily in the United States Army. Air Force civil engineers would provide engineering design, surveying, and master planning in addition to providing engineer support for utilities, infrastructure, operations, maintenance, and construction (Hartzer et al., 2014). In 2006, General Eulberg, The Civil Engineer at the time, described the increasingly common JETs:

> Half of the folks deployed—roughly 1,500—are doing "in-lieu-of" taskings, primarily supporting mission areas that typically reside in other services, such as the Army, and doing some things that we weren't traditionally organized, trained and equipped to perform. (p. 626)

In addition to working with sister services, Air Force civil engineers would work closely with coalition partners as part of Combined Joint Task Forces (CJTFs). Air Force civil engineers would continue to support the GWOT throughout the entire duration of OIF and OEF by deploying on JETs.

In 2009, the first ever Expeditionary Prime BEEF Group (EPBG) was created. The EPBG operated using a hub and spoke model. The EPBG increased the flexibility of providing engineering support between main operating bases (MOBs), forward operating bases (FOBs), and other areas as needed while still maintaining Air Force command and control. The EPBG would provide planning, programming, design, surveying, construction management, light troop construction, and life/health/safety assessments and repairs to the joint command (Bischoff, 2015). Personnel assigned to the EPBG would operate as much smaller units that could be sent wherever and whenever they were needed, leading to Prime BEEF teams being scattered to more than 90 locations across Afghanistan. The tasks performed by EPBG personnel would cover the entire spectrum of engineering and occasionally would fall outside of core competences.

The majority of deployed Air Force civil engineers would be in support of OEF and OIF but there were smaller contingencies that occurred during the same time period. Prime BEEF teams would support humanitarian, disaster relief, and training efforts in Africa, the Pacific, South America, and North America.

By December of 2011, the last Air Force civil engineers would depart from Iraq as OIF and OPERATION New Dawn formally ended. While the presence of troops in Iraq was waning, a troop surge occurred in Afghanistan as President Obama announced that United States combat operations would end by 2014. The nearly 33,000 additional troops deployed to Afghanistan would mean that Air Force civil engineers would be needed to support the surge (CNN, 2015). In 2012, the troop surge was over but approximately 68,000 troops still remained in Afghanistan (Nordland, 2012). In addition to continuing to provide engineer support, Air Force civil engineers would contribute to the retrograde of facilities and infrastructure across the theater, an effort that would be necessary to meet President Obama’s 2014 goal. As part of the 1st Expeditionary Civil

Engineer Group (ECEG), Expeditionary Prime BEEF Squadrons (EPBS) would provide a variety of engineering capabilities in support of meeting this goal. The EPBS maintained runways by executing rubber removal and paint re-striping. The EPBS utilized a specialized team to disassemble large tension fabric structures across the theater and created small maintenance and repair teams that would be a critical lifeline to bases as their contracted operations and maintenance support departed. The EPBS would also execute light construction projects that enabled the centralization of capabilities as entire bases were retrograded. Lastly, the EPBS provided Base Operation Support (BOS) to several locations while long-term solutions were procured (Gabrielson, 2014). In December of 2014, the U.S. ended the combat mission in Afghanistan but a limited military presence would remain.

Current Contingency Environment.

Air Force civil engineers remain deployed to contingency environments around the world. In 2012, Air Force civil engineers were deployed in every geographical Unified Command Area of Responsibility (AOR) from USCENTCOM to USAFRICOM (Stanley, 2012). The areas where Air Force engineers are deployed today does not differ greatly from 2012. This section will describe the current contingency environment for Air Force civil engineers.

Following OEF, approximately 10,000 U.S. troops remain in Afghanistan in support of OPERATION Freedom’s Sentinel (OFS). OFS has two clear mission sets aimed at assisting the government of Afghanistan to be independent and self-supporting. The first is to continue the counterterrorism mission against the remaining al-Qaeda and terrorist forces in Afghanistan. The second is to Train, Advise, and Assist (TAA) under

Resolute Support (RS), the name given to the North Atlantic Treaty Organization (NATO) led mission aimed at building and sustaining the capabilities of the Afghan National Defense and Security Forces (Department of Defense, 2015). Twenty-one NATO bases still remain in Afghanistan. The RS mission is headquartered at Kabul and Bagram with four spokes in the form of Train, Advise, and Assist Commands (TAACs) located in the North, South, East, and West regions of Afghanistan (NATO, 2012). Figure 4 shows the location of each TAAC and which coalition partner is in the lead role at that location.

Figure 4: Resolute Support Mission TAACs

Large portions of the U.S. forces supporting OFS are located at these five bases. Air Force civil engineers continue to maintain airfields around the theater in addition to supporting the TAA mission. The TAA mission for engineers involves the expansion of the organic capabilities of Afghan forces to sustain their own infrastructure including the maintenance of complex utility systems, site improvements, minor construction projects, and damage repairs (Department of Defense, 2015).

In the Middle East, over 6,000 airstrikes have occurred in Iraq and Syria with aircraft being supported from airbases around the region. The combat missions against the terrorist group Islamic State of Iraq and the Levant (ISIL) are named OPERATION Inherent Resolve (OIR). OIR seeks to eliminate ISIL and the threat they pose to region and the international community (USCENTCOM, 2014). Air Force civil engineers, including the 1st ECEG and 577th EPBS, support OIR throughout the Arabian Peninsula and Southwest Asia. The 577th EPBS conducts airfield improvements, performs light construction, erects tension fabric structures, performs surveying, beddown planning, and executes a large variety of other engineering tasks in support of operations in the region (1 ECEG, 2015). CGOs hold a number of different positions within the 1st ECEG including troop construction team officer in charge (OIC), staff officer, special capabilities flight OIC, chief of project management, and project engineer (Bischoff, 2015). Expeditionary Civil Engineer Squadrons (ECESs) also exist as base-level assets; this is in contrast to the 577th EPBS which is a theater-level asset. The ECESs primarily perform base operating support (BOS) for the base they are located at. Additionally, the ECESs perform emergency management (EM), fire and emergency services (F&ES),

explosive ordnance disposal (EOD), and base recovery after attack (BRAAT) (Bischoff, 2015).

Air Force civil engineers are also supporting operations in Africa as part of Combined Joint Task Force-Horn of Africa (CJTF-HOA). The AOR of CJTF-HOA includes the countries of Burundi, Djibouti, Eritrea, Ethiopia, Kenya, Rwanda, Seychelles, Somalia, Tanzania, and Uganda (USAFRICOM, 2015). The primary mission of CJTF-HOA is to support regional efforts, ensure regional access and freedom of movement, and to protect U.S. interests in the region. CJTF-HOA engineers are prepared to execute and provide support to crisis response and contingency operations. Additionally, CJTF-HOA engineers partner with host nations to conduct training and humanitarian assistance (White, 2014).

The Pacific Theater is an extremely large and highly complex operations area where Air Force civil engineers provide support. The threats in the Pacific Theater range from traditional military powers, such as North Korea, to more irregular, such as pirates and terrorists. Air force civil engineers are deployed to locations key to maintaining stability in the area. The Pacific region is also frequently hit by natural disasters and Air Force civil engineers provide relief efforts. Air Force civil engineers are involved in large multi-national exercises in the Pacific and deploy in order to maintain readiness for contingency situations. During a recent exercise in the Philippines, Air Force civil engineers worked with joint engineers as well as Filipino engineers to construct schools (Addison, 2015).

Air Force civil engineers that are part of United States Southern Command (USSOUTHCOM) respond to crises and contingencies in Central America, South

America, and the Caribbean. In 2010, large disaster relief efforts were undertaken following an earthquake in Haiti and U.S. forces remain ready to support in the aftermath of future disaster events. The humanitarian and civic efforts in the region are also very strong. Annual exercises are conducted where the construction of schools, clinics, and water wells is supported by Air Force civil engineers (USSOUTHCOM, 2015).

Contingency Training for Air Force Civil Engineer CGOs

Contingency training for Air Force CGOs includes individual training, leadership training, and team training. The civil engineer supplement to the War and Mobilization Plan-1 (WMP-1) describes each type of training:

> Individual Training: CE operations personnel must train in wartime construction and maintenance. They must train to be innovative because of shortages of supplies, equipment, and manpower will demand it. Their training must stress flexibility and multi-skilling capabilities because casualties or unforeseen situations will demand the most from them. All CE Airmen must train on contingency skills as well as their duty AFS. Field maneuvers must tax their physical and mental limits to build stamina, to minimize wartime trauma, and to acquaint them with the fog of war. Personnel must receive training on all tasks they could reasonably be expected to perform in wartime. They should receive task training in any AFS that they may be assigned to as substitutes. CE personnel must train for all conceivable missions in all kinds of weather and climate. They must train for the full spectrum of war, from low-intensity conflict to theater warfare. (p. F-1)
>
> Leadership Training: Officers, SNCOs, and NCOs must train to be effective leaders in a wartime environment. As leaders, they must be imaginative, innovative, and completely reliable. CE proficiency depends on adequate training and effective leadership at all levels of command. CE leaders are expected to be proficient in TTPs, Joint operation and interoperability, and to conduct and sustain operations in CBRN environments. (p. F-1)

> Team Training: In order to meet these energetic and demanding requirements, CE personnel will train to work as teams. Teams will train at US or overseas training sites and at home station. Every effort must be made to incorporate CE training scenarios into wing-level training plans and exercises to properly demonstrate the tie between CE wartime response capabilities and the operational mission.
> (p. F-1)

Individual, leadership, and team training for Air Force CGOs is accomplished through WMGT 101, *Air Force Civil Engineer Basic Course*, Home Station Training (HST), Silver Flag (SF), courses offered at the Civil Engineer School, and Expeditionary Skills Training (EST) (Department of the Air Force, 2015a). In addition to these training mechanisms, the preparedness of civil engineer officers to deploy relies heavily on the similarity of in-garrison tasks to those performed in the contingency environment.

WMGT 101, Air Force Civil Engineer Basic Course.

The minimum training requirement for CE officers in order to be eligible for world-wide deployment is the completion of WMGT 101, *Air Force Civil Engineer Basic Course*. The course is nine weeks long and covers a wide range of engineering topics. The topics covered include Air Force Civil Engineer doctrine, history, organization, and functions. The course also covers project management principles and basic engineering technical knowledge (AFIT, 2016a). Weeks six through eight of the course focus on contingency engineering. The contingency topics covered include expeditionary engineering, war planning, munitions storage, airfield criteria, MAAS, emergency airfield lighting system (EALS), pavement evaluation, soil classification, field data collection, force protection, beddown planning, water and waste water systems, mechanical and power systems, damage assessment, minimum operating surface (MOS) plotting, airfield damage repair (ADR), and environmental considerations (The Civil Engineer School, 2015). The course objective is to provide a knowledge foundation for new accessions that have very limited experience in the career field. The contingency training and development of CE officers is expanded through HST, SF, and CE school courses.

Home Station Training (HST).

Home Station Training (HST) includes any training that occurs at the permanent location where personnel or a unit is assigned. HST includes computer based training (CBT), classroom instruction, hands-on training, and a variety of other training delivery methods. AFI 10-210, *Prime BEEF Program,* and AFI 10-211, *Civil Engineer Contingency Response Planning*, define the HST requirements for all Air Force civil engineers that are not assigned to a RED HORSE unit. All of the HST requirements for CE officers are listed in Table 2 below.

A key component of HST is contingency project training. Contingency project training is a small construction project that fulfills a real-world need at the home station while providing an opportunity for officer and enlisted civil engineers to practice their contingency and wartime project skills. The projects chosen should include a variety of facility types and construction techniques in order to provide a wide array of experiences. Officers should expect to execute planning, design, and construction management in the fulfillment of the project (Department of the Air Force, 2015c). An active duty civil engineer unit should execute contingency project training annually.

Table 2: Home Station Training (HST) Requirements for CE officers

Course	Frequency	Delivery Method
Prime BEEF Orientation Course	One-Time	CBT
AFCAP Overview	24 mos	Classroom
Vehicle/Equipment Operations (GPV, 10K Fork, HMMWV)	48 mos	Hands-on
Contingency Project	12 mos	Hands-on
Damage Assessment and Response Team (DART)	24 mos	CBT
Tactical Convoy Operations	24 mos	CBT/Classroom/Hands-on
Land Navigation	24 mos	CBT/Classroom/Hands-on
Air Base Defense	24 mos	CBT/Classroom/Hands-on
Operating in a Joint Environment	48 mos	Classroom/Hands-on
Night Vision Devices	48 mos	CBT
Troop Leading Procedures	JIT or 24 mos	Classroom/Hands-on
CE Radio Communications	24 mos	CBT
Individual Movement Techniques	JIT or 24 mos	Classroom/Hands-on
Defensive Fighting Positions	24 mos	Classroom/Hands-on
Unit Type Code (UTC) Management	48 mos	CBT
Contingency and Disaster Planning	48 mos	CBT/Classroom/Hands-on
Disaster and Attack Preparations	48 mos	CBT/Classroom/Hands-on
Control Center Operations (CCO)	24 mos	CBT/Hands-on
Airfield Damage Assessment Teams (ADAT)	24 mos	CBT
Airfield Damage Repair (ADR)	JIT or 24 mos	CBT
Planning and Design of Expeditionary Airbases	One-Time	Classroom/Hands-on
Extreme Climate Deployment	JIT or 48 mos	CBT
Field Sanitation, Personal Hygiene and Pestborne Diseases	JIT or 48 mos	CBT
CPR	12 mos	Classroom/Hands-on
Bare Base Conceptual Planning	JIT or 48 mos	CBT
Bare Base Overview	48 mos	CBT
Contingency Operational Environmental Considerations	48 mos	CBT
Weapons Training (M-9 or M-4)	12 mos	Hands-on

Exercises are another component of HST. Exercises are periodically conducted base-wide and contain a variety of scenarios that may or may not involve CE personnel. It is the responsibility of the Civil Engineer Squadron Commander (CES/CC) to conduct training within the unit in addition to the base-wide scenarios. The scenarios within the unit should include peacetime contingencies as well as wartime contingencies. The exercises should range from simple pyramid recall response to more complex situations requiring personnel to perform contingency tasks. Exercises should realistically reflect plausible threats including natural and man-made disasters (Department of the Air Force, 2011).

Silver Flag (SF).

Silver Flag (SF) is a civil engineer field exercise that aims to provide expeditionary combat support training. SF is eight days long and occurs at one of three SF sites located around the globe. SF students include both officer and enlisted civil engineers. SF is not designed to replace HST and relies on a basic familiarity of contingency concepts learned from HST. SF provides CE personnel with the opportunity to learn and practice contingency skills in a low threat and non-operational environment.

The curriculum for officers and SNCOs during SF is focused on command and control (C2). The specific C2 curriculum varies by SF site but the same basic topics are covered. The C2 curriculum contains the following topics: force modules and agile combat support, joint doctrine, CE deployment and training requirements, troop leading procedures, convoy planning and control center operations, minimum aircraft operating surface selection, airfield damage assessment and repair, beddown planning, force protection, contingency assets, CE unit type codes (UTCs), fire and emergency services capabilities, contingency programming, and environmental planning (435th CTS, 2015). In addition to the C2 curriculum, officers become familiar with enlisted contingency tasks through observation and hands-on training. Officers should attend SF once every three years in order to maintain readiness and receive up-to-date training on contingency tasks and techniques. The SF curriculum for all training sites is presently under review to ensure the training content remains relevant to current and future contingency operations.

The Civil Engineer School.

The Civil Engineer school, located on Wright-Patterson Air Force Base, provides professional education and training for the CE career field. The CE School offers courses in a large number of CE specific areas. The Career Field Education and Training Plan (CFETP) for civil engineer officers identifies the courses that a CE CGO should seek to attend as early as possible or when resources allow. The courses identified include: Project Programming, Project Management, Contracting for Civil Engineering, Airfield Pavement Design and Maintenance, Airfield Pavement Construction Inspection, Simplified Facility Design, and other courses that are specific to duty positions. All of the aforementioned courses prepare a CE officer to operate in the contingency environment but only one contingency specific course is offered at the CE school. WMGT 585, *Contingency Engineer Command,* is targeted at CE officers with more than eight years of commissioned service and prepares officers to command in a variety of contingency operations. The course covers joint doctrine, command and control, leadership, lessons learned from current operations, and operating with federal, state, and local agencies (AFIT, 2016b). Courses offered by the CE School are taught in-residence and through Distance Learning (DL).

Expeditionary Skills Training (EST).

Expeditionary Skills Training (EST) is a variety of just-in-time (JIT) pre-deployment training that occurs only once an officer can been tasked with a deployment. EST includes but is not limited to Evasion and Conduct After Capture (ECAC), Fieldcraft for the Uncertain Environment (FC-U), Fieldcraft for the Hostile Environment (FC-H), Fieldcraft- CENTCOM (FC-CENTCOM), Combat Skills Training (CST), Air Advisor Course (AAC), and other courses based on the threat and the mission of the deployment. EST is not civil engineer specific and will not be discussed in detail in this section.

III. Methodology (Job Analysis)

Chapter Overview

This chapter provides the Job Analysis (JA) methodology used in this research. As there are many different JA methods available, the selected method should support its intended use (E. L. Levine et al., 1983). The purpose of the JA in this research is to identify the tasks performed by an Air Force (AF) Civil Engineer (CE) Company Grade Officer (CGO) in the contingency environment and the Knowledge, Skills, and Abilities (KSAs) related to the performance of those tasks. The chosen method of JA for this research is the Task Inventory (TI), and the remainder of this chapter will be devoted to it. The TI is part one of the two part Training Needs Analysis (TNA) process utilized for this research. The results of the TI (see Chapter IV) will identify what CE CGOs need to know while part two, the knowledge assessment (see Chapters V and VI), will identify what CE CGOs do know. The process used for designing, conducting, and analyzing the TI will be described in this chapter.

The Task Inventory (TI) Process

The TI used in this research largely follows the methods established by the United States Office of Personnel Management (OPM) in the *Delegated Examining Operations Handbook* (U.S. Office of Personnel Management, 2007). In addition to the methods given by the OPM, the TI approach taken for this research will utilize other sources as appropriate. The basic steps involved in a TI are: (1) collect information about the job, (2) create a list of tasks and KSAs that are required to perform the job, (3) develop and administer a survey for Subject Matter Experts (SMEs) to rate the tasks and KSAs, and

(4) perform analysis to identify the most critical tasks and KSAs. Each step will be described in detail in the sections that follow.

Step 1: Job Information Collection.

The first step in the TI was to collect information about the job. For this research, the job of interest is the civil engineer CGO operating in the contingency environment in a Prime BEEF role. Job information was obtained by reviewing Air Force doctrine, instructions, and plans including Air Force Doctrine Annex 3-34, *Engineer Operations*; Air Force Instruction (AFI) 10-210, *Prime BEEF Program*; and the Career Field Education and Training Plan (CFETP) 32EX, *Civil Engineer Officer*. Information about the civilian career fields of civil engineering and construction management was obtained from the United States Department of Labor's Occupational Network (O*NET) Online. Additional KSA specific information for general engineering and leadership was obtained from the OPM's Multipurpose Occupational Systems Analysis Inventory – Close-Ended (MOSAIC) database.

In addition to the archival data, a four item open-ended questionnaire was developed and administered to a sample of SMEs in order to collect the most relevant information. An open-ended question is a type of question that leaves the response pattern up to the respondent as opposed to close-ended questions where the researcher structures the available responses. In open-ended questions, the respondent is given the freedom to provide answers in their own terms and thought processes within the context of the question topic (Roulston, 2008). Open-ended questions are an effective method of soliciting honest and thorough qualitative data (Cohen et al., 2003). A SME is an individual who has specific knowledge about the topic of interest (Kline, 2005). For this part of the research, CE officers in the grades of O-3 to O-5 with a minimum of one deployment were considered SMEs. The O-3s offered the expert perspective at the tactical level while the O-4s and O-5s offered the expert perspective at the operational and strategic level. The O-3s have recent experience executing the job as CGOs. The O-4s and O-5s have experience giving direction and intent with respect to the job.

The method of selecting the sample of SMEs was purposive and convenient. A purposive sample is one that is believed to be a good source of information. A convenient sample is one that is obtained simply due to availability (Patten & Bruce, 2007). The sample of SMEs was made up of CE officers attending three different courses at the Civil Engineer School. The first course was WMGT 400, *Civil Engineer Commander and Deputy Commander Course*, and was made up of officers in the grades of O-4 and O-5. The second course was WMGT 430, *Operations Flight Commander Course*, and was made up of officers in the grades of O-3 and O-4. The last course was WMGT 420, *Engineering Flight Commander Course*, and was made up of officers in the grades of O-3 and O-4. These courses occurred in March of 2015. The four questions asked on the questionnaire are given below. Examples of tasks and KSAs accompanied questions 1 and 2 to avoid any confusion by participants.

1. What tasks are Prime BEEF CGOs expected to perform in the expeditionary environment?
2. What knowledge, skills, and abilities do Prime BEEF CGOs need to possess in order to successfully meet all mission requirements in today's expeditionary environment?
3. Does the curriculum of the current spectrum of CE officer contingency training (HST, Silver Flag, CE School, etc) provide adequate, timely, and relevant information to CE officers? Why or why not?

4. Please tell me any other thoughts you may have on civil engineer officer (32EX) contingency training.

The questionnaires were administered in paper form during a time that best suited the course directors. The questionnaire was also available online but no participants chose to complete the questionnaire using the online format. A brief verbal statement was given to participants that volunteered to complete the questionnaire. The verbal statement contained an introduction to the research which included an identification of the principal investigator, the student researcher, and the research sponsor as well as the purpose and focus of the research. The verbal statement also included information pertaining to the anonymous, voluntary, and low-risk nature of the questionnaire. Lastly, instructions for completing the questionnaire were given along with any assumptions that should be made when providing answers. Once the verbal statement was given, participants were allowed an opportunity to ask questions. The completed questionnaires were collected by the course directors and then compiled and stored by the student researcher. An example of the full instrument used for this initial data collection can be found in Appendix A. Institutional Review Board (IRB) exemption approval for the open-ended questionnaire was required. The IRB exemption approval letter can be found in Appendix B.

The open-ended responses were analyzed qualitatively by first reading each response to get a general sense of the content. Next, each response was read again and responses were transferred into a spreadsheet. Then, the completed questionnaires were analyzed using simple textual analysis that included word frequency counts and visualization through word clouds. A word cloud is a visual representation of a body of text(s) where the most frequently used words appear larger or are highlighted with contrasting colors. Word clouds are a quick way to identify the possible points of interest in text and are a useful tool for preliminary analysis (McNaught & Lam, 2010). The open-source software environment R was utilized to process the text data and produce the world cloud. Lastly, trends in the text were evaluated based on the analysis and recorded as the main themes.

Step 2: Task and KSA List Creation.

The next step in the TI was to create a preliminary list of the tasks required to perform the job and the KSAs related to the performance of those tasks based on the information collected in step 1. The list of tasks and KSAs developed for CE CGOs in the contingency environment was based on the sources in Table 3.

Table 3: Task and KSA Information Sources

Information Source	**(Tasks, KSAs, Both)**
O*NET Online, Civil Engineer	Both
O*NET Online, Construction Manager	Both
OPM MOSAIC Database, Science and Engineering	KSAs
OPM MOSAIC Database, Leadership	KSAs
Air Force Doctrine Annex 3-34, *Engineer Operations*	Both
Air Force Instruction 10-210, *Prime BEEF Program*	Both
CFETP 32EX, *Civil Engineer Officer*	Both
SME Questionnaire	Both

The list of tasks and KSAs was aggregated once a saturation of themes was reached from the sources in Table 3. A saturation of themes is the point where no more new perspectives or information is obtained. The number of tasks and KSAs included in the inventory was not pre-determined; tasks and KSAs were included in the inventory until a satisfactory level of comprehensiveness was reached. The task and KSA statements were written with similar structure, length, and specificity. The task statements consisted of an action verb and the object(s) of the verb. Most task statement used only a single action verb; multiple verbs were only used when appropriate. The KSA statements described a specific characteristic with enough detail to be understood by the reader. The terminology used in the task and KSA statements was consistent with current usage in the career field. Acronyms and abbreviations were avoided or written out if the term used was not considered general knowledge. Vague and ambiguous words were avoided as much possible (Melching, 1973).

Step 3: SME Survey Development and Administration.

The next step was the development and administration of the SME survey. The SME survey serves as a method for validating and refining the preliminary list of tasks and KSAs. The SME survey contained two demographic questions and three Likert item questions. The demographic questions asked participants to give their number of years of service and number of deployments. The Likert items utilized a five-point scale. Five-point scales are sufficient for most purposes and are easily understood by respondents (Brace, 2013). An odd number of points on a Likert scale allow respondents to select a middle or neutral point. Utilizing an even number of points on a Likert scale forces respondents to take a stance but has been found to have lower validity and higher random error variance (Lietz, 2010). Increasing the number of points on a Likert scale gives respondents more varieties of options and typically more accurately represents the objective reality of respondent's opinions but five-point scales are suitable when an absolute judgment is sought (Lietz, 2010).

Question 1 and question 2 asked SMEs to rate the preliminary list of tasks generated in step 2 according to importance and frequency. Importance and frequency were chosen as the measures of criticality because of their repeated historical use in job analysis surveys (Harvey, 1991; Manson et al., 2000; Raymond, 2001). Task importance is the overall importance of the task in the execution of the job. Task frequency was how often the task is performed in the execution of the job. The task statements were presented in the same order for importance and frequency. The respondents rated all tasks on importance before moving on to frequency. This format is preferred over having each task rated on importance followed by the same task rated on frequency because it decreases the probability of artificially high correlations between the two measures of criticality (Cadle, 2012).

Question 3 asks SMEs to rate the list of KSAs generated in step 2 according to importance. KSA importance is the overall importance of the KSA to the performance of the job. The number of questions was limited to three to keep the time required to complete the survey at a reasonable level. Additional measures of criticality would likely result in redundant information and no added value (Manson et al., 2000). The goal was for the survey to require no more than 15 minutes to complete.

The survey instrument was created using the online tool found at www.SurveyMonkey.com. Figure 5 gives an example of the task and KSA statements and rating scales as they appeared in the survey. The response scale options utilized verbal labelling that ranged from “not important” to “extremely important” for task and KSA importance and ranged from “never” to “very frequently” for task frequency. The response scale options were oriented with respect to level of importance or frequency from lowest as the leftmost response option to highest as the rightmost response option. The direction of the response scale options does not affect mean scores and standard deviations as long as the lowest option corresponds to the lowest numerical value and the highest option corresponds to the highest numerical value when applying weights and performing analysis (Lietz, 2010). The terminology used for KSAs was converted to competencies for the sake of common understanding. An example of the full survey instrument can be found in Appendix D.

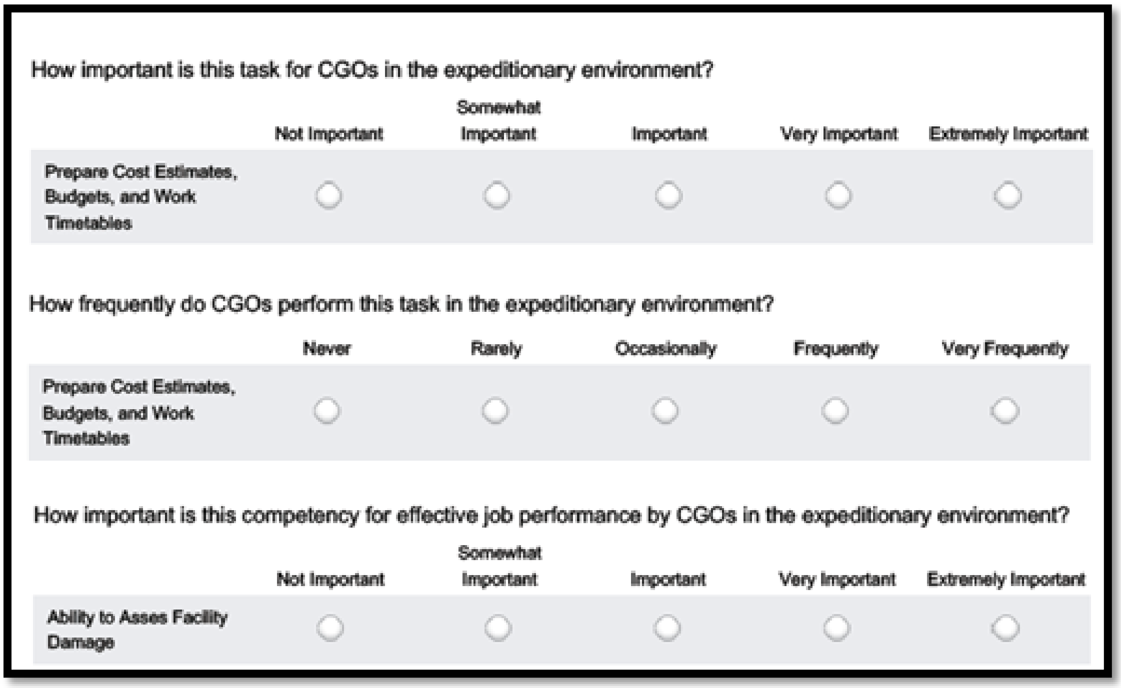


Figure 5: Example Task and KSA Statements

The SME samples for the survey differed slightly from the SME sample utilized in step 1. The SME samples for the survey were made up of CE officers in the grades of O-3 to O-6. The SME samples from step 1 that were made up of CE officers attending the WMGT 400 course and the WMGT 430 course were again asked to participate in the survey. An additional SME sample was targeted that was made up of CE officers that were either recently deployed in a leadership position or currently deployed in a leadership position. This sample was sought after due to their ability to provide answers that were as current as possible. This additional sample was also asked to fill out one additional question that consisted of an open-ended question regarding their opinion on CE training for officers in the contingency environment. The open-ended question responses can be found in Appendix C.

The survey was then pilot tested with a number of CE CGOs assigned to WPAFB that were full time masters students at AFIT. The pilot test was used to determine survey length, general clarity of the survey items, ease of use of the online survey tool, and overall presentation of the survey including the interpretation of the instructions, task and KSA statements, and rating scales. Minimal changes were needed after receiving feedback from the pilot test. The survey was then sent out to the SME samples. The survey was hosted by www.SurveyMonkey.com and the link was distributed through e-mail. The e-mail contained information summarizing the purpose of the research, identified the researchers and research sponsor, and provided instructions for completing the survey. Results of the survey were downloaded after giving respondents 30 days to complete the survey. A reminder was sent approximately half way through the 30 day period. The SME survey required IRB exemption approval as well as a Survey Control Number (SCN) from the Air Force Survey Control Office. The IRB exemption approval letter can be found in Appendix F and the SCN approval letter can be found in Appendix G.

Step 4: Analysis of Survey Results and TI finalization.

The final step of the TI is to perform and interpret statistical analysis of the survey results. The purpose of this analysis is to determine which tasks and KSAs should remain part of the final TI. All analysis was performed using Microsoft Excel (2010), for spreadsheet manipulation, and IBM SPSS Statistics (version 23), for data analytics.

Survey results were first checked for completeness. Responses with missing data were determined useable so long as they were at least 75% complete with respect to any one criticality measure (task importance, task frequency, or KSA importance).

Second, response rates were determined. Response rates were calculated by dividing the number of usable completed responses by the total number of survey solicitations. While no consensuses has been reached on minimum response rates, it is important to make every effort to get as high of a response rate as possible. High response rates lower the probability of non-response bias and enhance statistical power of the survey results (Baruch & Holtom, 2008).

Descriptive statistics were found for the two demographic questions and histograms were created to characterize the sample. Prior to any further analysis, a Kruskal-Wallis test was used to determine if there were significant differences in the responses among respondents according to years of service and number of deployments. The Kruskal-Wallis test is a non-parametric test of whether two or more independent groups differ (Field, 2007). The results of the Kruskal-Wallis test indicated that there were very few significant differences due to number of years of experience or number of deployments, thus combining all respondent ratings was a valid procedure to find means for the task and KSA statements.

Next, the mean importance and frequency ratings were found for each task statement and the mean importance rating was found for each KSA statement. Reliability of each question (task importance, task frequency, and KSA importance) on the survey was then estimated using Cronbach's alpha. Scatter plots were generated for task importance against task frequency. A positive linear relationship between task importance and task frequency appeared to be indicated by the scatter plot. Normality was then checked for task importance ratings and task frequency ratings. Pearson's correlation coefficient was then found for task importance and task frequency. The result confirmed the high positive correlation between task importance and task frequency. Due to task frequency and task importance being highly correlated, a composite score or criticality index was created for the task statements. The criticality index was created by multiplying task importance by task frequency. There are different arithmetic models that can be used to create composite scores but it has been shown that most do not create significantly different results (Belwalkar, Anderson, & Igou, 2013; Cadle, 2012).

Lastly, the task statements (by criticality index) and KSA statements (by importance) were rank ordered from highest rating to lowest rating. In order to determine which tasks and KSAs should be included in the final TI, a cut-off score for inclusion had to be determined. A number of different methods for determining cut-offs was explored including upper 95 percent means, lower 95 percent means, modes, medians, and scale mid-points. The cut-off used for the final determination of TI inclusion was the scale mid-point. The scale mid-point was chosen because it excluded the least amount of tasks and KSAs from the final TI. By using the scale mid-point, the final TI was as comprehensive as possible. For the task criticality index, the scale mid-point was 9 which was derived from the importance scale mid-point of 3 multiplied by the frequency scale mid-point of 3. For KSA importance, the scale mid-point was 3. The final TI was compiled from those tasks and KSAs that were above the cut-off points.

Summary

This chapter described the TI method used for JA in this research. The steps required for performing a TI were detailed. The first step was collecting information about the job. This was accomplished by performing a review of the existing literature as well as administering a questionnaire for SME input. The second step was creating a list of tasks and KSAs gathered during step one. The third step was using the list created in step two to develop and administer a survey for SMEs to rate the tasks and KSAs. The last step was performing statistical analysis on the results of step three to determine the most critical tasks and KSAs. The next chapter will provide the results and analysis of the completed TI.

IV. Analysis and Results (Job Analysis)

Chapter Overview

This chapter provides the analysis and results of the Job Analysis (JA) that was conducted for this research. The JA method chosen was the Task Inventory (TI). The analysis and results are offered in the same general sequence as the methodology described in Chapter III. First, the results of the job information collection step are presented. Next, the preliminary list of tasks and KSAs generated from step one are given. Then, the analysis and results of the SME survey are detailed. Lastly, the tasks and KSAs included in the final TI are presented.

Job Information Collection Results

The initial step of collecting job information was completed by first reviewing Air Force and professional sources. A total of three Air Force sources were utilized in this step and included Air Force Doctrine Annex 3-34, *Engineer Operations*; Air Force Instruction (AFI) 10-210, *Prime BEEF Program*; and the Career Field Education and Training Plan (CFETP) 32EX, *Civil Engineer Officer*. Table 4 summarizes the findings of the Air Force sources.

Table 4: Summary of Job Information: AFDA 3-34, AFI 10-210, and CFETP 32EX

Tasks	KSAs
Acquire, utilize, and dispose of facilities	Air base defense
Command and control of CE forces	Asset management
Construct and repair force protection	Bare base planning
Design and prepare plans and specifications for contracts	Contingency construction
Develop, monitor, and brief survivability actions and methods	Damage assessment
Development of construction budgets	Emergency management
Erect specialized structures	Engineering expertise
Establish, operate, maintain, recover, and reconstitute installations	Environmental management
Execute facility and utility construction, repair, modification, maintenance, and operation	Expedient damage repair
Execute force beddown and sustainment	Facilities engineering and management
Execute technical design	Force protection
Formulate and execute construction programs	Housing management
Implement CE force development	Land navigation
Implement environmental protection measures	Military decision making
Maintain airfield pavement	Military programming and planning
Modify and repair terrain	Operating in a joint environment
Monitor and protect resources	Prime BEEF structure and organization
Perform airfield damage repair	Resource acquisition and management
Perform bare base master planning, design, and contract support	Shelter systems
Perform base denial activities	Tactical convoy operations
Perform construction management	Vehicle and equipment operations
Perform emergency repairs	
Perform land management	
Perform light horizontal and vertical construction	
Program, budget, and manage projects	
Provide CE operational planning	
Provide facility support	
Provide housing management	
Provide staff supervision and technical advice	

Another source utilized to collect job information was the United States Department of Labor's Occupational Network (O*NET) Online. The two occupations researched were civil engineer and construction manager. Table 5 summarizes the information found for the civil engineer career field and Table 6 summarizes the information found for the construction manager career field.

Table 5: Summary of Job Information: O*NET Online – Civil Engineer

Tasks	KSAs
Analyze survey reports, maps, drawings, blueprints, or other engineering data	Active listening
Communicate with supervisors, peers, and subordinates	Administration and management
Compute load and grade requirements	Building and construction
Compute material stress factors	Complex problem solving
Compute water flow rates	Critical thinking
Coordinate, organize, plan, and prioritize work	Customer Service
Design energy efficient and environmentally sound civil structures	Design
Design or engineer waste management systems	Economics and accounting
Determine design specifications	Engineering and technology
Determine project feasibility	Fluency of Ideas
Develop and build teams	Inductive and deductive reasoning
Direct engineering activities	Judgement and decision making
Direct or participate in project layout	Law and government
Ensure conformance to design specifications	Mathematics
Ensure conformance to safety regulations	Operations analysis
Estimate quantities and cost of materials, equipment, or labor	Personnel and human resources
Identify engineering problems and assess potential project impact	Physics
Inspect project sites	Resource management
Interpret the meaning of information for others	Science
Judge the quality of things, services, or people	Social perceptiveness
Manage and direction construction, operations, or maintenance activities at project site	Systems analysis

Monitor project progress	Technical reading comprehension
Plan and design transportation systems	Time management
Prepare and present engineering reports	Visualization
Provide technical advice	Written and spoken communication
Resolve conflicts and negotiate with others	
Schedule work and activities	
Test soils or materials to determine adequacy	

Table 6: Summary of Job Information: O*NET Online – Construction Manager

Tasks	KSAs
Apply for or obtain necessary permits or licenses	Administration and management
Communicate with supervisors, peers, or subordinates	Building and construction
Confer with supervisory personnel, owners, contractors, or other professionals to discuss and resolve construction issues	Clerical actions
Determine appropriate construction methods	Complex problem solving
Determine labor requirements	Computers and electronics
Develop and implement quality control programs	Coordination
Direct and supervise construction	Critical thinking
Guide, direct, and motivate subordinates	Customer service
Implement plans in response to delays or emergencies	Design
Inspect objects, structures, or materials	Economics and accounting
Inspect or review projects to monitor compliance with codes and regulations	Engineering and technology
Interpret and explain plans and contracts to others	Inductive and deductive reasoning
Investigate damage, accidents, or delays at sites	Information ordering
Judge quality of things, services, or people	Mathematics
Plan, organize, or direct activities concerned with the construction or maintenance of structures, facilities, or systems	Problem sensitivity
Plan, schedule, or coordinate construction project activities	Public safety and security
Prepare and submit budget estimates, progress reports, or cost tracking reports	Quality control analysis
Prepare contracts or negotiate contractual agreements	Resource management
Provide consultation and advice to others	Social perceptiveness

Requisition supplies or materials	Systems analysis
Work directly with the public	Time management
	Written and spoken communication

The last source used for collecting job information prior to the open-ended questionnaire was the United States Office of Personnel Management's Multipurpose Occupational Systems Analysis Inventory – Close-Ended (MOSAIC) database. The MOSAIC database contains general KSA information for a large number of jobs. KSA information was collected for science and engineering and leadership. Table 7 summarizes the information found in the MOSAIC database.

Table 7: Summary of Job Information: OPM MOSAIC Database – KSAs only

KSAs	
General Engineering	**Leadership**
Administration and management	Accountability
Agility	Client orientation
Attention to detail	Conflict management
Conflict management	Continual learning
Contracting and procurement	Creative thinking and innovation
Creative thinking	Customer service
Customer Service	Decisiveness
Decision making	External awareness
Depth perception	Financial management
External awareness	Human resources management
Financial management	Influencing and negotiating
Hand-eye coordination	Integrity
Human resource management	Interpersonal skills
Influencing and negotiating	Managing/leveraging diverse workforce
Information management	Mental flexibility
Integrity	Oral communication
Leadership	Planning and evaluating
Mathematical reasoning	Political Savvy
Mental flexibility	Problem solving
Oral and written communication	Resilience

Organization awareness	Self-direction
Perceptual speed	Service motivation
Administration and management	Strategic thinking
Agility	Team building
Attention to detail	Technical competence
Conflict management	Technology management
Contracting and procurement	Vision
Creative thinking	Written Communication
Customer Service	

Next, the results of the open-ended questionnaire were analyzed. A total of 43 usable responses were collected from the open-ended questionnaire with the largest proponent of responses coming from the WMGT 430, *Operations Flight Commander Course*. The mean years of service for the total sample was 11.2 years, the minimum was 5 years, the maximum was 17 years, and the standard deviation was 3 years. The mean number of deployments was 3, the minimum was 1, the maximum was 5, and the standard deviation was 1.1. The full characteristics of the sample are given in Table 8. The sample represented a wealth of experience shown both by years of service and number of deployments. The sample also represented a breadth of experience, from junior CGOs to senior FGOs.

Table 8: Sample Characteristics: Open-Ended Questionnaire

Sample	N	# of Years of Service		# of Deployments	
WMGT 400	15	Mean:	13.9	Mean:	3.7
		Std Dev:	2.4	Std Dev:	1.1
		Min:	9	Min:	2
		Max:	17	Max:	5
WMGT 430	23	Mean:	10.3	Mean:	2.8
		Std Dev:	1.8	Std Dev:	1.1
		Min:	6	Min:	1
		Max:	14	Max:	5
WMGT 420	5	Mean:	7.2	Mean:	2.2
		Std Dev:	1.9	Std Dev:	0.75
		Min:	5	Min:	1
		Max:	10	Max:	3
Totals	43	Mean:	11.2	Mean:	3.0
		Std Dev:	3.0	Std Dev:	1.1
		Min:	5	Min:	1
		Max:	17	Max:	5

After reading each open-ended response and gaining a general understanding of the content, the open-ended responses were transcribed into a Microsoft Excel (2010) spreadsheet. Next, basic text analysis was conducted on question 1 and question 2.

Question 1 asked respondents to list the tasks that a CGO would be expected to perform in the expeditionary environment. Figure 6 displays the frequencies of words used more than four times in response to question 1. Figure 7 displays the word cloud that was produced in conjunction with the word frequency plot for question 1. From the figures, the main themes of beddown, planning, construction, project management, design, programming, and management emerged.

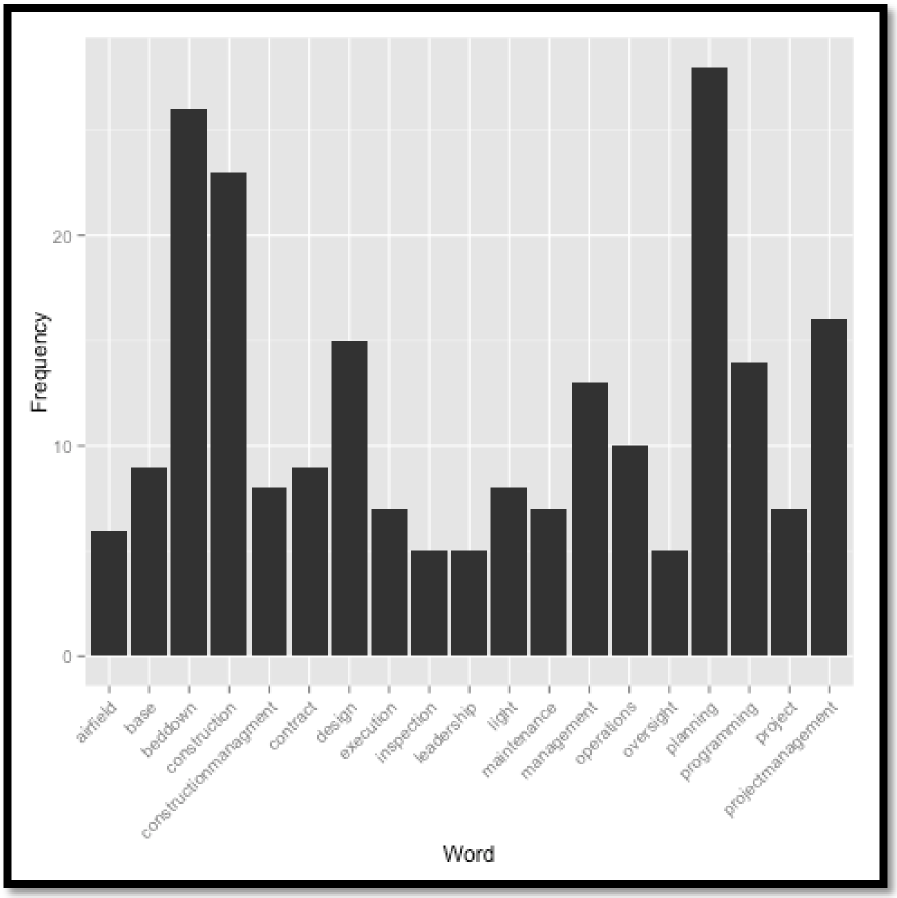


Figure 6: Question 1 (Tasks) Word Frequency Plot

Figure 7: Question 1 (Tasks) Word Cloud

Question 2 asked respondents to list the KSAs that a CGO would need in order to successfully meet all mission requirements in the expeditionary environment. Figure 8 displays the frequencies of words used more than four times in response to question 2. Figure 9 displays the word cloud that was produced in conjunction with the word frequency plot for question 2. From the figures, the main themes of construction (basic and contingency), design (basic and contingency), leadership, construction management, and contracts emerged. The full transcript of the open-ended questionnaire responses including questions 3 and 4 can be found in Appendix E.

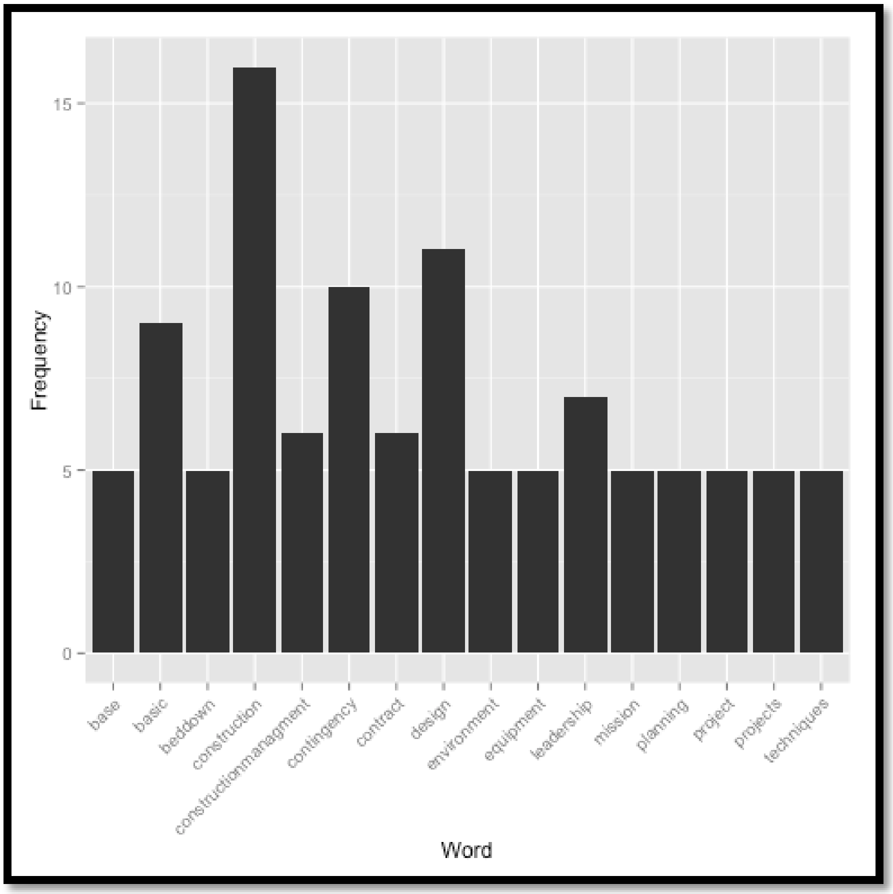


Figure 8: Question 2 (KSAs) Word Frequency Plot

Figure 9: Question 2 (KSAs) Word Cloud

Lastly, a comprehensive list of the main topics found in common between the literature review and the open-ended questionnaire was produced. Step 1 provided the information needed to move on to the next step of the TI process.

Task and KSA List Creation Results

The second step in the TI process was to create the preliminary list of task and KSA statements. The preliminary list contained 46 task statements and 66 KSA statements. The list of task statements is found in Table 9 and the list of KSA statements is found in Table 10.

Table 9: List of Task Statements

Task Statement
Analyze Survey Reports, Maps, and Other Data to Plan Projects
Bare Base Master Planning
Collect and Apply Subject Matter Expert (SME) Inputs
Command and Control of Civil Engineer Forces
Determine and Implement Environmental Protection Measures
Determine Feasibility and Constructability of Projects
Determine Project Design Specifications
Determine Project Personnel and Resource Requirements
Develop and Implement Quality Control Programs
Develop Courses of Action for Engineering Problems
Develop, Monitor, and Brief Survivability Actions and Methods
Discuss and Resolve Construction Issues
Ensure Compliance with Requirements, Codes, and Regulations
Ensure Conformance to Project Design Specifications
Establish, Operate, and Maintain Installations
Execute Basic Combat Tasks
Force Beddown
Help Prepare Contracts and Negotiate Contractual Agreements
Inspect Project Sites
Installation/Base Master Planning
Interact with Multi-National and Joint Forces
Interpret and Explain Contracts to Others
Investigate Damage, Accidents, or Delays at Construction Sites
Mentor Host Nation Forces
Monitor Project Progress
Monitor the Air Force Civil Augmentation Program (AFCAP)
Order Construction Materials and Equipment
Organize, Plan, and Prioritize Work
Perform Base Denial Activities
Perform Base Hardening
Perform Contracting Officer Representative (COR) Activities
Perform Convoy Planning and Operations
Perform Deconstruction Activities

Perform Emergency Repairs
Perform Military Administrative Actions (DECs, LOEs, Discipline, etc.)
Perform Project Risk Analysis
Perform Site Evaluations
Plan and Establish Land Use
Prepare Cost Estimates, Budgets, and Work Timetables
Prepare Performance Work Statements
Present Information to Superiors through Formal and Informal Communications
Provide Technical Advice to Colleagues and Superiors
Respond to Work Delays, Emergencies, and Other Problems
Select, Schedule, and Coordinate Jobsite Activities
Study User Requirements and Determine Construction Methods
Use Design Software to Plan Projects

Table 10: List of KSA Statements

KSA Statement
Ability to Asses Facility Damage
Ability to do Design Reviews
Ability to do Master/Community Planning
Ability to do Simple Cost Estimation
Ability to Manage a Diverse Workforce
Ability to Multitask
Ability to Negotiate
Ability to Perform Customer Service
Ability to Solve Complex Problems
Ability to use AutoCAD/Develop Drawings
Ability to use Computers
Ability to use GIS systems for Planning Purposes and Decision Making
Ability to use Radio Communications
Ability to use Standard Issued Weapons Proficiently
Ability to Work in Teams
Ability to Write Effectively
Accountability
Active Listening
Attention to Detail
Confidence

Critical Thinking
Deductive Reasoning
Inductive Reasoning
Interpersonal Skills
Knowledge of Administration and Personnel Management
Knowledge of Air Base Defense and Security Activities
Knowledge of Air Force Facilities and Management
Knowledge of Airfield Damage Repair
Knowledge of Bare Base Assets
Knowledge of Bare Bases, Main Operating Bases, Joint Operating Bases, Forward Operating Bases, and Combat Outposts
Knowledge of Building and Construction (temporary, semi-permanent, permanent, and host nation)
Knowledge of Civil Engineer Enlisted AFSCs
Knowledge of Construction Management
Knowledge of Contingency Construction Techniques
Knowledge of Defensive Fighting Positions
Knowledge of Engineering Technologies
Knowledge of Expeditionary Shelters (AF, Joint Force, Multinational)
Knowledge of Field Sanitation Techniques
Knowledge of Financial Management
Knowledge of General Engineering
Knowledge of Human Resource Management
Knowledge of Job Site Safety
Knowledge of Joint Force Structure, Organization, Mission, Capabilities, and Ranks
Knowledge of Law and Government
Knowledge of Military Paperwork
Knowledge of Military Resource Procurement
Knowledge of Nighttime Operations
Knowledge of Prime BEEF Structure
Knowledge of Project Management
Knowledge of Reach Back Support Resources (AFCEC)
Knowledge of Simple Facility Design
Knowledge of Tactical Convoy Operations
Knowledge of the Air Force Civil Augmentation Program (AFCAP)
Knowledge of the Base Operation Support Integrator (BOS-I) and Senior Airfield Authority (SAA) system
Knowledge of the CENTCOM Sandbook and other Theater Standards
Knowledge of the Federal Acquisition Regulations (FAR)

Knowledge of the Military Decision Making Process
Knowledge of Theater Tactics, Techniques, and Procedures (TTPs)
Knowledge of Vehicle and Equipment Operations
Leadership
Political Savvy
Public Speaking
Reading Comprehension
Strategic Thinking
Stress Tolerance
Time Management

The next step was to utilize the lists of task and KSA statements to create a survey for SMEs to assign ratings of importance and frequency to the task statements and importance to the KSA statements. The full survey instrument can be found in Appendix D.

Analysis of Survey Results and TI Finalization

A total of 61 solicitations for survey participation were sent and 27 useable completed surveys were received; one unusable response was received that had the demographic questions completed but was left blank for all other questions. This represented a response rate of 44 percent. The response rate was lower than desired but characteristics of the sample represented a well-distributed and high level of expertise.

The mean number of years of experience for the sample was 14.5 years, the minimum was 7 years, the maximum was 26 years, and the standard deviation was 5.1 years. While the range of 19 years was large, this was part of the design of the survey. Expertise from the tactical, operational, and strategic levels was sought. The mean number of deployments was 3.6, the minimum was 2, the maximum was 8, and the standard deviation was 1.5. Similar to the range for years of service, the range for number of deployments was also large. A summary of the sample characteristics can be found in Table 11. Additionally, histograms for number of years of experience and number of deployments are shown in Figure 10 and Figure 11.

Table 11: Sample Characteristics: SME Survey

# of Years of Service		# of Deployments	
Mean:	14.48	Mean:	3.56
Median:	14	Median:	3
Std Dev:	5.07	Std Dev:	1.53
Min:	7	Min:	2
Max:	26	Max:	8
Range:	19	Range:	6

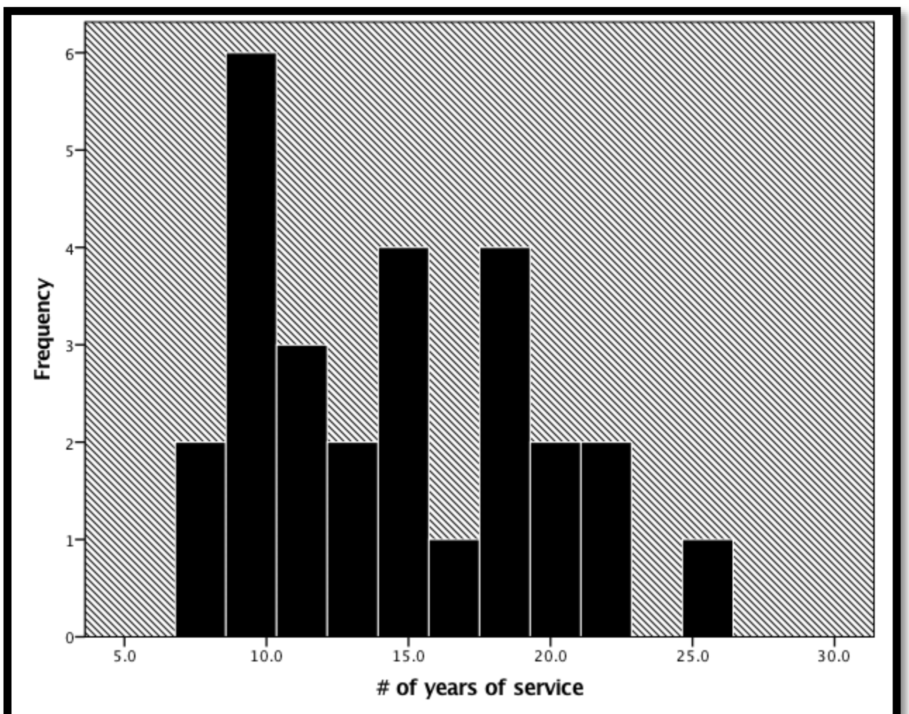


Figure 10: Histogram – Number of Years of Service

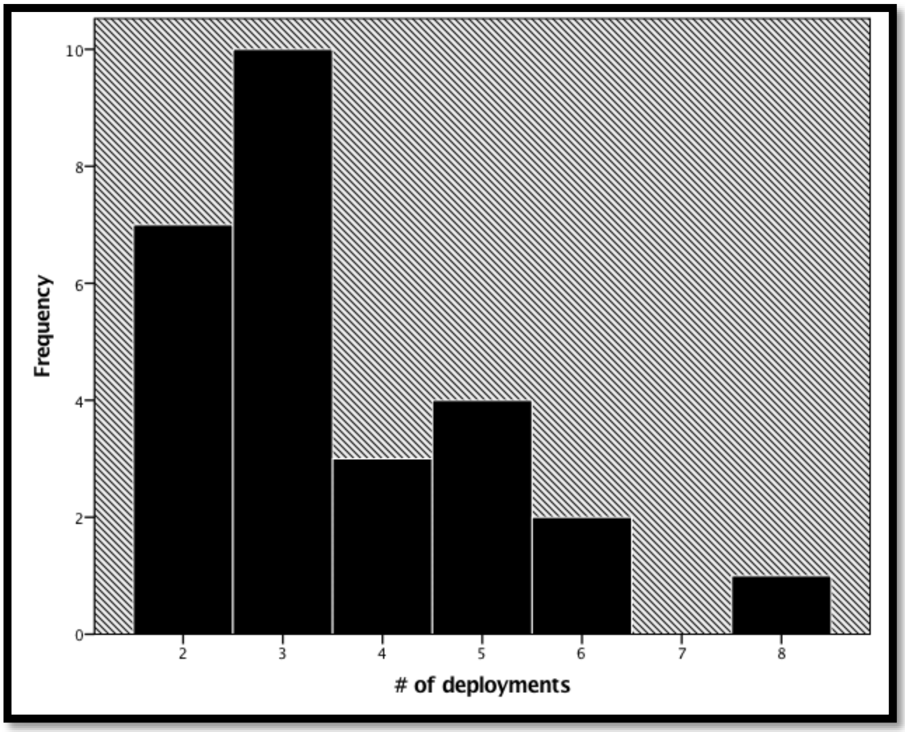


Figure 11: Histogram – Number of Deployments

The reliabilities for the survey items were then estimated by calculating Cronbach's Alpha for each question. The results of the reliability analysis are shown in Table 12. Each set of items had a Cronbach's Alpha over 0.90 indicating a high level of reliability.

Table 12: Results of Reliability Analysis

Question	N of Items	Cronbach's Alpha
Task Frequency	46	.94
Task Importance	46	.91
KSA Importance	66	.96

The large ranges for years of service and number of deployments made it necessary to check the sample to determine if there were significant differences in the responses among the sample due to years of service and number of deployments. Parametric assumptions were not met for individual item response data so the Kruskal-Wallis test was used to detect differences in the responses. The Kruskal-Wallis test was used for every item on the survey (46 task importance items, 46 task frequency items, and 66 KSA importance items). The null hypothesis was that the distribution of responses (per item) was the same across number of years of service or number of deployments. A summary of the results of the Kruskal-Wallis test are shown in Table 13 and Table 14.

Table 13: Results of Kruskal-Wallis Test: Number of Years of Service

Question	Result
1) Task Frequency	46/46 items retain the null hypothesis
2) Task Importance	46/46 items retain the null hypothesis
3) KSA Importance	66/66 items retain the null hypothesis

Table 14: Results of Kruskal-Wallis Test: Number of Deployments

Question	Result	Details
1) Task Frequency	46/46 items retain the null hypothesis	N/A
2) Task Importance	45/46 items retain the null hypothesis	#39
3) KSA Importance	64/66 items retain the null hypothesis	#19, #48

Every item retained the null hypothesis across years of service, indicating that years of service did not significantly affect responses. Across number of deployments, the null hypothesis was rejected for one task importance item and two KSA importance items. The specific item numbers are indicated in Table 14. Task statement 39 was "Mentor Host Nation Forces". KSA statement 19 was "Ability to Use Computers" and KSA statement 48 was "Ability to Use Radio Communications". Upon further investigation, respondents with six or more deployments rated the task "Mentor Host Nation Forces" significantly less important than those with less than six deployments. For KSA statement 19, "Ability to Use Computers", two individuals with four deployments rated its importance significantly lower than those on either end of the deployment range. For KSA statement 48, "Ability to use Radio Communications", respondents with five or more deployments rated its importance significantly higher than those with less than five deployments. Overall, the majority of item responses did not differ across years of service or number of deployments.

Based on the results of the Kruskal-Wallis test, a mean importance score was computed for each task and KSA statement and a mean frequency score was computed for each task statement. A scatterplot was generated to compare the mean importance scores and mean frequency scores and check for possible outliers. The scatterplot appeared to indicate a positive linear correlation between task importance and task frequency with no significant outliers. The scatterplot can be seen in Figure 12.

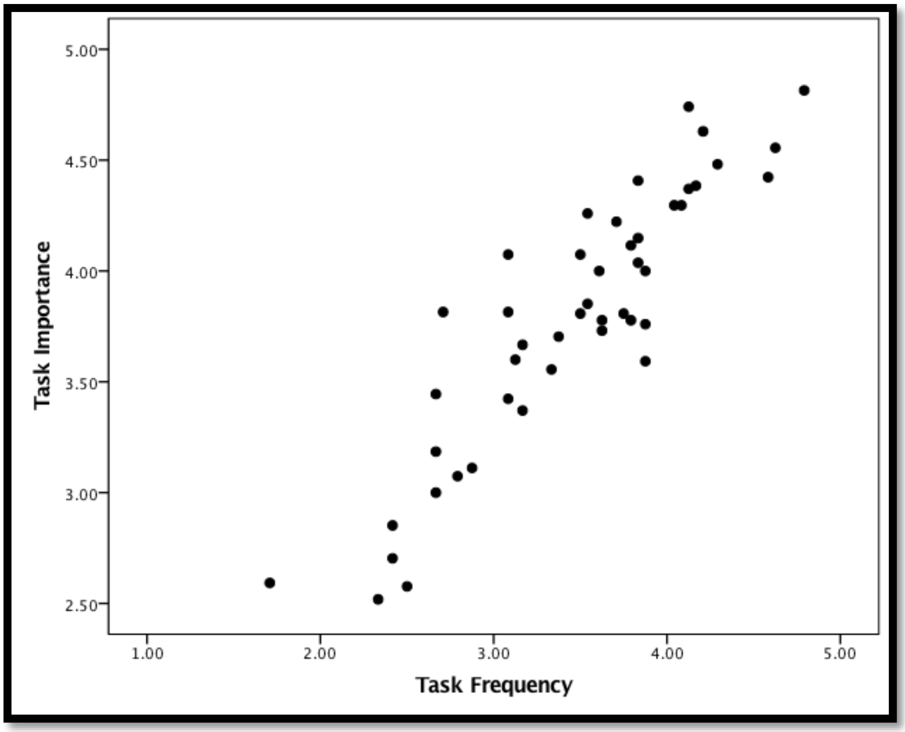


Figure 12: Scatterplot: Task Importance vs Task Frequency

In order to confirm the relationship between task importance and task frequency with Pearson's correlation coefficient, the distribution of scores were checked for normality using the Shapiro-Wilk test. The results of the Shapiro-Wilk test can be found in Table 15. The results indicated that the scores were normally distributed.

Table 15: Results of Shapiro-Wilk Test: Task Importance and Task Frequency

	Statistic	**df**	**Sig.**
Task Importance	.961	46	.121
Task Frequency	.978	46	.523

The Pearson's correlation coefficient was then calculated. The results of Pearson's correlation coefficient can be found in Table 16. The results confirmed the strong positive linear correlation indicated by the scatter plot.

Table 16: Results of Pearson's Correlation: Task Importance and Task Frequency

		Task Importance	Task Frequency
Task Importance	Pearson Correlation	1	.904**
	Sig. (2-tailed)		.000
	N	46	46
Task Frequency	Pearson Correlation	.904**	1
	Sig. (2-tailed)	.000	
	N	46	46

** Correlation is significant at the 0.01 level (2-tailed)

Due to the high correlation of task importance and task frequency, a composite score was created to indicate the overall criticality of each task. The composite score was created by multiplying the mean task importance score by the mean task frequency score. A summary of the results of the creation of the task Criticality Index (CI) are shown in Table 17.

Table 17: Results of Task Criticality Index (CI)

Task ID	Task Statement	Import Score	Std Dev	Freq Score	Std Dev	I x F (CI)
1	Respond to Work Delays, Emergencies, and Other Problems	4.74	0.52	4.13	0.78	19.56
2	Present Information to Superiors through Formal and Informal Communications	4.81	0.39	4.79	0.50	23.07
3	Monitor Project Progress	4.56	0.57	4.63	0.48	21.07
4	Establish, Operate, and Maintain Installations	4.63	0.55	4.21	1.00	19.48
5	Inspect Project Sites	4.37	0.67	4.13	0.53	18.03
6	Command and Control of Civil	4.41	0.62	3.83	1.03	16.90

	Engineer Forces					
7	Organize, Plan, and Prioritize Work	4.42	0.63	4.58	0.64	20.27
8	Discuss and Resolve Construction Issues	4.38	0.68	4.17	0.80	18.27
9	Develop Courses of Action for Engineering Problems	4.48	0.57	4.29	0.79	19.23
10	Prepare Cost Estimates, Budgets, and Work Timetables	4.30	0.94	4.04	0.73	17.36
11	Interpret and Explain Contracts to Others	4.04	1.00	3.83	0.94	15.48
12	Ensure Conformance to Project Design Specifications	4.30	0.71	4.08	0.64	17.54
13	Perform Contracting Officer Representative (COR) Activities	3.85	0.97	3.54	1.00	13.64
14	Ensure Compliance with Requirements, Codes, and Regulations	4.15	0.85	3.83	0.69	15.90
15	Interact with Multi-National and Joint Forces	4.26	0.75	3.54	1.04	15.08
16	Determine Feasibility and Constructability of Projects	4.12	0.80	3.79	1.00	15.60
17	Installation/Base Master Planning	4.07	0.94	3.50	1.12	14.26
18	Prepare Performance Work Statements	4.00	0.77	3.88	0.88	15.50
19	Determine Project Personnel and Resource Requirements	4.22	0.87	3.71	1.02	15.66
20	Determine Project Design Specifications	3.81	0.92	3.50	0.76	13.33
21	Perform Site Evaluations	4.00	1.09	3.61	0.77	14.43
22	Select, Schedule, and Coordinate Jobsite Activities	3.81	0.92	3.75	0.66	14.28
23	Force Beddown	4.07	1.05	3.08	1.22	12.56
24	Perform Project Risk Analysis	3.60	1.20	3.13	1.05	11.25
25	Provide Technical Advice to Colleagues and Superiors	3.78	0.83	3.79	0.87	14.32
26	Study User Requirements and Determine Construction Methods	3.76	1.07	3.88	0.88	14.57
27	Perform Emergency Repairs	3.67	1.25	3.17	0.99	11.61
28	Collect and Apply Subject Matter Expert (SME) Inputs	3.78	0.83	3.63	0.75	13.69
29	Analyze Survey Reports, Maps, and Other Data to Plan Projects	3.73	0.98	3.63	1.03	13.52
30	Help Prepare Contracts and Negotiate Contractual Agreements	3.70	1.01	3.38	1.03	12.50
31	Bare Base Master Planning	3.81	1.19	2.71	1.14	10.33

32	Plan and Establish Land Use	3.81	0.94	3.08	1.11	11.76
33	Develop and Implement Quality Control Programs	3.42	0.88	3.08	0.86	10.55
34	Execute Basic Combat Tasks	3.44	1.26	2.67	1.07	9.19
35	Investigate Damage, Accidents, or Delays at Construction Sites	3.56	0.99	3.33	0.94	11.85
36	Develop, Monitor, and Brief Survivability Actions and Methods	3.19	0.94	2.67	1.03	8.49
37	Perform Military Administrative Actions (DECs, LOEs, Discipline, etc.)	3.59	0.99	3.88	1.09	13.92
38	Order Construction Materials and Equipment	3.37	1.22	3.17	0.99	10.67
39	Mentor Host Nation Forces	3.11	0.96	2.88	0.97	8.94
40	Perform Convoy Planning and Operations	2.85	1.24	2.42	0.91	6.89
41	Determine and Implement Environmental Protection Measures	3.07	0.86	2.79	0.91	8.58
42	Perform Base Denial Activities	2.59	0.91	1.71	0.61	4.43
43	Perform Base Hardening	3.00	1.02	2.67	0.85	8.00
44	Perform Deconstruction Activities	2.70	0.94	2.42	0.70	6.53
45	Use Design Software to Plan Projects	2.58	1.08	2.50	0.96	6.44
46	Monitor the Air Force Civil Augmentation Program (AFCAP)	2.52	1.10	2.33	0.94	5.88

The last step was to compile the final TI based on the task CI scores and the KSA importance scores that were above the cut-off score. The cut-off score for the task CI scores was 9 and the cut-off score for the KSA importance scores was 3. The scores were rank-ordered and the cut-off was applied. Applying the cut-off to the task CI scores eliminated the 10 lowest scoring tasks. Applying the cut-off to the KSA importance scores eliminated the 8 lowest scoring KSAs. The rank-ordered list of tasks and KSAs that were included in the final TI are shown in Table 18 and Table 19.

Table 18: Task CI Scores Rank-Ordered with Cut-off Displayed

Task Statement	CI	Rank
Present Information to Superiors through Formal and Informal Communications	23.07	1
Monitor Project Progress	21.07	2
Organize, Plan, and Prioritize Work	20.27	3
Respond to Work Delays, Emergencies, and Other Problems	19.56	4
Establish, Operate, and Maintain Installations	19.48	5
Develop Courses of Action for Engineering Problems	19.23	6
Discuss and Resolve Construction Issues	18.27	7
Inspect Project Sites	18.03	8
Ensure Conformance to Project Design Specifications	17.54	9
Prepare Cost Estimates, Budgets, and Work Timetables	17.36	10
Command and Control of Civil Engineer Forces	16.90	11
Ensure Compliance with Requirements, Codes, and Regulations	15.90	12
Determine Project Personnel and Resource Requirements	15.66	13
Determine Feasibility and Constructability of Projects	15.60	14
Prepare Performance Work Statements	15.50	15
Interpret and Explain Contracts to Others	15.48	16
Interact with Multi-National and Joint Forces	15.08	17
Study User Requirements and Determine Construction Methods	14.57	18
Perform Site Evaluations	14.43	19
Provide Technical Advice to Colleagues and Superiors	14.32	20
Select, Schedule, and Coordinate Jobsite Activities	14.28	21
Installation/Base Master Planning	14.26	22
Perform Military Administrative Actions (DECs, LOEs, Discipline, etc.)	13.92	23
Collect and Apply Subject Matter Expert (SME) Inputs	13.69	24
Perform Contracting Officer Representative (COR) Activities	13.64	25
Analyze Survey Reports, Maps, and Other Data to Plan Projects	13.52	26
Determine Project Design Specifications	13.33	27
Force Beddown	12.56	28
Help Prepare Contracts and Negotiate Contractual Agreements	12.50	29
Investigate Damage, Accidents, or Delays at Construction Sites	11.85	30
Plan and Establish Land Use	11.76	31
Perform Emergency Repairs	11.61	32
Perform Project Risk Analysis	11.25	33
Order Construction Materials and Equipment	10.67	34

Develop and Implement Quality Control Programs	10.55	35
Bare Base Master Planning	10.33	36
Execute Basic Combat Tasks	9.19	37
Mentor Host Nation Forces	8.94	38
Determine and Implement Environmental Protection Measures	8.58	39
Develop, Monitor, and Brief Survivability Actions and Methods	8.49	40
Perform Base Hardening	8.00	41
Perform Convoy Planning and Operations	6.89	42
Perform Deconstruction Activities	6.53	43
Use Design Software to Plan Projects	6.44	44
Monitor the Air Force Civil Augmentation Program (AFCAP)	5.88	45
Perform Base Denial Activities	4.43	46

Table 19: KSA Importance Scores Rank-Ordered with Cut-Off Displayed

KSA Statement	Import Score	Std Dev.	Rank
Ability to Work in Teams	4.83	0.38	1
Critical Thinking	4.83	0.38	1
Stress Tolerance	4.78	0.44	3
Time Management	4.78	0.41	3
Leadership	4.74	0.41	5
Accountability	4.70	0.65	6
Attention to Detail	4.65	0.55	7
Deductive Reasoning	4.65	0.48	7
Interpersonal Skills	4.65	0.56	7
Active Listening	4.61	0.48	10
Confidence	4.61	0.49	10
Inductive Reasoning	4.61	0.49	10
Ability to Solve Complex Problems	4.57	0.57	13
Ability to Write Effectively	4.57	0.58	13
Reading Comprehension	4.52	0.71	15
Ability to Manage a Diverse Workforce	4.52	0.58	15
Ability to use Computers	4.52	0.80	15
Knowledge of Project Management	4.30	1.07	18
Ability to Multitask	4.26	0.83	19
Ability to do Simple Cost Estimation	4.26	0.75	19

Knowledge of Construction Management	4.22	0.61	21
Knowledge of Building and Construction (temporary, semi-permanent, permanent, and host nation)	4.17	0.86	22
Strategic Thinking	4.13	0.72	23
Knowledge of Contingency Construction Techniques	4.09	0.62	24
Ability to Perform Customer Service	4.04	0.64	25
Public Speaking	4.04	0.88	25
Knowledge of Simple Facility Design	4.00	0.93	27
Knowledge of General Engineering	4.00	0.86	27
Political Savvy	3.96	0.78	29
Knowledge of Civil Engineer Enlisted AFSCs	3.95	0.88	30
Ability to Negotiate	3.91	1.10	31
Ability to do Design Reviews	3.87	0.93	32
Knowledge of the CENTCOM Sandbook and other Theater Standards	3.83	1.15	33
Ability to use Standard Issued Weapons Proficiently	3.78	0.71	34
Knowledge of the Base Operation Support Integrator (BOS-I) and Senior Airfield Authority (SAA) system	3.74	0.85	35
Knowledge of Financial Management	3.74	0.94	35
Knowledge of Job Site Safety	3.74	0.71	35
Knowledge of Military Resource Procurement	3.70	0.80	38
Ability to use Radio Communications	3.70	0.96	38
Knowledge of Bare Bases, Main Operating Bases, Joint Operating Bases, Forward Operating Bases, and Combat Outposts	3.61	0.88	40
Knowledge of Air Force Facilities and Management	3.57	0.93	41
Knowledge of Airfield Damage Repair	3.57	0.74	41
Knowledge of Expeditionary Shelters (AF, Joint Force, Multinational)	3.52	1.21	43
Knowledge of Joint Force Structure, Organization, Mission, Capabilities, and Ranks	3.52	0.82	43
Knowledge of Bare Base Assets	3.52	0.71	43
Knowledge of Theater Tactics, Techniques, and Procedures (TTPs)	3.48	1.01	46
Knowledge of Administration and Personnel Management	3.48	0.88	46
Ability to do Master/Community Planning	3.48	1.00	46
Knowledge of Reach Back Support Resources (AFCEC)	3.48	0.83	46
Knowledge of the Federal Acquisition Regulations (FAR)	3.43	0.97	50
Knowledge of Human Resource Management	3.43	0.87	50
Ability to Asses Facility Damage	3.39	0.68	52

Knowledge of the Military Decision Making Process	3.39	1.02	52
Knowledge of Prime BEEF Structure	3.35	0.80	54
Knowledge of Military Paperwork	3.22	0.87	55
Knowledge of Field Sanitation Techniques	3.17	0.75	56
Knowledge of Air Base Defense and Security Activities	3.13	0.93	57
Knowledge of Engineering Technologies	3.13	1.31	57
Knowledge of Law and Government	2.96	0.91	59
Knowledge of Vehicle and Equipment Operations	2.96	0.87	59
Knowledge of the Air Force Civil Augmentation Program (AFCAP)	2.78	0.92	61
Knowledge of Tactical Convoy Operations	2.70	1.04	62
Ability to use GIS systems for Planning Purposes and Decision Making	2.61	0.97	63
Knowledge of Defensive Fighting Positions	2.61	0.82	63
Knowledge of Nighttime Operations	2.57	1.10	65
Ability to use AutoCAD/Develop Drawings	2.13	0.85	66

Figure 13 displays the tasks with the 10 highest CIs and the tasks with the 10 lowest CIs. The task rated most critical was presenting information to superiors through formal and informal communications. The task rated least critical was performing base denial activities.

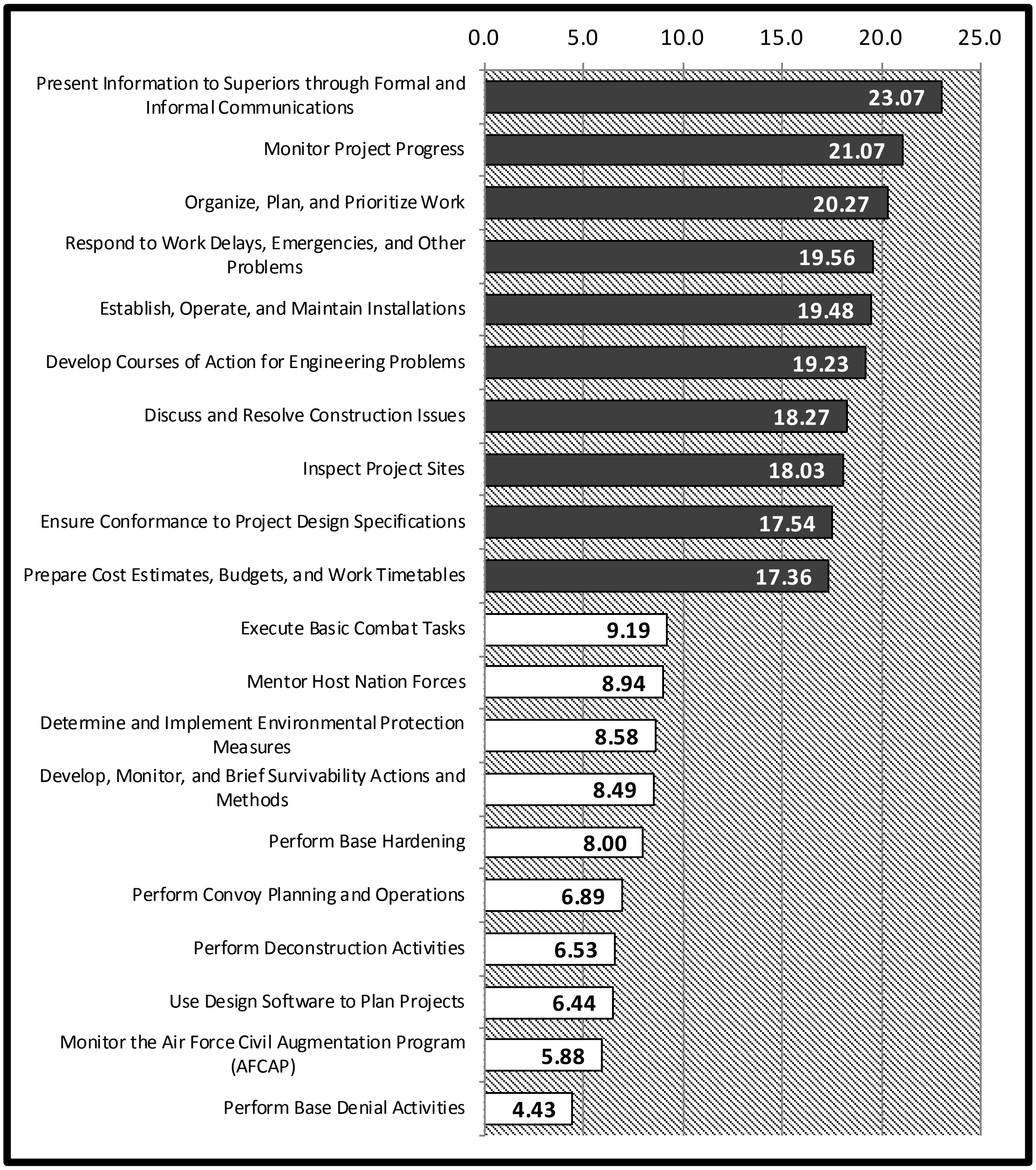


Figure 13: 10 Highest and 10 Lowest Rated Tasks

Figure 14 displays the 10 highest rated KSAs and the 10 lowest rated KSAs. The ability to work in teams and critical thinking were the overall KSAs rated most important and the ability to use Computer Assisted Design (CAD) software was the KSA rated least important.

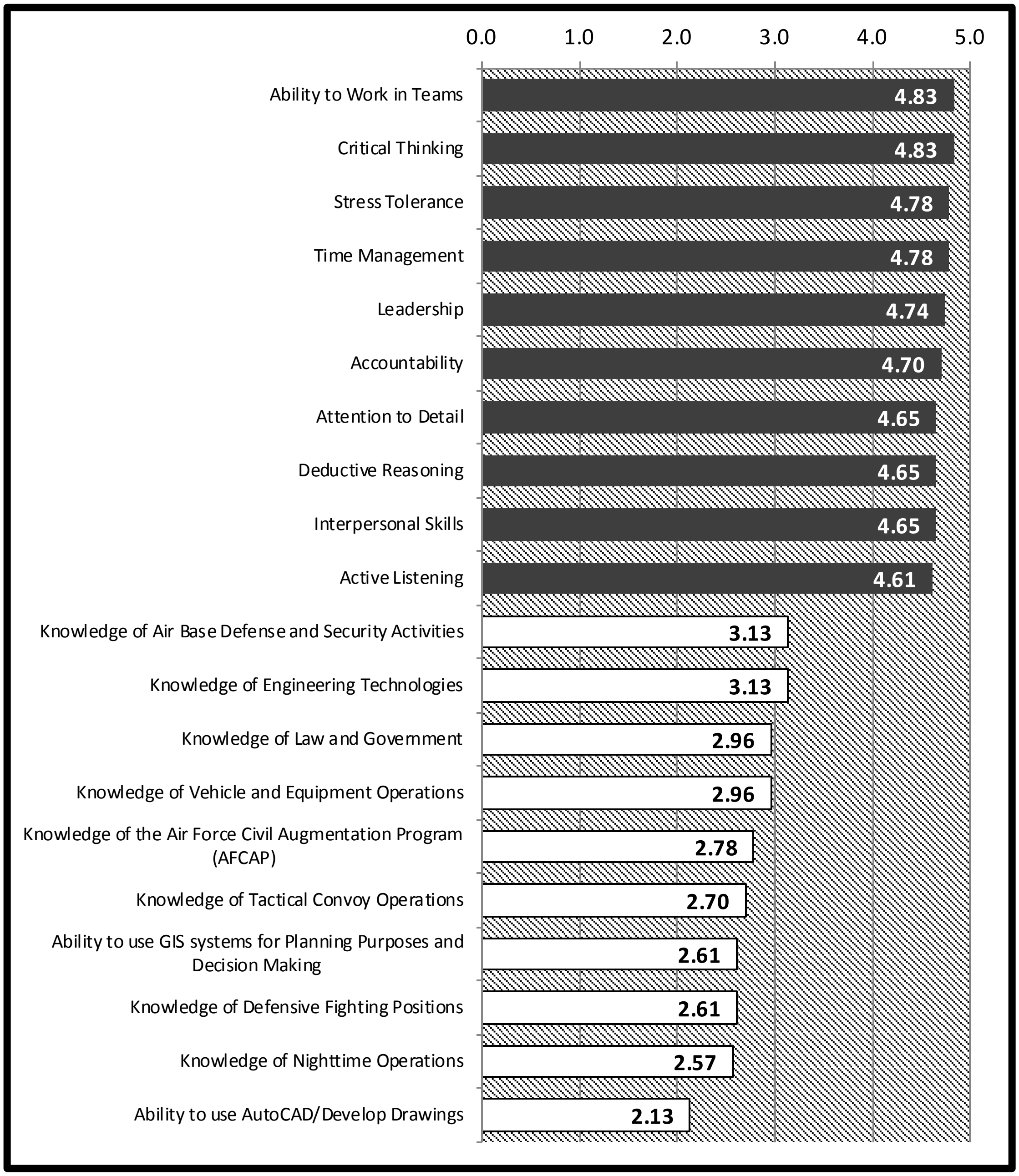


Figure 14: 10 Highest and 10 Lowest Rated KSAs

Research Questions

The JA completed in the first phase of this research sought to provide answers to the first two research questions.

1. **What are the most important and most frequent tasks performed by CE CGOs in the current contingency environment?**

Completing a literature review and conducting an open-ended questionnaire broadly identified the pertinent tasks of a CE CGO in the contingency environment. The results of this step reinforced the shared traits and responsibilities inherent to the profession of civil engineering while identifying the unique tasks expected of the military civil engineer.

The list of tasks was then further honed in on by soliciting the opinion of 27 very knowledgeable and highly experienced SMEs. With their help, the most important and most frequent tasks were identified. The analysis found that the most important tasks were also the most frequently performed tasks, which led to the creation of a task criticality index. The task criticality index offered a composite score that simplified the interpretation of the task data.

Project management tasks were among the most critical. The task of solving problems, both in the construction of projects but also in the operations and maintenance of those projects, was also rated very critical. Above all other tasks, the most critical function of the CE CGO was to effectively communicate information to superiors so that precise operational and strategic decisions can be made.

It is also important to capture the tasks that were rated least critical. The tasks included aspects of technical design and operations. The tasks rated least critical were mostly secondary functions of engineers. These tasks, while still very important to the overall mission, are probably best assigned to other professions with higher levels of knowledge and training in the direct execution of the tasks.

Lastly, the list of critical tasks contributes directly to the creation of the content for the second phase of this research.

2. What are the Knowledge, Skills, and Abilities (KSAs) needed for effective job performance in the current contingency environment?

The initial literature review and open-endued questionnaire also extended to the identification of the KSAs associated with CE CGOs in the contingency environment. The KSAs are those that are needed to execute the most critical tasks. The KSAs were rated only according their absolute importance to job.

The KSAs determined to be most important were not ones unique to the civil engineer career field. The most important KSAs were higher-level traits expected of all military personnel, particularly those expected of an officer. Stress tolerance and time management were rated just behind teamwork and critical thinking. Stress tolerance and time management are especially important in the contingency environment where stress is high and time is of the essence.

The least important KSAs echoed the trend found with the tasks, that the specific technical aspects of the job were less critical. The lowest rated KSAs were associated with typically low frequency tasks such as nighttime operations and tactical convoy operations. It is also important to note that the least important KSAs were generally knowledge domains whereas the most important KSAs were cognitive abilities.

Summary

This chapter provided the analysis and results of the TI that was conducted as the first part of this research. First, the results of the job information collection were presented. The job information was collected from sources generic to the civil engineering profession and from sources specific to the Air Force civil engineer. Commonalities and differences were found among all sources and provided the foundation for further exploration of the critical tasks and KSAs for CE CGOs. Next, the preliminary list of tasks and KSAs was given. The job information collected was aggregated into 46 tasks and 66 KSAs that were found to be common themes among all sources. Then, the analysis and results of the SME survey were detailed. The SME survey found that the majority of tasks and KSAs identified were well above the mid-point when rated on importance and frequency. It was found that task frequency was highly correlated to task importance and a composite score for the tasks was created. Lastly, the tasks and KSAs included in the final TI were presented. The final TI eliminated 10 tasks and 8 KSAs from the initial list. These lowest rated tasks and KSAs were not included into the content domain for the creation of the contingency job knowledge test instrument.

V. Methodology (Test Instrument)

Chapter Overview

This chapter provides the methodology for the design, administration, evaluation, and analysis of the test instrument used in this research. Effective test development is a product of a systematic process. Theresa Kline presents the systematic process through 12 chapters of her book, *Psychological Testing: A Practical Approach to Design and Evaluation* (2005). Steven Downing and Thomas Haladyna provide a 12-step framework with supporting content from other authors in their compilation, *Handbook of Test Development* (2006). The methodology used in this research chiefly followed the processes outlined by those two primary sources. The processes are summarized in this chapter into four distinct areas: design, administration, evaluation, and analysis.

Design

The first step in the design of the test instrument was identifying the construct (Downing, 2006c; Kline, 2005). The construct for the test instrument in this research was contingency job knowledge. A contingency, as defined by Joint Publication 1-02, *Department of Defense Dictionary of Military and Associated Terms*, is "a situation requiring military operations in response to natural disasters, terrorists, subversives, or as otherwise directed by appropriate authority to protect US interests" (p.47). Job knowledge is an accumulation of the facts, principles, and procedures related to the execution of the tasks associated with a job (DuBois, Shalin, Levi, & Borman, 1993). The construct itself is abstract and cannot be directly measured or observed thus necessitating that the construct be broken down into sub-constructs and individual areas. A representation of the theoretical relationships between constructs, sub-constructs, and individual areas is called a nomological network (Cronbach & Meehl, 1955). The nomological network can be displayed visually or described in narrative form. The nomological network for this research was defined using the results of the task inventory (see Chapter IV). Creating the nomological network helps further identify the construct and aids in defining the test content domain (Downing, 2006c). Figure 15 gives the nomological network that was created for the test instrument.

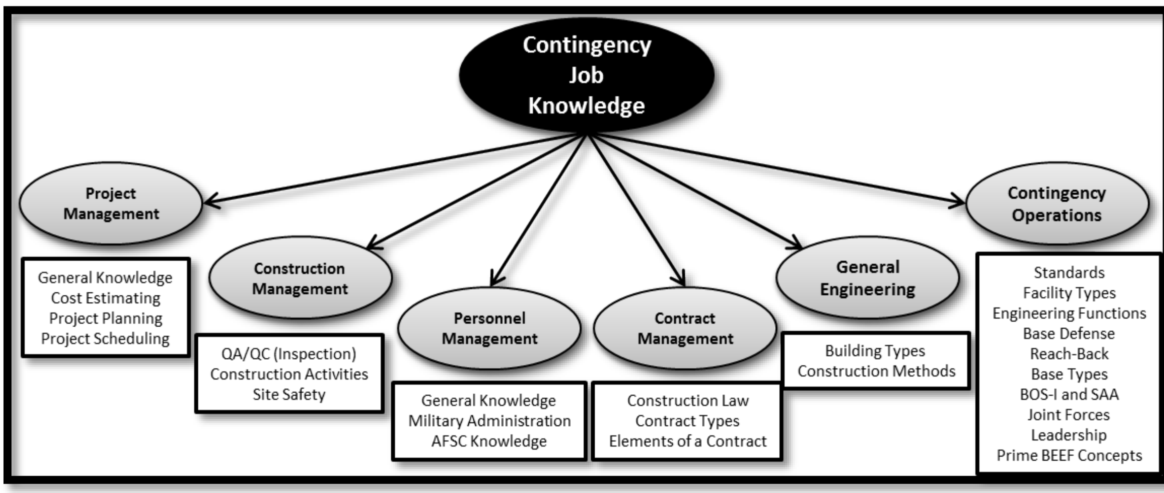


Figure 15: Contingency Job Knowledge Nomological Network

Closely related to the construct, the next step was to determine the purpose of the test instrument. The purpose of the test instrument was to identify contingency job knowledge weaknesses in CE CGOs so that, together with the task inventory, training needs could be estimated. A test used for this purpose is also called an achievement test because the test is designed to measure specific content knowledge (Webb, 2006).

Achievement tests can be norm-referenced, criterion-referenced, or domain-referenced. A norm-referenced test compares the scores of test-takers relative to the scores of other test-takers. A criterion-referenced test compares the scores of test-takers to a predetermined minimum level of competency. A domain-referenced test compares the scores of test-takers to the overall level of competence in a domain (Cohen et al., 2003). The job knowledge test used in this research was a domain-referenced test because it was concerned with the levels of contingency job knowledge of each CE CGO without making a direct comparison to each other or to a pre-determined cut-off score.

After defining the construct and purpose of the test instrument, the next step was to determine the test content. The content of a test instrument is one of the most important steps in creating content validity evidence. The content for the test instrument was systematically determined by the task inventory. The test content is a matter of human judgement but the methods and procedures used to make content decisions should seek to maximize objectivity (Downing, 2006c). The final list of critical tasks found in Chapter IV were grouped into sub-constructs and individual areas that fit into those sub-constructs. The content domain for the creation of the test items was outlined by the lowest level in the nomological network. Table 20 provides a list of the individual areas that made up the lowest level of the nomological network seen in Figure 15.

Table 20: Individual Items of the Lowest Nomological Network Level

Project Mgmt	Construction Mgmt	Personnel Mgmt	Contract Mgmt	General Engineering	Contingency Operations
General Knowledge	QA/QC (Inspection)	General Knowledge	Construction Law	Building Types	Standards
Cost Estimating	Construction Activities	Military Admin	Contract Types	Construction Methods	Facility Types
Project Planning	Site Safety	AFSC Knowledge	Elements of a Contract		Engineering Functions
Project Scheduling					Base Defense
					Reach-Back
					Base Types
					BOS-I and SAA
					Joint Forces
					Leadership
					Prime BEEF Concepts

The next step in the design of the test instrument was to determine the test specifications. The test specifications include the test item format, the type of test items, the total number of items, the item scoring rules, and the number of questions allocated to each content area.

The test item format used for the test instrument was selected-response. The selected-response item format is an efficient, effective, and widely-used test item format for achievement tests (Downing, 2006a). The selected-response item format describes a test item where test-takers choose an answer among a given list of possible answers. The types of selected-response items used for the test instrument were multiple-choice, true or false, and extended matching. The total number of test items was initially determined by allocating approximately one minute for each question. With the goal duration being one hour for the test, the total number of items was set at 76. The total number of items was later adjusted to 123 after a pilot test of the test instrument was conducted. The test items were dichotomously scored as either correct or incorrect. One point was given for each correct response and no point was given for an incorrect response. Each test item was equally weighted. The number of items for each content area and level of cognitive complexity was determined subjectively. Generally, the sub-constructs and individual areas stemming from the tasks rated most critical on the task inventory had more test items developed.

The next step in the design of the test instrument was to write the test items. The approach taken to writing each item was to first explore the option of using a test question that had already been written by another test developer. If no pre-existing test question was available, a source was found for each question. Table 21 provides an overview of the sources that were used for pre-existing questions or as content sources for the creation of new test items. The approach that was taken to creating new test items generally followed the set of nine guiding principles collected by Kline (2005): (1) deal with only one central thought in each item; (2) be precise; (3) be brief; (4) avoid awkward wording or dangling constructs; (5) avoid irrelevant information; (6) present items in positive language; (7) avoid double negatives; (8) avoid absolute terms such as all, none, always, and never; and (9) avoid indeterminate and vague terms such as frequently and sometimes.

Table 21: Overview of Test Item Sources

Source	Sub-Construct/ Individual Area	Pre-Existing Question or Content Source
Canadian Construction Association Practice Exam	Proj Mgmt/General Knowledge	Pre-Existing Question
Preparepm.com PMP Practice Exam	Proj Mgmt/General Knowledge	Pre-Existing Question
Oliver F. Lehmann Project Management Training	Proj Mgmt/General Knowledge	Pre-Existing Question
United Facilities Criteria 3-740-05, *Handbook: Construction Cost Estimating*	Proj Mgmt/Cost Estimating	Content Source
Canadian Construction Association Practice Exam	Proj Mgmt/Cost Estimating	Pre-Existing Question
Preparepm.com PMP Practice Exam	Proj Mgmt/Project Planning	Pre-Existing Question
AFI 65-501, *Economic Analysis*	Proj Mgmt/Project Planning	Content Source
WMGT 101 Student Outline Guide: Week 3	Proj Mgmt/Project Scheduling	Content Source
USAF Project Manager's Guide for Design and Construction	Proj Mgmt/Project Scheduling	Content Source
Oliver F. Lehmann Project Management Training	Proj Mgmt/Project Scheduling	Pre-Existing Question
2015 DOD IG Report: Military Construction in a Contingency Environment	Construction Mgmt/QA/QC (Inspection)	Content Source
USACE and NAVFAC Construction Quality Management (CQM) Study Guide	Construction Mgmt/QA/QC (Inspection)	Content Source
USAF Project Manager's Guide for Design and Construction	Construction Mgmt/Construction Activities	Content Source
American Institute of Constructors Certified Professional Constructor Guide	Construction Mgmt/Site Safety	Content Source
AFI 91-203, *Air Force Consolidated Occupational Safety Instruction*	Construction Mgmt/Site Safety	Content Source

Whole Building Design Guide (WBDG) – Building Types	General Engineering/Building Types	Content Source
UFC 1-201-01, *Non-Permanent DOD Facilities in Support of Military Operations*	General Engineering/Construction Methods	Content Source
AFIT ABET GEM Entrance-Exit Exam (Draft)	Contract Mgmt/Construction Law	Pre-Existing Question
AFPAM 32-1005, *Working in the Engineering Flight*	Contract Mgmt/Construction Law	Content Source
WMGT 101 Student Outline Guide: Week 3	Contract Mgmt/Construction Law	Content Source
United States Code, uscode.house.gov	Contract Mgmt/Contract Types	Content Source
AFI 32-1021, *Planning and Programming MILCON Projects*	Contract Mgmt/Contract Types	Content Source
American Institute of Constructors Certified Professional Constructor Guide	Contract Mgmt/Contract Types	Content Source
American Institute of Constructors Certified Professional Constructor Guide	Contract Mgmt/Elements of a Contract	Pre-Existing Question and Content Source
WMGT 101 Student Outline Guide: Week 3	Contract Mgmt/Elements of a Contract	Content Source
Oliver F. Lehmann Project Management Training	Personnel Mgmt/General Knowledge	Pre-Existing Question
USAF Deployed Leaders Guide to the AEF	Personnel Mgmt/Military Admin	Content Source
Air Force Enlisted Classification Directory (AFECD)	Personnel Mgmt/AFSC Knowledge	Content Source
UFC 1-201-01, *Non-Permanent DOD Facilities in Support of Military Operations*	Contingency Operations/Standards	Content Source
Central Command Regulation 415-1, *"The Sand Book"*	Contingency Operations/Standards	Content Source
European Command Base Camp Facility Standards, *"The Red Book"*	Contingency Operations/Standards	Content Source

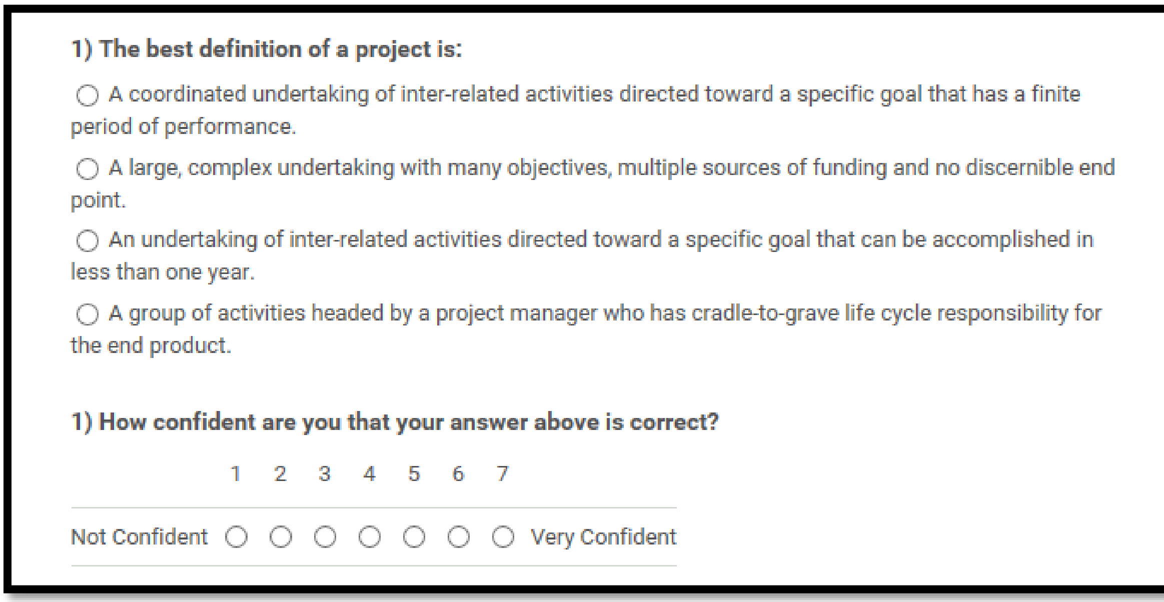
Pacific Command Contingency Basing and Construction Standards, *"The Blue Book"*	Contingency Operations/Standards	Content Source
UFC 1-201-01, *Non-Permanent DOD Facilities in Support of Military Operations*	Contingency Operations/Facility Types	Content Source
JP 3-34, *Joint Engineer Operations*	Contingency Operations/Facility Types	Content Source
Central Command Regulation 415-1, *"The Sand Book"*	Contingency Operations/Facility Types	Content Source
JP 3-34, *Joint Engineer Operations*	Contingency Operations/Engineer Functions	Content Source
GTA 90-01-011, *Joint Forward Operations Base (JFOB) Protection Handbook*	Contingency Operations/Base Defense	Content Source
Central Command Regulation 415-1, *"The Sand Book"*	Contingency Operations/Base Defense	Content Source
AFCEC Reach-Back Center (RBC) and USACE Reach-Back Operations Center (UROC)	Contingency Operations/Reach-Back	Content Source
Central Command Regulation 415-1, *"The Sand Book"*	Contingency Operations/Base Types	Content Source
Air Force Doctrine Annex 3-34, *Engineer Operations*	Contingency Operations/BOS-I and SAA	Content Source
Central Command Regulation 415-1, *"The Sand Book"*	Contingency Operations/BOS-I and SAA	Content Source
JP 3-34, *Joint Engineer Operations*	Contingency Operations/Joint Forces	Content Source
USAF Deployed Leaders Guide to the AEF	Contingency Operations/Joint Forces	Content Source
USAF Deployed Leaders Guide to the AEF	Contingency Operations/Leadership	Content Source
Air Force Doctrine Annex 3-34, *Engineer Operations*	Contingency Operations/Prime BEEF Concepts	Content Source

Test assembly occurs after the test items have been written. During test assembly, the test items are collected and placed into their final form. Quality control is an important aspect of test assembly. Inaccurate or careless construction of the test form can introduce construct-irrelevant variance (CIV) into the test instrument (Downing, 2006c).

First, the test items were arranged and ordered in a word processing document and checked for spelling errors and typos. Next, the template for the test form was built using Google Forms®. A plain, professional, and easy to read format was chosen for the test form. A brief introduction to the test instrument along with instructions were placed at the top of the test form. Several demographic questions were created prior entering the knowledge assessment questions. The demographic questions included: (1) years of service, (2) number of deployments, (3) hours per month spent on Home Station Training (HST), (4) number of Civil Engineer School courses attended, and (5) number of Silver Flag (SF) trainings attended. Additionally, demographic questions 3, 4, and 5 included a follow-on question asking test-takers to rate the quality of the respective training mechanism. The demographic follow-on question utilized a seven-point Likert scale that ranged from "very poor" to "exceptional".

Google Forms® allowed for the easy creation of several different types of selected-response questions. The test items were entered one at a time. Each test item also had a follow-on question associated with it. The follow-on question asked test-takers to provide a confidence rating for the answer they provided to each test item. The confidence rating utilized a seven-point Likert scale that ranged from "not confident" to "very confident". The purpose of the follow-on question was to add fidelity to understanding the overall construct, contingency job knowledge. The follow-on question also served as a method for identifying questions where the correct response was achieved by guessing.

A key consideration when putting the test items together is the location of the correct response. A relatively equal frequency of correct response options was used with no distinguishable pattern to the actual correct responses. Figure 16 shows the first question as it was presented to test-takers. The full test instrument can be found in Appendix H. Institutional Review Board (IRB) exemption approval for the test instrument was required. The IRB exemption approval letter can be found in Appendix I.



1) The best definition of a project is:

◯ A coordinated undertaking of inter-related activities directed toward a specific goal that has a finite period of performance.

◯ A large, complex undertaking with many objectives, multiple sources of funding and no discernible end point.

◯ An undertaking of inter-related activities directed toward a specific goal that can be accomplished in less than one year.

◯ A group of activities headed by a project manager who has cradle-to-grave life cycle responsibility for the end product.

1) How confident are you that your answer above is correct?

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

Figure 16: Test Question as Presented to Test-Takers

Pilot testing was the last step in the design of the test instrument. Pilot testing provides feedback on the duration, clarity, difficulty level, and quality of the test instrument (Kline, 2005). The test instrument was pilot tested with a group of 24 CE CGOs. The average duration for test completion was 29 minutes, indicating that test takers needed approximately 30 seconds to answer each question as opposed to the estimated one minute. The total number of test items was increased to 123 based on the designed duration of one hour. During the administration, several items required clarification and were noted by the researcher for further investigation. After grading the test, the noted items were checked for levels of correctness. The items were eliminated if it was determined that the lack of clarity was negatively influencing the ability of the test takers to correctly answer the question. Several items were rewritten to improve clarity and avoid misinterpretation for future administrations. The average number of correct items was 53 out of a total of 76, which equated to approximately 70 percent. The maximum score was 82 percent, the minimum score was 57 percent, and the standard deviation was approximately 7 percent. A number of grammatical errors and typos were identified by the test takers and corrected for the final version of the test. The test takers did not experience difficulty accessing the web-based test instrument or utilizing the form to complete the test. No errors in the functioning of the form to record test taker information or item responses were encountered.

Administration

The test instrument was administered in a web-based format. The test instrument was administered to a sample of CE CGOs over the course of five months. The target population was CE CGOs with a focus on those CGOs that had graduated from WMGT 101, *Civil Engineer Basic Course*. The sample was made up of attendees to courses offered at the Civil Engineer School as well as CE CGOs that were stationed at WPAFB. A sample of 22 junior CE CGOs that were near WMGT 101 graduation were also administered the test. The WMGT 101 sample was used as a performance baseline for the rest of the sample.

The test instrument was distributed via a hyperlink using e-mail. The e-mail contained information summarizing the purpose of the research, identified the researchers and research sponsor, and provided instructions for completing the test. Additionally, the e-mail explicitly stated the anonymous and low risk nature of the test. Informed consent was obtained by ensuring that by participating in the research, volunteers had read and fully understood the information provided in the solicitation e-mail. The CE CGOs that were attending courses at the Civil Engineer School were asked to complete the test within one week of their course completion. A reminder was sent near the end of each course.

The completed test forms were graded automatically using Flubaroo®, an educational grading tool developed for Google Sheets®. Prior to utilizing the tool, an answer key was produced and checked for accuracy. The completed forms were graded after indicating which test form responses should receive a grade. The non-graded items included the demographic information and the item confidence ratings. The completed forms and graded responses were exported to a spreadsheet once all planned samples were given the opportunity to take the test.

Evaluation

Once the test instrument had been designed and administered, the next step was to evaluate reliability and validity.

Reliability.

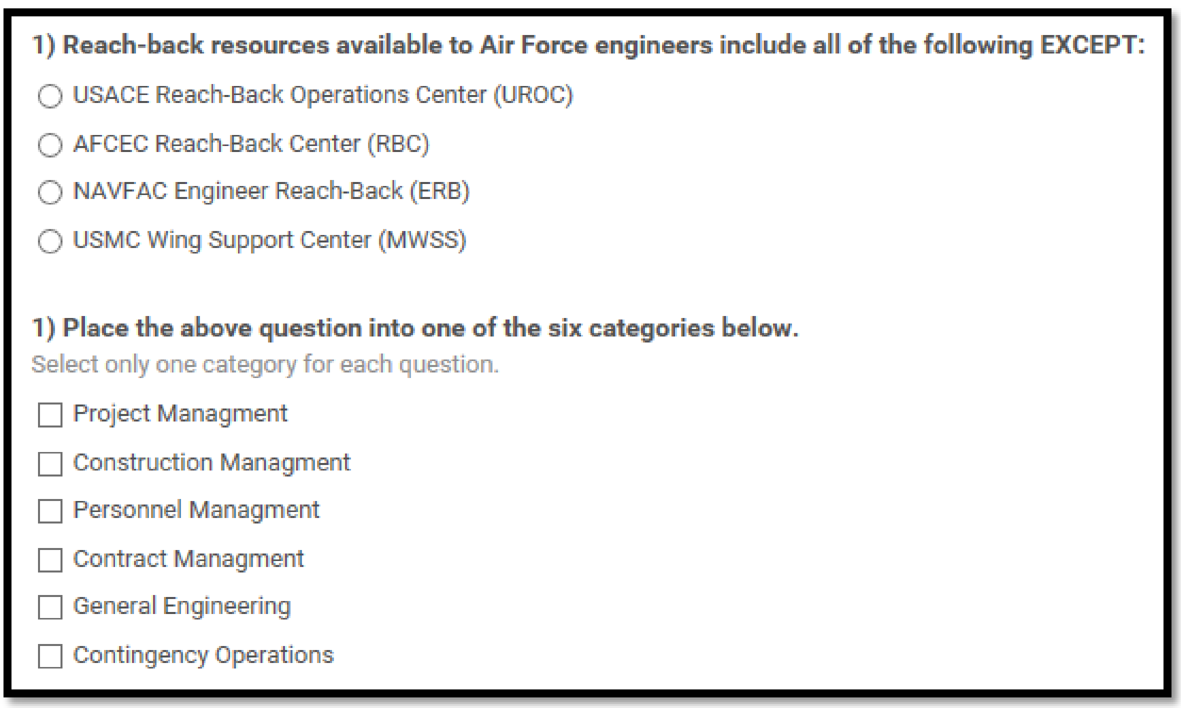
Reliability of the test instrument refers to the ability to get consistent results (Patten & Bruce, 2007). The measure of reliability available to the research was internal consistency. Internal consistency is an assessment of the responses across the items and not the total scores of a test. Internal consistency compares the responses for an item or group of items to the responses for another item or group of items. Internal consistency utilizes the responses of all participants for a single administration of the test instrument. The internal consistency of the test instrument was estimated using Kuder-Richardson 20 (KR-20) for the dichotomously scored items and Cronbach's alpha for the confidence ratings. Reliability was checked for each individual area within the sub-constructs, at the sub-construct level, and at the construct level.

Validity.

Validity is the ability of a test instrument to be useful for the purpose it was developed for (Patten & Bruce, 2007). Test instruments themselves are not the concern of validity but rather the interpretations made from the scores are the focus. The validity of the test instrument was assessed by offering evidence of content validity.

Content validity is a measure of the appropriateness of the content of the test instrument. The first step of content validity begins during test development (Higley, 2009). The primary source of evidence for the content validity of the test instrument is the task inventory (TI). The TI determined the content that was included in the development of the test items.

In addition to the TI, a Q-Sort was conducted to assess the face validity of how the individual items were categorized into sub-constructs. A Q-Sort is a qualitative method for assessing a person's subjective viewpoint and compare it to the viewpoints of others (Coogan & Herrington, 2011). The Q-Sort involves asking a group of SMEs to sort a number of items (Q-Set) into categories based on their opinion. The completed Q-Sort is then compared to how the items were categorized in the research. For the Q-Sort, the test instrument created with Google Forms® was modified. The question order was randomized and the confidence rating was replaced with the new Q-Sort component. The new Q-Sort component was the six sub-constructs placed into a check-box item. Figure 17 shows the first question as it was presented in the Q-Sort questionnaire.



1) Reach-back resources available to Air Force engineers include all of the following EXCEPT:

- ◯ USACE Reach-Back Operations Center (UROC)
- ◯ AFCEC Reach-Back Center (RBC)
- ◯ NAVFAC Engineer Reach-Back (ERB)
- ◯ USMC Wing Support Center (MWSS)

1) Place the above question into one of the six categories below.

Select only one category for each question.

- ☐ Project Managment
- ☐ Construction Managment
- ☐ Personnel Managment
- ☐ Contract Managment
- ☐ General Engineering
- ☐ Contingency Operations

Figure 17: Q-Sort Question as Presented to SMEs

The Q-Sort questionnaire was given to six CE CGOs. Five of the CGOs participated in the previous test administration and one CGO did not have prior experience with the test instrument. As an indicator of agreement, the percent of respondents that categorized the item the same as the item was categorized for the research was calculated.

Analysis

The purpose of the analysis of the test instrument was to identify knowledge areas where the sample of CE CGOs scored the lowest. In addition to identifying the knowledge weaknesses in the sample, the analysis of the test instrument sought to uncover useful relationships and trends in the data. All analysis was performed using Microsoft Excel (2010), for spreadsheet manipulation, and IBM SPSS Statistics (version 23), for data analytics.

Test results were first checked for quality. The primary concern for completeness was that test item responses had very few missing values. Missing data for the demographic questions or for the confidence ratings was less critical. Any submission that had fewer than ten missing test items responses was deemed useable.

Second, the overall response rate was determined. Response rates were calculated by dividing the number of usable completed submissions by the total number of test solicitations. The response rate was calculated without including the WMGT 101 sample. In addition to response rate, the overall representativeness of the sample was found. The representativeness of the sample was calculated using current information on the population of active duty CE CGOs obtained from Air Force Personnel Command (AFPC).

Next, descriptive statistics were found for the demographic questions. Histograms were produced to characterize the sample. The WMGT 101 sample did not include any demographic questions and was not included in this step.

After describing the sample, test scores were calculated for each test submission. The test scores were calculated at the item level (dichotomously), at the individual area level (mean score), at the sub-construct level (mean score), and at the construct level (total test score). Grand means for the entire sample were also found at the item level (mean score), at the individual area level (mean score), at the sub-construct level (mean score), and at the construct level (total test score). The test score data was then checked for possible outliers. The process was repeated for the confidence ratings. Scores were then compared to the confidence ratings. This served to help identify guessing as well as provide more information about the knowledge levels of the sample. The correlation between mean score per item and mean confidence rating per item was then calculated. Mean score per item and mean confidence rating per item were checked for normality and then the appropriate correlation coefficient was calculated.

After calculating the test score data, a cut-off for the determination of low-scores needed to be made. The cut-off was set at 70 percent correct. Any item score, individual area score, or sub-construct score that averaged less than 70 percent correct was reported as low-scoring.

Lastly, the relationships between the test scores and the demographic information were explored. No relationships were hypothesized before conducting the analysis. A one-way between groups analysis of variance (ANOVA) was conducted where the different set of test scores were used as the dependent variable and the demographic responses were used as the independent variables. Prior to conducting the ANOVA, normality and homogeneity of variance were checked. If the assumptions necessary to carry out the ANOVA were not met, an alternative method was used. If any statistically significant differences in the test scores between groups were found, post-hoc comparisons using means plots were made.

Summary

This chapter provided the methodology used to design, administer, evaluate, and analyze the test instrument developed for this research. The design was described according to construct identification, purpose determination, content determination, test specification creation, item writing, test assembly, and pilot testing. The administration and scoring of the test instrument were described. Then, the ways for evaluating the test instrument including reliability and validity were detailed. Lastly, the methods for analyzing the results of the test instrument were given.

VI. Analysis and Results (Test Instrument)

Chapter Overview

This chapter provides the analysis and results of the test instrument that was administered for this research. First, the results of the reliability analysis will be presented and then the results of the Q-Sort will be given. Next, response rates and representativeness will be shown. Third, the sample will be characterized with descriptive statistics and histograms. After describing the sample, the test scores will be presented at the overall construct level, at the sub-construct level, at the individual area level, and at the item level. The low-scoring sub-constructs, individual areas, and items will then be discussed. Lastly, the results of the exploratory analysis of the relationships between demographic information and test scores will be presented.

Reliability Analysis

The reliability of the test instrument was estimated at the construct level, the sub-construct level, and at the individual area level. Reliability was estimated using the Kuder-Richardson 20 (KR-20) coefficient for dichotomous test item scores (i.e., the actual measurements), and Cronbach's Alpha (α) was used to estimate the reliability for the confidence ratings associated with each test item (i.e., how confident you are that your answer is correct). Table 22 provides a summary of the results of the reliability analysis.

Table 22: Reliability Analysis Results Summary

Construct/Sub-Construct/Individual Area	N of Items	KR-20 (Items)	N of Items	α (Confidence Ratings)
Contingency Job Knowledge – Overall	122	.758	123	.981
Project Management (PM) – Overall	25	.467	25	.909
PM – General Knowledge	4	.067	4	.764
PM – Cost Estimating	9	.233	9	.862
PM – Project Planning	5	.374	5	.659
PM – Project Scheduling	7	.262	7	.755
Construction Management (CM) – Overall	11	.056	11	.805
CM – QA/QC (Inspection)	4	.166	4	.722
CM – Construction Activities	2	.280	2	.416
CM – Site Safety	5	-.491	5	.659
General Engineering (GE) – Overall	6	-.389	6	.726
GE – Building Types	4	-.172	4	.707
GE – Construction Methods	2	.143	2	.158
Contract Management (ConM) – Overall	19	.563	19	.914
ConM – Construction Law	8	.613	8	.819
ConM – Contract Types	5	.252	5	.701
ConM – Contract Elements	6	.219	6	.824
Personnel Management (PerM) – Overall	12	.319	12	.860
PerM – Basic Knowledge	5	.244	5	.798
PerM – Military Admin	4	-.846	4	.807
PerM – AFSC Knowledge	3	.548	3	.855
Contingency Operations (CO) – Overall	50	.634	50	.970
CO – Prime BEEF Concepts	2	.154	2	.663
CO – Standards	6	.175	6	.696
CO – Facility Types	8	.368	8	.887
CO – Engineering Functions	5	.564	5	.885
CO – Base Defense	4	.088	4	.719
CO – Reach-Back	4	.344	4	.761
CO – Base Types	6	.356	6	.867
CO – BOS-I and SAA	4	.546	4	.892
CO – Joint Forces	4	.186	4	.840
CO – Deployed Leadership	7	.290	7	.914

The results of the reliability analysis suggest that the internal consistency for the dichotomously scored items is low when assessed at the sub-construct and individual area levels. The low internal consistency could be due to the small number of items per sub-construct (ranging from 6 to 50) or individual area (ranging from 2 to 9). When N is increased to include the full test, the reliability is well within the acceptable range. Low internal consistency could also be due to a lack of unidimensionality within each sub-construct or individual area. A set of test items is said to be unidimensional if all of the items within that set measure the same underlying dimension or construct. The dimensionality of a test instrument is typically evaluated by conducting a factor analysis, ideally with a large sample (N>200) (Jones, Smith, & Talley, 2006). The limitations of this research prevent such an analysis from being feasible. Moreover, a large number of other latent traits or constructs could be present in the test items due to imperfect test design; this condition would cause a severe underestimation of reliability (Tavakol & Dennick, 2011). The internal consistency of the test sees more acceptable values (0.70 to 0.90) when Cronbach's Alpha is used for the confidence ratings in place of KR-20 for the dichotomously scored items.

Q-Sort

The Q-Sort was conducted by administering the Q-Sort questionnaire to six CE CGOs. The Q-Sort sample had an average of 5.5 years of service and 1.2 deployments. The purpose of the Q-Sort was to gauge the level of agreement between how the test items were categorized and how the Q-Sort sample thought they should be categorized. Table 23 provides a summary of the results of the Q-Sort.

Table 23: Q-Sort Results Summary

Overall	66% agreement
Project Management	78% agreement
Construction Management	42% agreement
General Engineering	75% agreement
Contract Management	75% agreement
Personnel Management	74% agreement
Contingency Operations	58% agreement

The sub-constructs with the lowest levels of agreement were construction management and contingency operations. The Q-Sort sample had a level of agreement greater than or equal to 50 percent for 95 of the test items and less than 50 percent for 28 of the test items. The 28 items may have been incorrectly categorized by the researcher and warrant further analysis in future research. The overall level of agreement was 66 percent, which demonstrated a fair level of agreement. If the 28 items with less than 50 percent agreement were excluded, the overall level of agreement would increase to approximately 80 percent. After excluding the 28 items with less than 50 percent agreement, the reliability analysis was re-run with mixed results. The overall test reliability decreased after exclusion but increased for some of the sub-constructs and individual areas, further indicating that these items could be incorrectly categorized. The full results of the Q-Sort can be found in Appendix J. The results of the Q-Sort demonstrated that the test items were categorized into sub-constructs fairly well for project management, general engineering, contract management, and personnel management but somewhat poorly for construction management and contingency operations. Overall, the result was satisfactory.

Response Rates and Representativeness

The total number of solicitations for test participation was 101. The number of usable submissions received was 42, representing a response rate of 42 percent. The WMGT 101 sample was not included in calculating response rate. As with the SME survey conducted as part of the job analysis, the response rate was lower than desired. Despite the low response rate, the overall representativeness of the sample was satisfactory. As of November of 2015, there were 683 active duty CE CGOs in the Air Force. A total of 64 useable submissions were received; 42 from the main sample and an additional 22 from the WMGT 101 sample. The sample represented approximately 9.4 percent of the population of interest.

Sample Characteristics

The sample characteristics presented in this section do not include the WMGT 101 sample. No demographic information was collected from the WMGT 101 sample. The main sample had an average of 4.4 years of service and 0.83 deployments. The sample met the target characteristics of a CE CGO. A summary of the sample characteristics can be found in Table 24. Histograms for number of years of service and number of deployments can be found in Figure 18 and Figure 19. The respective mean value is marked by a red dashed line in each histogram.

Table 24: Sample Characteristics – # of Years of Service and # of Deployments

# of Years of Service		# of Deployments	
Mean:	4.4	Mean:	.83
Median:	4	Median:	1
Std Dev:	1.9	Std Dev:	.15
Min:	1	Min:	0
Max:	10	Max:	4
Range:	9	Range:	4

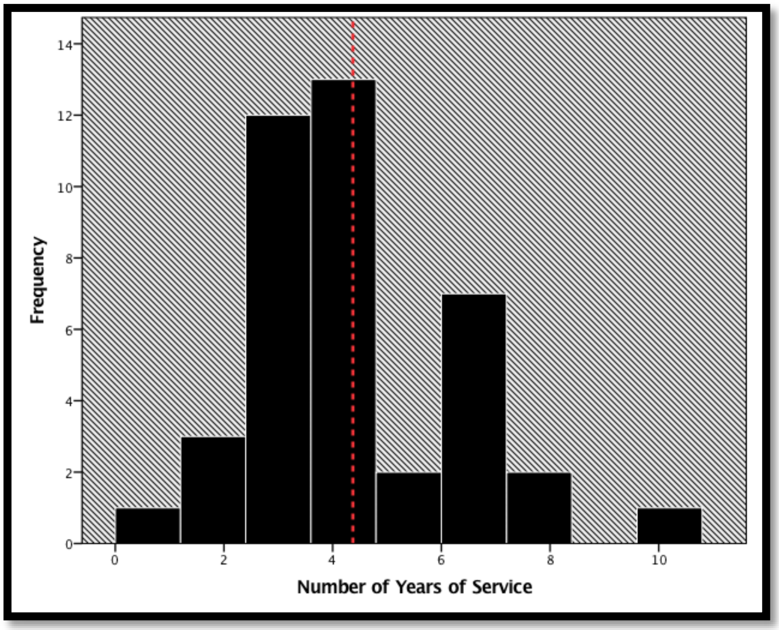


Figure 18: Histogram – Number of Years of Service

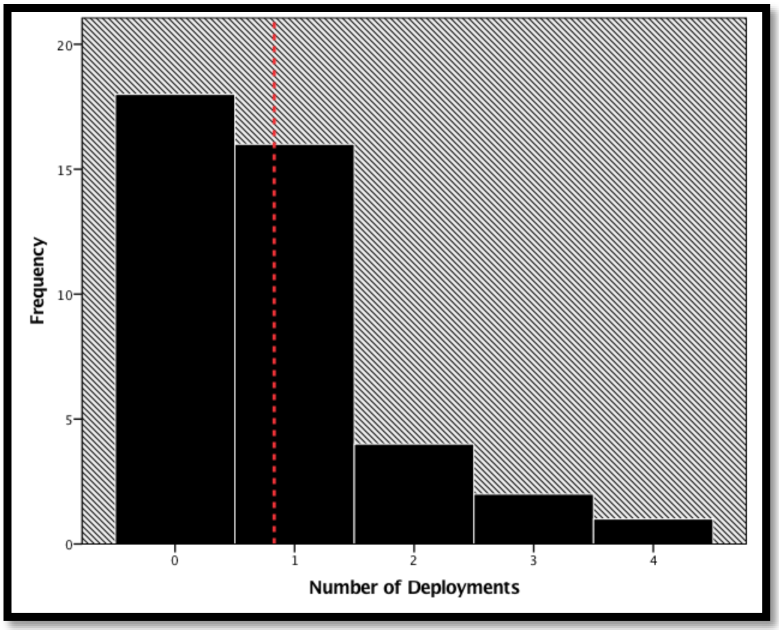


Figure 19: Histogram – Number of Deployments

In addition to number of years of service and number of deployments, the main sample was given three more demographic questions regarding Home Station Training (HST), CE School courses, and Silver Flag. A summary of the responses received on the three additional questions can be found in Table 25.

Table 25: Sample Characteristics – HST, CE School, and Silver Flag

Time Spent on HST (hrs/mo)		# of CE School Courses		# of Silver Flags	
Mean:	5.0	Mean:	2.9	Mean:	.71
Median:	4	Median:	3	Median:	1
Std Dev:	4.2	Std Dev:	1.5	Std Dev:	.64
Min:	0	Min:	0	Min:	0
Max:	20	Max:	5	Max:	2
Range:	20	Range:	5	Range:	2

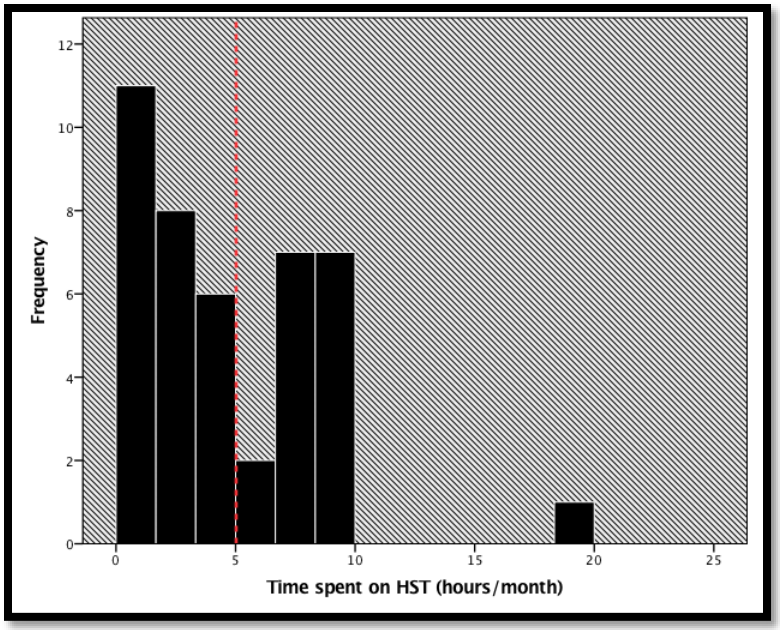


Figure 20: Histogram – Time Spent on HST (hrs/mo)

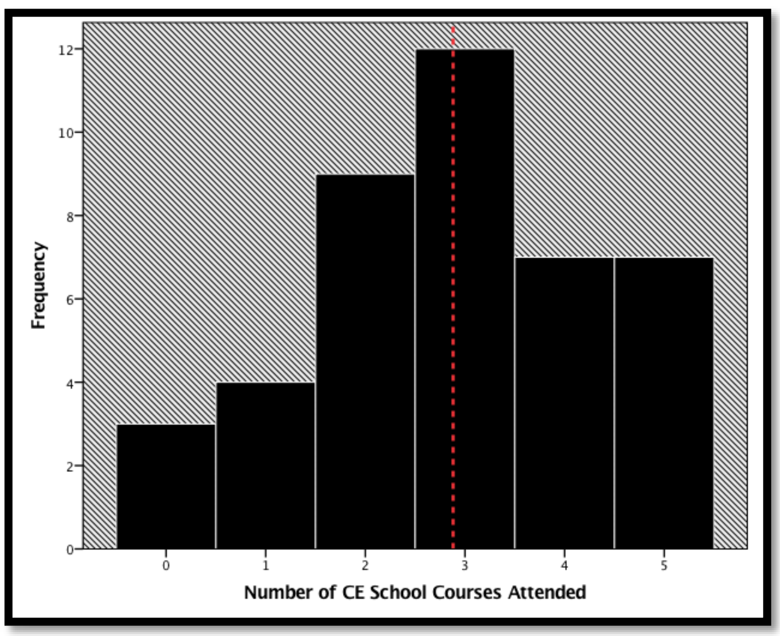


Figure 21: Histogram – Number of CE School Courses Attended

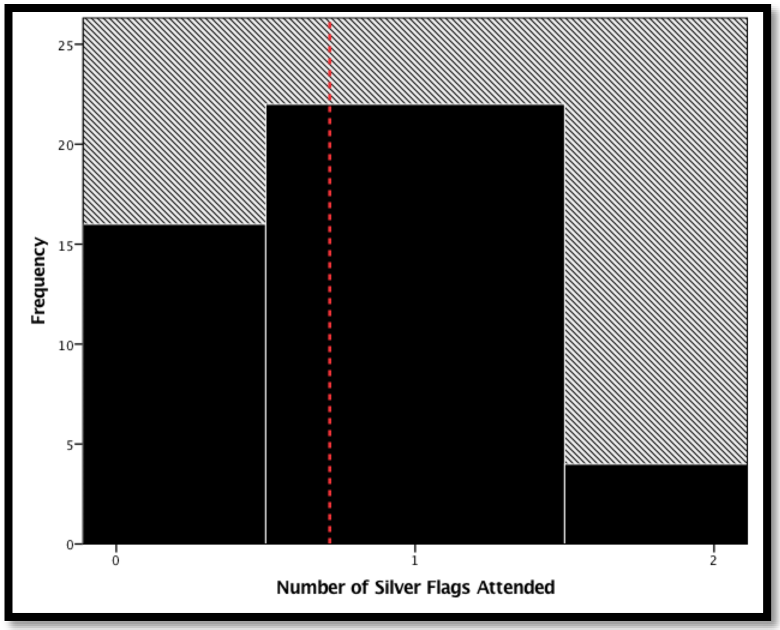


Figure 22: Histogram – Number of Silver Flags Attended

Each additional demographic question was followed by a seven-point Likert scale question asking test takers to rate the quality of HST, CE School courses, and Silver Flag. Of the three training mechanisms, test takers rated the quality of CE School courses highest, the quality of Silver Flag in the middle, and HST lowest. A paired samples dependent t-test was used to test the significance of the differences in quality ratings. The results of the t-test indicated that the difference between the quality rating of CE school courses was significantly higher than the SF quality ratings and the HST quality ratings. The results are shown in Table 26.

Table 26: Results of Paired Samples t-Test

	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper	t	df	Sig.(2-tailed)
CE School - Silver Flag	.6428	1.543	.2381	.1619	1.123	2.700	41	.010
Silver Flag - HST	1.119	1.549	.2391	.6362	1.601	4.681	41	.000
CE School - HST	1.761	1.461	.2256	1.306	2.217	7.811	41	.000

The mean quality rating of 5.6 for CE School courses was well above the scale mid-point of 4. The lowest rated training mechanism was HST, with a mean quality rating of 3.9. A summary of the quality ratings for each training mechanism can be found in Table 27. Additionally, histograms of the quality ratings for each training mechanism are given in Figure 23, Figure 24, and Figure 25.

Table 27: Sample Characteristics – HST, CE School, and SF Quality Ratings

HST Quality Rating		**CE School Quality Rating**		**Silver Flag Quality Rating**	
Mean:	3.9	Mean:	5.6	Mean:	5.0
Median:	4	Median:	6	Median:	5
Std Dev:	1.5	Std Dev:	.89	Std Dev:	1.5

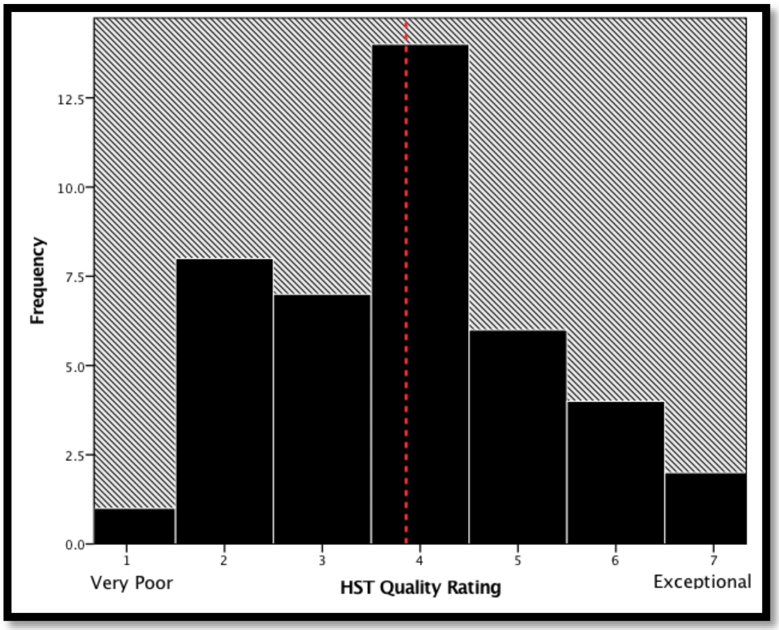


Figure 23: Histogram – HST Quality Rating

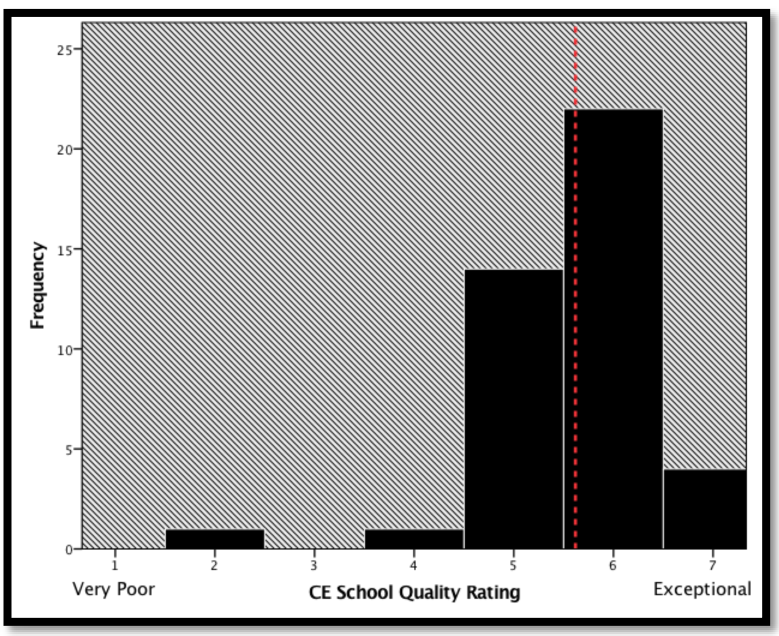


Figure 24: Histogram – CE School Quality Rating

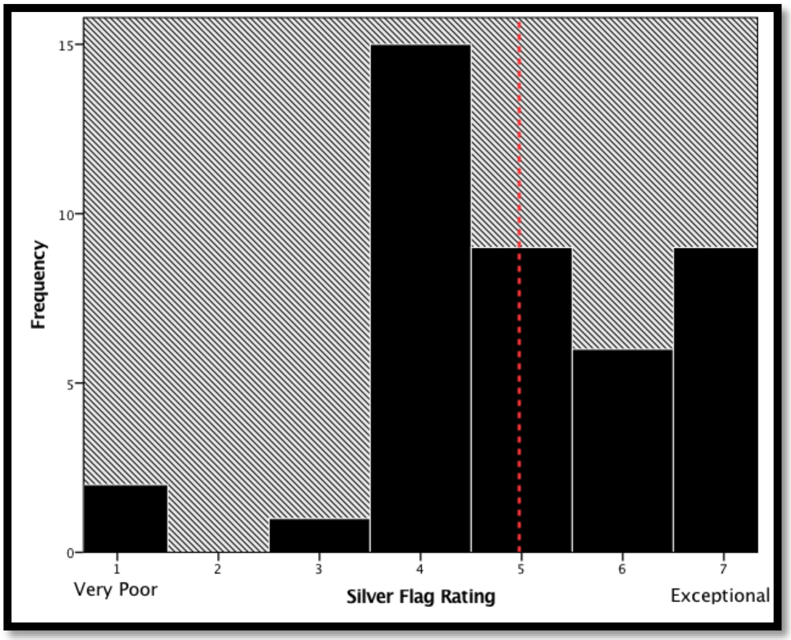


Figure 25: Histogram – Silver Flag Rating

Test Scores and Confidence Ratings

Test Scores

Composite test scores were created from the dichotomously scored items at the construct level (overall test), sub-construct level, and individual area level. The main sample and WMGT 101 sample were separated out when reporting the results. A summary of the test score results is given in Table 28. The mean test score was 73.5 percent for the main sample and 65.5 percent for the WMGT 101 sample. The overall mean score was 71 percent when combining scores from both samples.

Table 28: Summary of Test Score Results

Construct/Sub-Construct/Individual Area	N of Items	Score % (sample)		Score% (WMGT101)	
		Mean	Std Dev	Mean	Std Dev
Contingency Job Knowledge	123	73.5	5.50	65.5	7.40
Project Management (PM)	25	78.8	8.20	71.1	11.2
PM – General Knowledge	4	93.5	11.0	87.5	18.1
PM – Cost Estimating	9	81.6	14.5	78.5	14.0
PM – Project Planning	5	75.2	18.9	69.1	24.7
PM – Project Scheduling	7	69.3	14.2	53.7	15.4
Construction Management (CM)	11	74.3	12.3	69.6	12.5
CM – QA/QC (Inspection)	4	69.6	22.2	69.3	22.5
CM – Construction Activities	2	65.5	31.8	54.5	36.6
CM – Site Safety	5	81.0	15.1	75.5	12.0
General Engineering (GE)	6	78.5	8.90	67.5	10.5
GE – Building Types	4	73.2	12.7	69.3	12.9
GE – Construction Methods	2	89.3	17.5	68.2	22.3
Contract Management (ConM)	19	79.9	11.0	70.0	13.2
ConM – Construction Law	8	80.3	17.5	68.2	22.3
ConM – Contract Types	5	70.5	17.0	66.4	25.1
ConM – Contract Elements	6	86.9	13.5	75.0	15.2
Personnel Management (PerM)	12	75.6	12.6	66.6	12.6
PerM – Basic Knowledge	5	85.2	15.8	72.7	22.2
PerM – Military Admin	4	81.5	11.0	72.7	10.4
PerM – AFSC Knowledge	3	51.6	36.6	48.5	31.5
Contingency Operations (CO)	50	66.0	8.60	59.5	10.5
CO – Prime BEEF Concepts	2	38.1	35.9	34.1	27.7
CO – Standards	6	56.7	18.2	53.0	19.3
CO – Facility Types	8	73.4	16.5	66.7	20.8
CO – Engineering Functions	5	74.3	21.1	89.1	20.7
CO – Base Defense	4	78.0	19.1	75.0	23.8
CO – Reach-Back	4	64.9	22.5	58.0	24.3
CO – Base Types	6	71.0	18.9	56.0	21.7
CO – BOS-I and SAA	4	73.8	23.1	45.5	27.8
CO – Joint Forces	4	53.6	24.7	46.6	31.3
CO – Deployed Leadership	7	68.6	15.1	53.8	22.3

Confidence Ratings

Composite ratings were created from the confidence ratings for items at the construct level (overall test), sub-construct level, and individual area level. The main sample and WMGT 101 sample were separated out when reporting the results. A summary of the confidence rating results are given in Table 38.

Table 29: Summary of Confidence Rating Results

Construct/Sub-Construct/Individual Area	N of Items	Conf Rating (sample)		Conf Rating (WMGT101)	
		Mean	Std Dev	Mean	Std Dev
Contingency Job Knowledge	123	5.02	0.98	4.62	1.09
Project Management (PM)	25	5.61	0.76	5.21	0.95
PM – General Knowledge	4	5.87	0.93	5.52	1.08
PM – Cost Estimating	9	5.56	0.92	5.47	1.09
PM – Project Planning	5	5.50	0.87	5.15	1.18
PM – Project Scheduling	7	5.50	0.97	4.69	1.13
Construction Management (CM)	11	5.37	0.82	5.23	0.94
CM – QA/QC (Inspection)	4	5.56	0.95	5.23	1.02
CM – Construction Activities	2	5.52	1.09	5.05	1.19
CM – Site Safety	5	5.04	1.06	5.41	0.96
General Engineering (GE)	6	5.38	0.98	5.16	0.97
GE – Building Types	4	5.21	1.08	5.48	1.05
GE – Construction Methods	2	5.54	1.10	4.84	1.10
Contract Management (ConM)	19	5.06	0.96	4.36	1.01
ConM – Construction Law	8	5.42	1.02	4.72	1.25
ConM – Contract Types	5	4.13	1.06	3.43	0.97
ConM – Contract Elements	6	5.63	1.08	4.93	1.10
Personnel Management (PerM)	12	5.11	0.94	4.38	1.12
PerM – Basic Knowledge	5	5.28	1.09	4.78	0.97
PerM – Military Admin	4	5.73	1.09	4.27	1.45
PerM – AFSC Knowledge	3	4.31	1.84	4.09	1.68
Contingency Operations (CO)	50	4.58	1.10	4.25	1.00
CO – Prime BEEF Concepts	2	5.31	1.06	5.09	1.31
CO – Standards	6	3.78	1.01	3.91	1.20
CO – Facility Types	8	5.18	1.04	4.73	1.15
CO – Engineering Functions	5	5.17	1.34	5.60	1.37
CO – Base Defense	4	5.03	1.37	4.80	1.03
CO – Reach-Back	4	4.23	1.35	4.23	1.17

CO – Base Types	6	3.88	1.39	3.58	1.17
CO – BOS-I and SAA	4	4.27	1.65	3.29	1.24
CO – Joint Forces	4	4.18	1.54	3.66	1.40
CO – Deployed Leadership	7	4.74	1.22	3.62	1.48

Mean score per item and mean confidence rating per item was compared by first generating a scatter plot. The scatter plot appeared to show a positive linear relationship between mean score per item and mean confidence rating per item. The scatter plat can be seen in Figure 26.

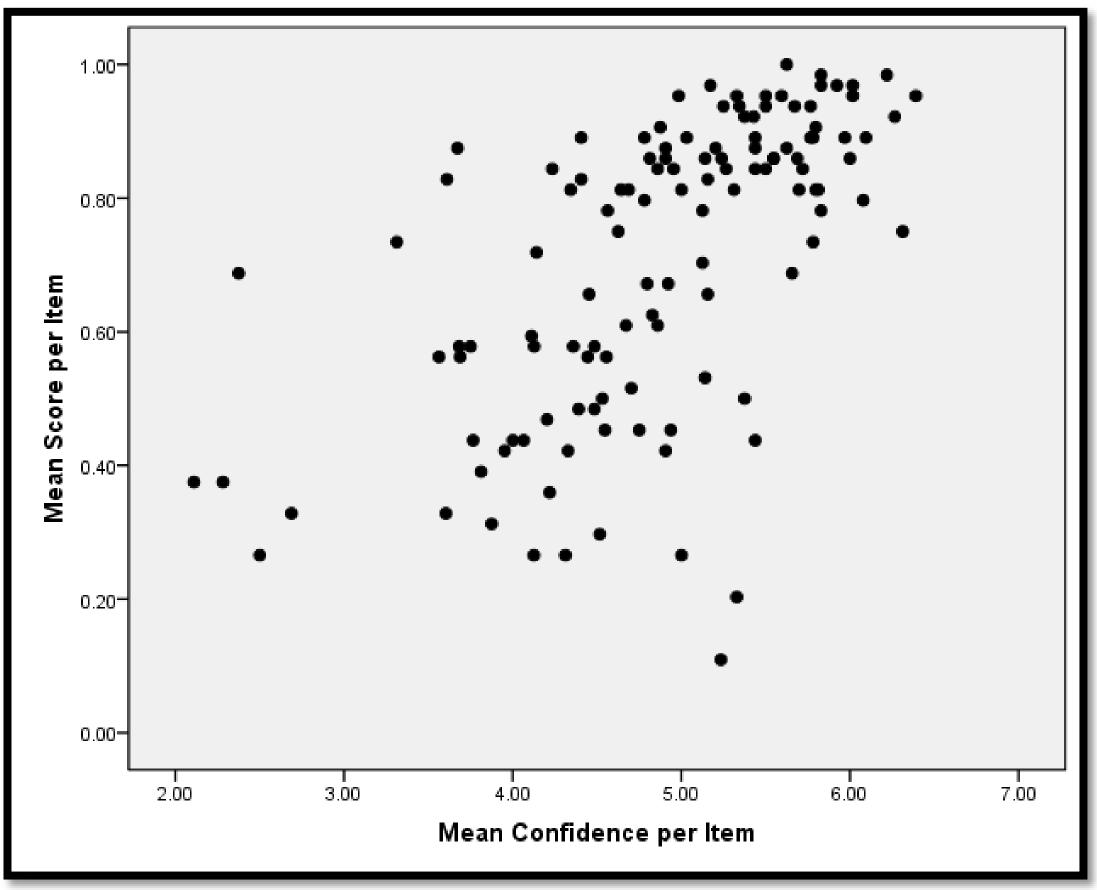


Figure 26: Scatterplot – Mean Score per Item vs Mean Confidence Rating per Item

Next, the distributions for mean score per item and mean confidence rating per time were checked for normality using the Shapiro-Wilk test. Both distributions were non-normal and Spearman's correlation coefficient was used in place of Pearson's correlation coefficient (Field, 2007). Table 30 displays the result of the Shapiro-Wilk test and Table 31 gives Spearman's correlation coefficient. A moderate positive correlation between the mean score per item and mean confidence rating per item was detected. The relationship was logical and helped strengthen the results of the reliability analysis.

Table 30: Shapiro-Wilk Results

	Statistic	**df**	**Sig.**
Mean Score per Item	.907	123	.000
Mean Confidence per Item	.951	123	.000

Table 31: Spearman's Correlation Coefficient

			Mean Score per Item	**Mean Conf per Item**
Spearman's rho	**Mean Score per Item**	Correlation Coefficient	1.000	.656**
		Sig. (2-tailed)	.	.000
		N	123	123
	Mean Confidence per Item	Correlation Coefficient	.656**	1.000
		Sig. (2-tailed)	.000	.
		N	123	123

** Correlation is significant at the 0.01 level (2-tailed)

Low-Scores and Knowledge Gaps

The cut-off for low-scores was set at 70 percent. Any item score, individual area score, or sub-construct score that averaged less than 70 percent correct was reported as low-scoring. The lowest scoring areas represented the knowledge gaps of the CE CGO sample. Table 32 provides a summary of the scores for each section and if they were identified as low-scoring.

Table 32: Low Score Summary

Construct/Sub-Construct/Individual Area	Score % (sample)		Score % (WMGT101)	
	Low (Y/N)	Mean	Low (Y/N)	Mean
Contingency Job Knowledge	N	73.5	Y	65.5
Project Management (PM)	N	78.8	N	71.1
PM – General Knowledge	N	93.5	N	87.5
PM – Cost Estimating	N	81.6	N	78.5
PM – Project Planning	N	75.2	Y	69.1
PM – Project Scheduling	Y	69.3	Y	53.7
Construction Management (CM)	N	74.3	Y	69.6
CM – QA/QC (Inspection)	Y	69.6	Y	69.3
CM – Construction Activities	Y	65.5	Y	54.5
CM – Site Safety	N	81.0	N	75.5
General Engineering (GE)	N	78.5	Y	67.5
GE – Building Types	N	73.2	Y	69.3
GE – Construction Methods	N	89.3	Y	63.6
Contract Management (ConM)	N	79.9	N	70.0
ConM – Construction Law	N	80.3	Y	68.2
ConM – Contract Types	N	70.5	Y	66.4
ConM – Contract Elements	N	86.8	N	75.0
Personnel Management (PerM)	N	75.6	Y	66.6
PerM – Basic Knowledge	N	85.2	N	72.7
PerM – Military Admin	N	81.5	N	72.7
PerM – AFSC Knowledge	Y	51.6	Y	48.5
Contingency Operations (CO)	Y	66.0	Y	59.5
CO – Prime BEEF Concepts	Y	38.1	Y	34.1
CO – Standards	Y	56.7	Y	53.0
CO – Facility Types	N	73.4	N	66.7
CO – Engineering Functions	N	74.3	N	89.1
CO – Base Defense	N	78.0	N	75.0
CO – Reach-Back	Y	64.9	Y	58.0
CO – Base Types	N	71.0	Y	56.0
CO – BOS-I and SAA	N	73.8	Y	45.5
CO – Joint Forces	Y	53.6	Y	46.6
CO – Deployed Leadership	Y	68.6	Y	53.8

The main sample only had a single sub-construct that was low-scoring and the WMGT 101 sample had four sub-constructs that were low-scoring. Table 33 provides a list of the sub-constructs rank-ordered by composite score. Low-scoring sub-constructs are highlighted in red.

Table 33: Low Score Summary – Sub-Constructs Rank Ordered

Main Sample (N=42)		WMGT 101 Sample (N=22)	
Sub-Construct	**Score**	**Sub-Construct**	**Score**
Contract Management	79.9	Project Management	71.1
Project Management	78.8	Contract Management	70.0
General Engineering	78.5	Construction Management	69.6
Personnel Management	75.9	General Engineering	67.5
Construction Management	74.3	Personnel Management	66.6
Contingency Operations	66.0	Contingency Operations	59.5

The main sample had eight individual areas that were low-scoring and the WMGT 101 sample had sixteen individual areas that were low-scoring. Table 34 provides a list of the individual areas rank-ordered by composite score. Low-scoring individual areas are highlight in red.

Table 34: Low Score Summary – Individual Areas Rank Ordered

Main Sample (N=42)		WMGT 101 Sample (N=22)	
Individual Area	**Score**	**Individual Area**	**Score**
PM – General Knowledge	93.5	CO – Engineering Functions	89.1
GE – Construction Methods	89.3	PM – General Knowledge	87.5
ConM – Contract Elements	86.8	PM – Cost Estimating	78.5
PerM – Basic Knowledge	85.2	CM – Site Safety	75.5
PM – Cost Estimating	81.6	ConM – Contract Elements	75.0
PerM – Military Admin	81.5	CO – Base Defense	75.0
CM – Site Safety	81.0	PerM – Basic Knowledge	72.7
ConM – Construction Law	80.3	PerM – Military Admin	72.7
CO – Base Defense	78.0	GE – Building Types	69.3
PM – Project Planning	75.2	CM – QA/QC (Inspection)	69.3
CO – Engineering Functions	74.3	PM – Project Planning	69.1
CO – BOS-I and SAA	73.8	ConM – Construction Law	68.2
CO – Facility Types	73.4	CO – Facility Types	66.7
GE – Building Types	73.2	ConM – Contract Types	66.4
CO – Base Types	71.0	GE – Construction Methods	63.6
ConM – Contract Types	70.5	CO – Reach-Back	58.0
CM – QA/QC (Inspection)	69.6	CO – Base Types	56.0
PM – Project Scheduling	69.3	CM – Construction Activities	54.5
CM – Construction Activities	65.5	PM – Project Scheduling	53.7
CO – Reach-Back	64.9	CO – Standards	53.0
CO – Standards	56.7	PerM – AFSC Knowledge	48.5
CO – Joint Forces	53.6	CO – Joint Forces	46.6
PerM – AFSC Knowledge	51.6	CO – BOS-I and SAA	45.5
CO – Prime BEEF Concepts	38.1	CO – Prime BEEF Concepts	34.1

Lastly, the low scoring questions were identified for each sample. The main sample had 46 low-scoring items and the WMGT 101 sample had 64 low-scoring items. Table 35 provides a list of the low scoring items rank-ordered by score for the main sample. Table 36 provides a list of the low scoring items rank-ordered by score for the WMGT 101 sample.

Table 35: Low Scoring Items – Main Sample

Item	Question	Score
88	The quickest way to provide a facility to an organization in need is to:	66.7%
103	A Forward Operating Base (FOB) or Forward Operating Site (FOS) is best defined as:	66.7%
104	A Cooperative Security Location (CSL) is best defined as:	66.7%
65	You are managing an internationally dispersed project team. The members of your team have different cultural backgrounds and primary languages, but all are educated and able to communicate eloquently in English. You should nevertheless bear in mind that:	64.3%
13	Troop labor is an unfunded project cost.	61.9%
71	You have been tasked with preparing a set of drawings that shows the proposed layout of an Entry Control Point (ECP) renovation. Who should you seek assistance from?	61.9%
18	An Economic Analysis (EA) is required for construction projects in the contingency environment exceeding $2,000,000. (T/F)	59.5%
22	The phases of a construction project can be intentionally overlapped in a practice called:	59.5%
55	Which of the following contract formation principles are needed to form a valid contract?	59.5%
72	Several expeditionary shelters are having issues with electrical shortages. Who should you task with inspecting the problem?	59.5%
83	________ construction standards are used for austere facilities requiring moderate engineer effort and offer an increased level of efficiency, safety, and durability.	59.5%
87	An example of a suitable method for constructing a helipad to INITIAL standards would be:	59.5%
89	All of the following are PRIMARY considerations when constructing facilities for host nation use EXCEPT:	59.5%
116	A Combined Joint Task Force (CJTF) is made up of:	59.5%
44	You are the project manager for a project at a contingency base. The threat level at the base has increased. You are unable to answer Requests for Information (RFIs) according to the timeline in the contract because you are busy dealing with force projection issues. The project cannot move forward without resolution from the RFIs. This type of construction delay is:	57.1%
45	A ________ ambiguity is obvious in the contract language and requires the owner to be informed of its presence.	57.1%
113	The engineering directorate in a joint contingency environment is typically organized under the:	57.1%
117	The main functions of the Personnel Support for Contingency Operations (PERSCO) team include all of the following EXCEPT:	57.1%

34	According to OSHA, what is the most frequent cause of construction fatalities?	54.8%
112	Additional maintenance ramps and facilities are required at a deployed location. The ramps and facilities are located adjacent to but within the airfield fence line. Who is responsible for the construction of the new ramps and facilities?	54.8%
118	When the mission of a UTC or individual member is complete, they should be returned home regardless of the tour length specified in the CED order.	54.8%
109	The Base Operation Support Integrator (BOS-I) is responsible for:	52.4%
98	All of the following are PRIMARY considerations when selecting force protection and physical security measures EXCEPT:	50.0%
114	The Air Force organizational component Flight (e.g. engineering flight) is most closely the equivalent of the Army organizational component(s):	50.0%
26	A 2015 DoD IG report on military construction in the contingency environment identified reliance on contractors' technical expertise, lack of documentation, inadequate Government resources, and not holding contractors accountable for unsatisfactory performance as consistently present problems. All of these issues stem from a lack of ________.	47.6%
74	The expeditionary Prime Base Engineer Emergency Force (PRIME BEEF) is best described as:	47.6%
84	________ construction standards are used for facilities designed and constructed with finishes, materials, and systems selected for moderate energy efficiency, maintenance and life cycle cost.	47.6%
102	An online library of standard designs for use in the contingency environment is available from:	47.6%
115	The Air Force organizational component Squadron (e.g. Civil Engineer Squadron) is most closely the equivalent of the Army organizational component(s):	47.6%
30	The preconstruction meeting is NOT the time to discuss potential change requests unless the changes have a direct impact on the mission.	45.2%
27	The OVERALL purpose of quality control and quality assurance is to:	42.9%
16	A stakeholder is someone who:	40.5%
77	The publication that provides guidance, responsibilities, and procedures for military contingency construction in the PACOM AOR is the:	40.5%
78	The publication that provides guidance, responsibilities, and procedures for military contingency construction in the EUCOM AOR is the:	38.1%
70	A number of air conditioning units servicing a small maintenance shelter are broken. Which airman under your command would you task with the repair?	33.3%
68	The letter of evaluation (LOE) is mandatory for non-commanders on deployments less than 180 days	31.0%
101	A searchable online database of current and previously answered RFIs sent by deployed engineers is available through the:	31.0%

108	Match the contingency basing location type to the corresponding defining characteristics.	31.0%
24	Crashing describes a technique used to speed up a project by:	28.6%
75	An expeditionary PRIME BEEF squadron (EPBS) has the responsibility of conducting routine facility modification, maintenance, and operations at contingency bases.	28.6%
25	When should the project schedule be developed?	26.2%
90	Joint Publication 3-34, Engineer Operations, categorizes engineer functions into three areas including all of the following EXCEPT:	26.2%
122	The Air Force will maintain ________ over Air Force members assigned to a joint service mission unless assigned to special operations forces.	26.2%
52	Match the construction type to the correct United States Code: [US Military Construction]	23.8%
80	The only United Facilities Criteria (UFC) requirements that apply to contingency construction for military operations are those found in UFC 1-201-01, Non-Permanent DoD Facilities in Support of Military Operations.	21.4%
40	PRIMARY factors to consider when designing an aircraft maintenance hangar include all of the following EXCEPT:	9.5%

Table 36: Low Scoring Items – WMGT 101 Sample

Item	Question	Score
67	You are deployed. A MSgt is under your command for 100 days. His or her performance should be informally documented using the:	68.2%
97	A structural analysis and materials evaluation is generally not needed before affixing force protection to a structure.	68.2%
106	An Intermediate Staging Base (ISB) is best defined as:	68.2%
120	Tactical Control (TACON) is best defined as:	68.2%
11	You are responsible for creating a cost estimate for a new project. Your commander needs the cost estimate to move forward with advocating for funds in 2 days. The new project is nearly identical to a previously completed project but is smaller in overall size. Which method of cost estimating would be the best choice to use?	68.2%
65	You are managing an internationally dispersed project team. The members of your team have different cultural backgrounds and primary languages, but all are educated and able to communicate eloquently in English. You should nevertheless bear in mind that:	68.2%
87	An example of a suitable method for constructing a helipad to INITIAL standards would be:	68.2%
98	All of the following are PRIMARY considerations when selecting force	68.2%

	protection and physical security measures EXCEPT:	
1	The best definition of a project is:	63.6%
95	The command and control center for integrated defense (ID) operations during routine and emergency operations on a base is the:	63.6%
58	This document informs the contractor that the work on a project is being stopped:	63.6%
19	Refer to Gantt chart #1 to answer this question. Which task(s) are behind schedule if the blue line represents the current date?	63.6%
119	Operational Control (OPCON) is best defined as:	63.6%
53	Unspecified minor military construction (UMMC) projects are authorized by which United States Code?	63.6%
88	The quickest way to provide a facility to an organization in need is to:	63.6%
74	The expeditionary Prime Base Engineer Emergency Force (PRIME BEEF) is best described as:	63.6%
27	The OVERALL purpose of quality control and quality assurance is to:	63.6%
81	The levels of construction for contingency military operations are primarily based on life expectancy of the facility.	59.1%
107	A Contingency Basing Location supports immediate but temporary contingency operations. (T/F)	59.1%
12	You are responsible for creating a cost estimate for a new project. The project is unlike anything that has previously been constructed on base. Your commander wants to ensure an accurate estimate as any additional funding is very limited. Your commander has given you 45 days to get the estimate completed. Which method of cost estimating would be the best choice to use?	59.1%
13	Troop labor is an unfunded project cost.	59.1%
71	You have been tasked with preparing a set of drawings that shows the proposed layout of an Entry Control Point (ECP) renovation. Who should you seek assistance from?	59.1%
72	Several expeditionary shelters are having issues with electrical shortages. Who should you task with inspecting the problem?	59.1%
44	You are the project manager for a project at a contingency base. The threat level at the base has increased. You are unable to answer Requests for Information (RFIs) according to the timeline in the contract because you are busy dealing with force projection issues. The project cannot move forward without resolution from the RFIs. This type of construction delay is:	59.1%
26	A 2015 DoD IG report on military construction in the contingency environment identified reliance on contractors' technical expertise, lack of documentation, inadequate Government resources, and not holding contractors accountable for unsatisfactory performance as consistently present problems. All of these issues stem from a lack of ________.	59.1%
28	Government QA personnel have the responsibility to do all of the following EXCEPT:	54.5%

110	The Senior Airfield Authority (SAA) is responsible for:	54.5%
121	Administrative Control (ADCON) is best defined as:	54.5%
18	An Economic Analysis (EA) is required for construction projects in the contingency environment exceeding $2,000,000. (T/F)	54.5%
116	A Combined Joint Task Force (CJTF) is made up of:	54.5%
113	The engineering directorate in a joint contingency environment is typically organized under the:	54.5%
122	The Air Force will maintain ________ over Air Force members assigned to a joint service mission unless assigned to special operations forces.	54.5%
83	________ construction standards are used for austere facilities requiring moderate engineer effort and offer an increased level of efficiency, safety, and durability.	50.0%
16	A stakeholder is someone who:	50.0%
50	As a Civil Engineer Officer you may be appointed to be a Contracting Officer's Representative (COR). The duties of a COR include all of the following EXCEPT:	40.9%
42	Common construction methods for non-permanent facilities in the contingency environment include all of the following EXCEPT:	40.9%
103	A Forward Operating Base (FOB) or Forward Operating Site (FOS) is best defined as:	40.9%
104	A Cooperative Security Location (CSL) is best defined as:	40.9%
114	The Air Force organizational component Flight (e.g. engineering flight) is most closely the equivalent of the Army organizational component(s):	40.9%
84	________ construction standards are used for facilities designed and constructed with finishes, materials, and systems selected for moderate energy efficiency, maintenance and life cycle cost.	40.9%
45	A ________ ambiguity is obvious in the contract language and requires the owner to be informed of its presence.	36.4%
115	The Air Force organizational component Squadron (e.g. Civil Engineer Squadron) is most closely the equivalent of the Army organizational component(s):	36.4%
30	The preconstruction meeting is NOT the time to discuss potential change requests unless the changes have a direct impact on the mission.	36.4%
78	The publication that provides guidance, responsibilities, and procedures for military contingency construction in the EUCOM AOR is the:	36.4%
101	A searchable online database of current and previously answered RFIs sent by deployed engineers is available through the:	36.4%
108	Match the contingency basing location type to the corresponding defining characteristics.	36.4%
80	The only United Facilities Criteria (UFC) requirements that apply to contingency construction for military operations are those found in UFC 1-201-01, Non-Permanent DoD Facilities in Support of Military Operations.	36.4%
117	The main functions of the Personnel Support for Contingency Operations	31.8%

	(PERSCO) team include all of the following EXCEPT:	
77	The publication that provides guidance, responsibilities, and procedures for military contingency construction in the PACOM AOR is the:	31.8%
52	Match the construction type to the correct United States Code: [US Military Construction]	31.8%
89	All of the following are PRIMARY considerations when constructing facilities for host nation use EXCEPT:	27.3%
109	The Base Operation Support Integrator (BOS-I) is responsible for:	27.3%
70	A number of air conditioning units servicing a small maintenance shelter are broken. Which airman under your command would you task with the repair?	27.3%
68	The letter of evaluation (LOE) is mandatory for non-commanders on deployments less than 180 days	27.3%
25	When should the project schedule be developed?	27.3%
33	According to OSHA, what is the most frequently occurring type of construction injury?	22.7%
112	Additional maintenance ramps and facilities are required at a deployed location. The ramps and facilities are located adjacent to but within the airfield fence line. Who is responsible for the construction of the new ramps and facilities?	22.7%
102	An online library of standard designs for use in the contingency environment is available from:	22.7%
24	Crashing describes a technique used to speed up a project by:	22.7%
55	Which of the following contract formation principles are needed to form a valid contract?	18.2%
118	When the mission of a UTC or individual member is complete, they should be returned home regardless of the tour length specified in the CED order.	18.2%
40	PRIMARY factors to consider when designing an aircraft maintenance hangar include all of the following EXCEPT:	13.6%
22	The phases of a construction project can be intentionally overlapped in a practice called:	9.1%
75	An expeditionary PRIME BEEF squadron (EPBS) has the responsibility of conducting routine facility modification, maintenance, and operations at contingency bases.	4.5%

Exploratory Analysis

The purpose of the exploratory analysis was to identify significant relationships between the demographics of the sample and test performance. The WMGT 101 sample was not used for the exploratory analysis. The primary method for conducting the exploratory analysis was the one-way ANOVA or a suitable non-parametric alternative. Prior to conducting any comparisons, the demographic information groups were defined. Table 37 provides an overview of the six groups that were created.

Table 37: Summary of Demographic Groups

Group ID	Demographic Information	Values
SampleGroup	Main Sample or WMGT 101 Sample	0 = Else 1 = WMGT 101 Sample
YrsServiceGroup	# of Years of Service	0 = 0-2 years of service 1 = 3-4 years of service 2 = more than 4 years of service
DeployGroup	# of Deployments	0 = has not deployed 1 = has deployed at least once
HSTGroup	Time Spent on HST (hr/mo)	0 = less than or equal to 5 hr/mo 1 = more than 5 hr/mo
CESchoolGroup	# of CE School Courses Attended	0 = has not attended a course 1 = has attended 1 to 3 courses 2 = has attended more than 3 courses
SFGroup	# of Silver Flags Attended	0 = has not attended 1 = has attended at least once

First, the assumptions necessary to run an ANOVA were checked. Histograms of the standardized residuals for each dependent and independent combination were checked for outliers. If an outlier was detected, Cook's distance (D) was used to determine how influential the point was. No significantly influential points (Cook's $D > 1$) were found (Field, 2007). Next, the standardized residuals were checked for normality and homogeneity of variance. Normality was checked using the Shapiro-Wilk test. Homogeneity of variance was checked using Levene's test. If normality was not met, but homogeneity of variance was met, then the non-parametric Mann-Whitney or Kruskal-Wallis test was used instead of ANOVA. If normality was met, but homogeneity of variance was not met, then Welch F was used instead of ANOVA. The null hypothesis (H_0) was that the distribution was normal for the Shapiro-Wilk test and that the variance was homogeneous for Levene's test. Table 38 displays the results of checking ANOVA assumptions, and the alternative chosen if the assumptions were not met.

Table 38: Summary of ANOVA Assumptions Check

Score	Group	Shapiro-Wilk	Levene	Alternative
Total	Sample	Retain H_0	Retain H_0	N/A
Total	Years Service	Retain H_0	Retain H_0	N/A
Total	Deployments	Retain H_0	Retain H_0	N/A
Total	HST	Retain H_0	Retain H_0	N/A
Total	CE School	Retain H_0	Retain H_0	N/A
Total	Silver Flag	Retain H_0	Retain H_0	N/A
PM Composite	Sample	Retain H_0	Retain H_0	N/A
PM Composite	Years Service	Retain H_0	Retain H_0	N/A
PM Composite	Deployments	**Reject H_0**	Retain H_0	Mann-Whitney
PM Composite	HST	**Reject H_0**	**Reject H_0**	Mann-Whitney
PM Composite	CE School	**Reject H_0**	Retain H_0	Kruskal-Wallis
PM Composite	Silver Flag	Retain H_0	Retain H_0	N/A
CM Composite	Sample	Retain H_0	Retain H_0	Mann-Whitney
CM Composite	Years Service	**Reject H_0**	**Reject H_0**	Kruskal-Wallis
CM Composite	Deployments	Retain H_0	Retain H_0	N/A
CM Composite	HST	**Reject H_0**	Retain H_0	Mann-Whitney
CM Composite	CE School	Retain H_0	Retain H_0	N/A
CM Composite	Silver Flag	**Reject H_0**	Retain H_0	Mann-Whitney
GE Composite	Sample	**Reject H_0**	Retain H_0	Mann-Whitney
GE Composite	Years Service	**Reject H_0**	Retain H_0	Kruskal-Wallis
GE Composite	Deployments	**Reject H_0**	**Reject H_0**	Mann-Whitney
GE Composite	HST	**Reject H_0**	Retain H_0	Mann-Whitney
GE Composite	CE School	**Reject H_0**	Retain H_0	Kruskal-Wallis
GE Composite	Silver Flag	**Reject H_0**	Retain H_0	Mann-Whitney
ConM Composite	Sample	Retain H_0	Retain H_0	N/A
ConM Composite	Years Service	Retain H_0	Retain H_0	N/A
ConM Composite	Deployments	**Reject H_0**	Retain H_0	Mann-Whitney
ConM Composite	HST	Retain H_0	Retain H_0	N/A
ConM Composite	CE School	Retain H_0	Retain H_0	N/A
ConM Composite	Silver Flag	Retain H_0	Retain H_0	N/A
PerM Composite	Sample	**Reject H_0**	Retain H_0	Mann-Whitney
PerM Composite	Years Service	Retain H_0	**Reject H_0**	Welch F

PerM Composite	Deployments	**Reject H_0**	Retain H_0	Mann-Whitney
PerM Composite	HST	Retain H_0	Retain H_0	N/A
PerM Composite	CE School	**Reject H_0**	Retain H_0	Kruskal-Wallis
PerM Composite	Silver Flag	Retain H_0	Retain H_0	N/A
CO Composite	Sample	**Reject H_0**	Retain H_0	Mann-Whitney
CO Composite	Years Service	**Reject H_0**	Retain H_0	Kruskal-Wallis
CO Composite	Deployments	**Reject H_0**	Retain H_0	Mann-Whitney
CO Composite	HST	**Reject H_0**	Retain H_0	Mann-Whitney
CO Composite	CE School	**Reject H_0**	Retain H_0	Kruskal-Wallis
CO Composite	Silver Flag	Retain H_0	Retain H_0	N/A

A total of 42 tests were conducted to explore test performance at the construct and sub-construct level within the demographic groups. Table 39 gives the results of each test. Significance level was set at 0.05. Significant results are highlighted in grey and one near-significant result is highlighted in yellow.

Table 39: Summary of ANOVA Results

Score	Group	Test	p-value	Sig (level=.05) (Y/N)
Total	Sample	ANOVA	.000	Y
Total	Years Service	ANOVA	.083	N
Total	Deployments	ANOVA	.046	Y
Total	HST	ANOVA	.338	N
Total	CE School	ANOVA	.891	N
Total	Silver Flag	ANOVA	.410	N
PM Composite	Sample	ANVOA	.003	Y
PM Composite	Years Service	ANOVA	.044	Y
PM Composite	Deployments	Mann-Whitney	.336	N
PM Composite	HST	Mann-Whitney	.037	Y
PM Composite	CE School	Kruskal-Wallis	.407	N
PM Composite	Silver Flag	ANOVA	.045	Y
CM Composite	Sample	Mann-Whitney	.189	N
CM Composite	Years Service	Kruskal-Wallis	.085	N
CM Composite	Deployments	ANOVA	.546	N
CM Composite	HST	Mann-Whitney	.535	N
CM Composite	CE School	ANVOA	.191	N
CM Composite	Silver Flag	Mann-Whitney	.699	N
GE Composite	Sample	Mann-Whitney	.000	Y

GE Composite	Years Service	Kruskal-Wallis	.039	Y
GE Composite	Deployments	Mann-Whitney	.006	Y
GE Composite	HST	Mann-Whitney	.588	N
GE Composite	CE School	Kruskal-Wallis	.376	N
GE Composite	Silver Flag	Mann-Whitney	.466	N
ConM Composite	Sample	ANOVA	.003	Y
ConM Composite	Years Service	ANOVA	.891	N
ConM Composite	Deployments	Mann-Whitney	.701	N
ConM Composite	HST	ANOVA	.069	N
ConM Composite	CE School	ANOVA	.896	N
ConM Composite	Silver Flag	ANOVA	.994	N
PerM Composite	Sample	Mann-Whitney	.013	Y
PerM Composite	Years Service	Welch F	.402	N
PerM Composite	Deployments	Mann-Whitney	.079	N
PerM Composite	HST	ANOVA	.163	N
PerM Composite	CE School	Kruskal-Wallis	.609	N
PerM Composite	Silver Flag	ANOVA	.703	N
CO Composite	Sample	Mann-Whitney	.017	Y
CO Composite	Years Service	Kruskal-Wallis	.052	N
CO Composite	Deployments	Mann-Whitney	.004	Y
CO Composite	HST	Mann-Whitney	.503	N
CO Composite	CE School	Kruskal-Wallis	.728	N
CO Composite	Silver Flag	ANOVA	.687	N

Significant results were further explored by generating means plots. The following series of figures are presented in the order as given in Table 39. From the means plots, the direction and magnitude of the significant relationship among the values within each group can be seen.

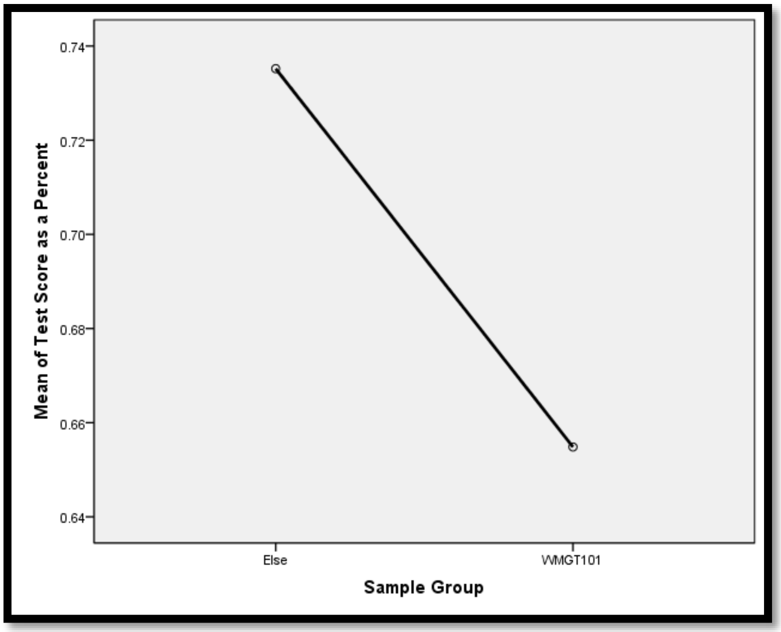


Figure 27: Means Plot – Total by Sample Group

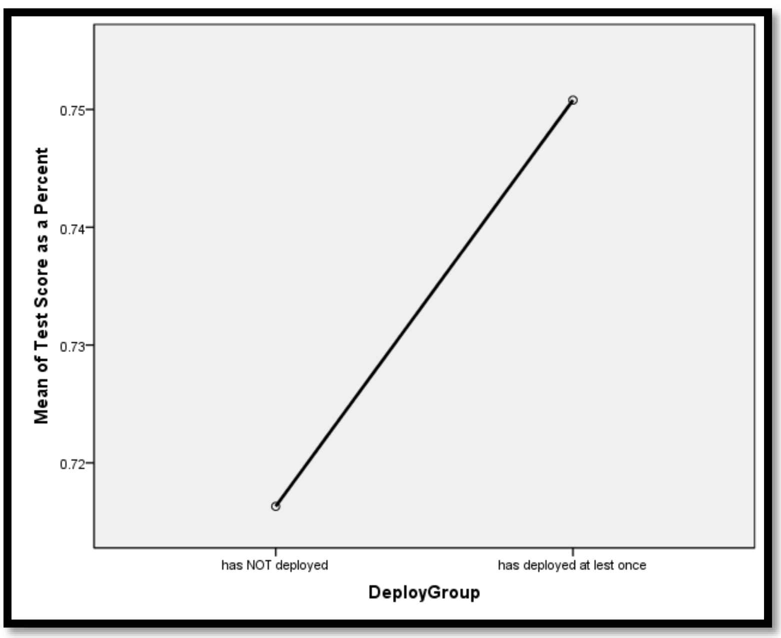


Figure 28: Means Plot – Total by Deploy Group

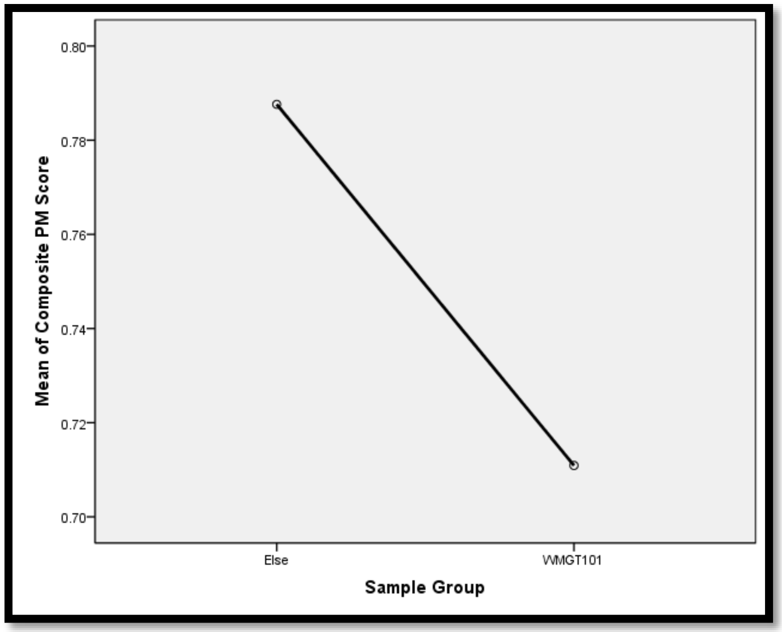


Figure 29: Means Plot – PM Composite by Sample Group

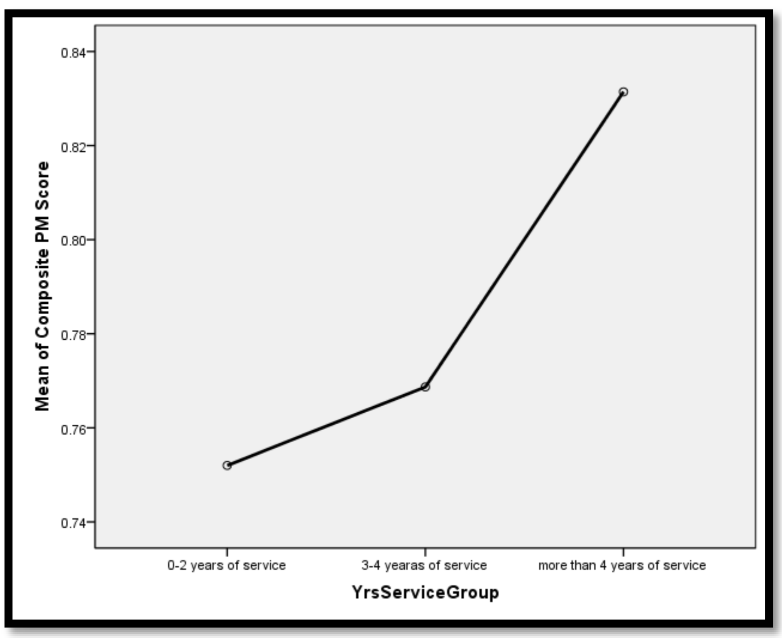


Figure 30: Means Plot – PM Composite by Yrs Service Group

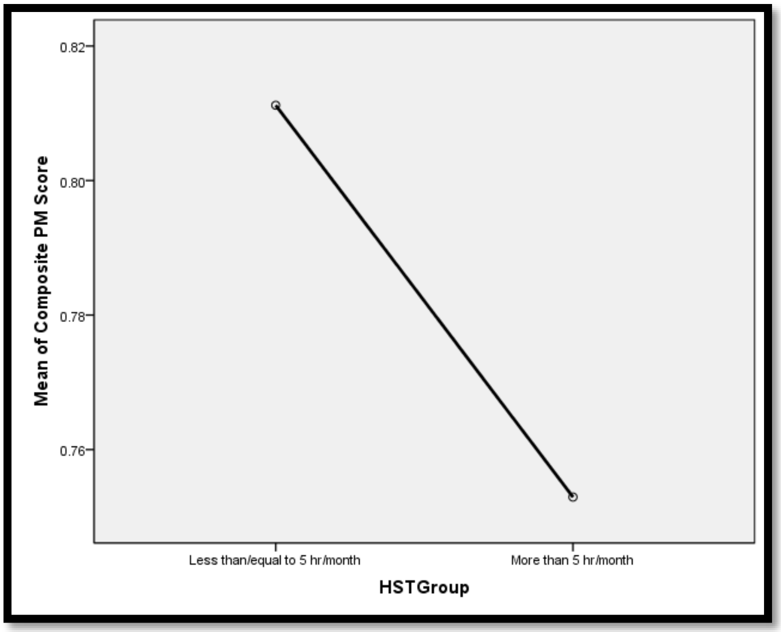


Figure 31: Means Plot – PM Composite by HST Group

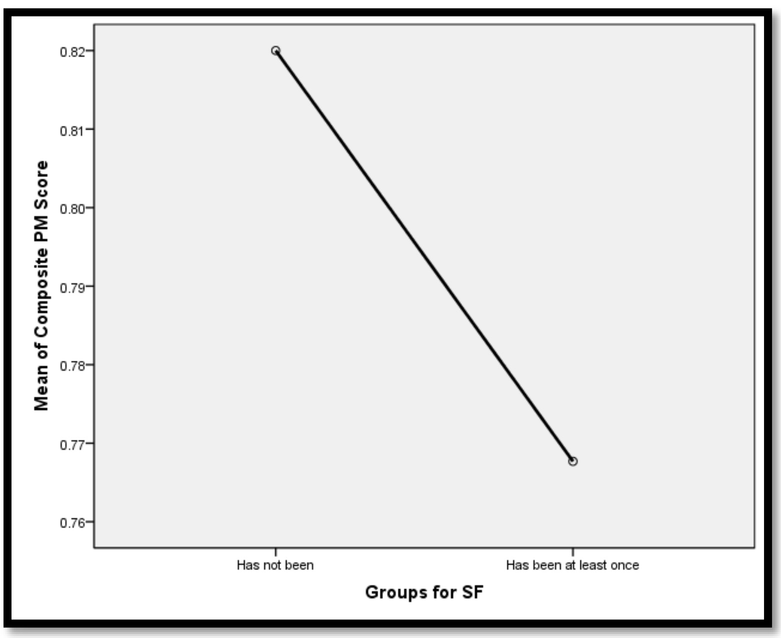


Figure 32: Means Plot – PM Composite by Silver Flag Group

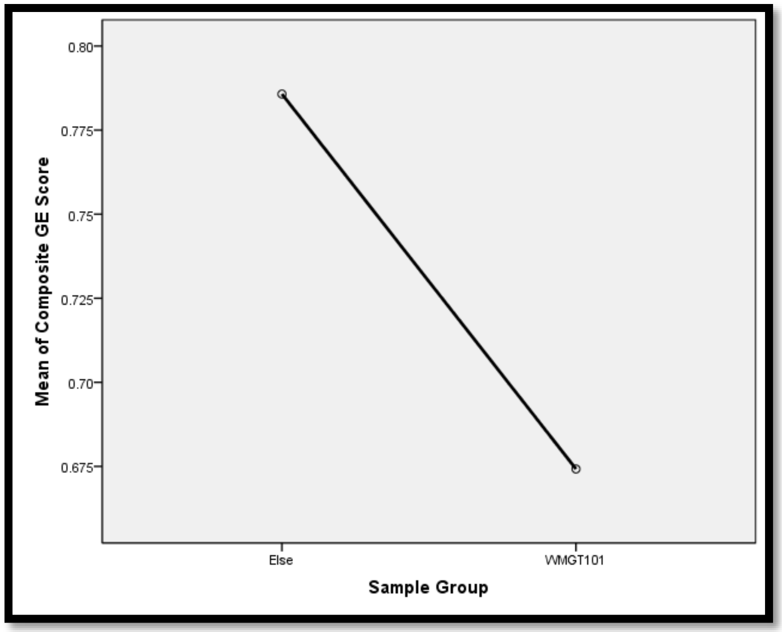


Figure 33: Means Plot – GE Composite by Sample Group

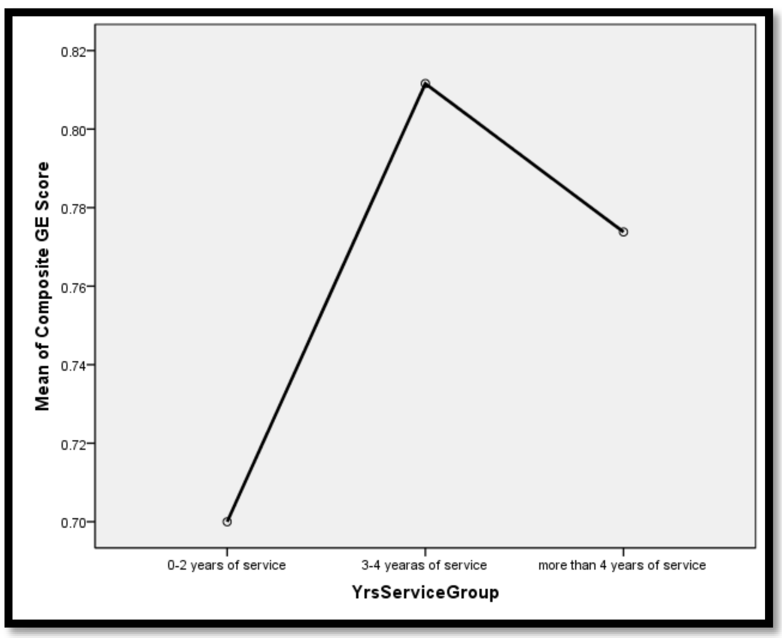


Figure 34: Means Plot – GE Composite by Yrs Service Group

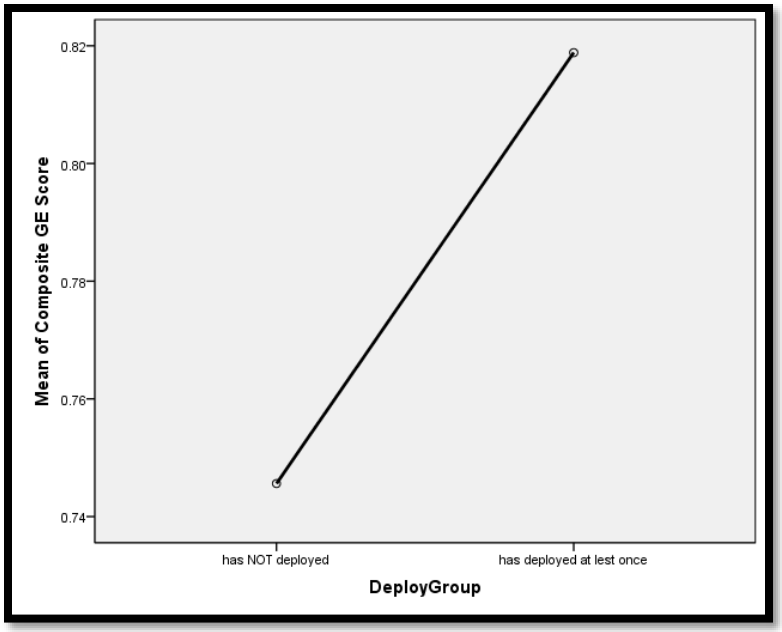


Figure 35: Mean Plot – GE Composite by Deploy Group

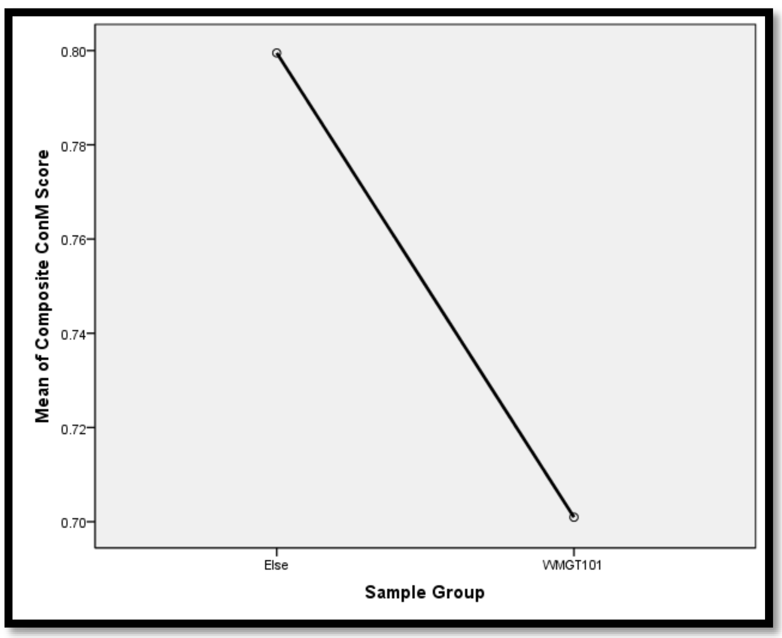


Figure 36: Mean Plot – ConM Composite by Sample Group

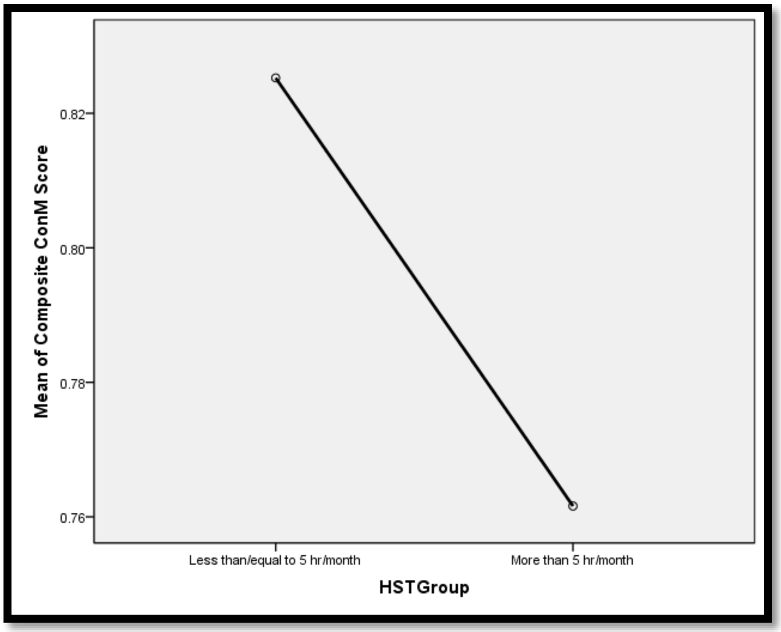


Figure 37: Means Plot – ConM Composite by HST Group

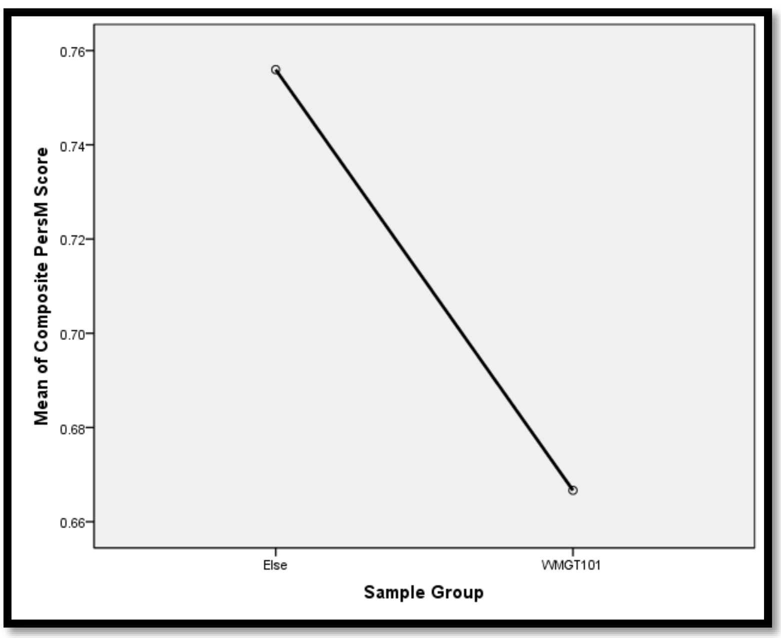


Figure 38: Means Plot – PerM Composite by Sample Group

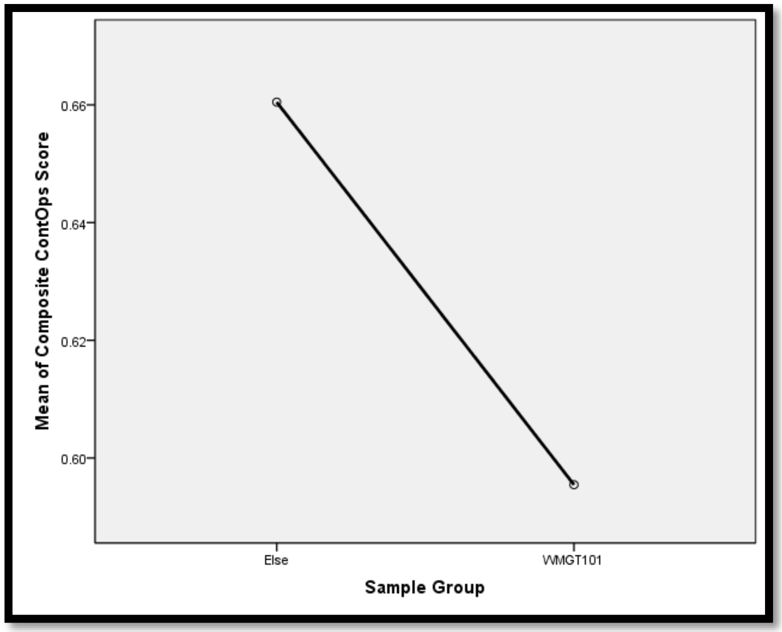


Figure 39: Means Plot – CO Composite by Sample Group

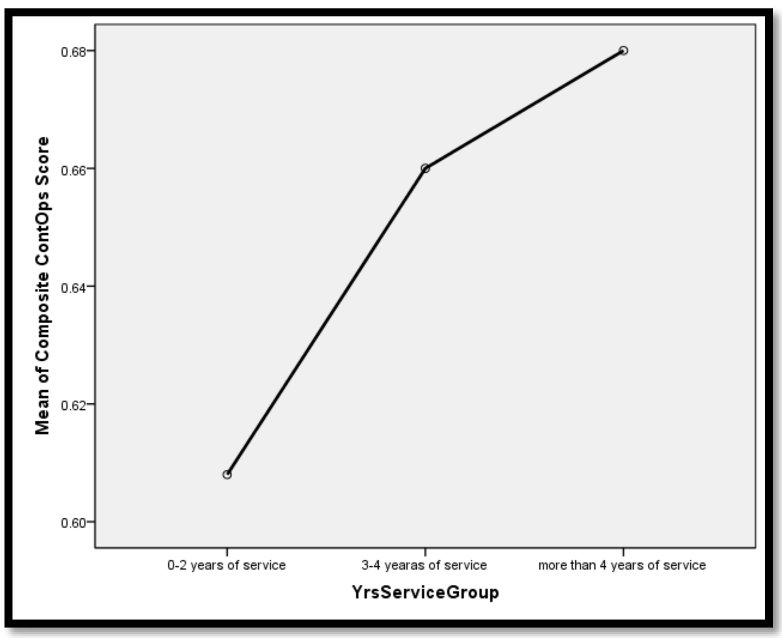


Figure 40: Means Plot – CO Composite by Yrs Service Group

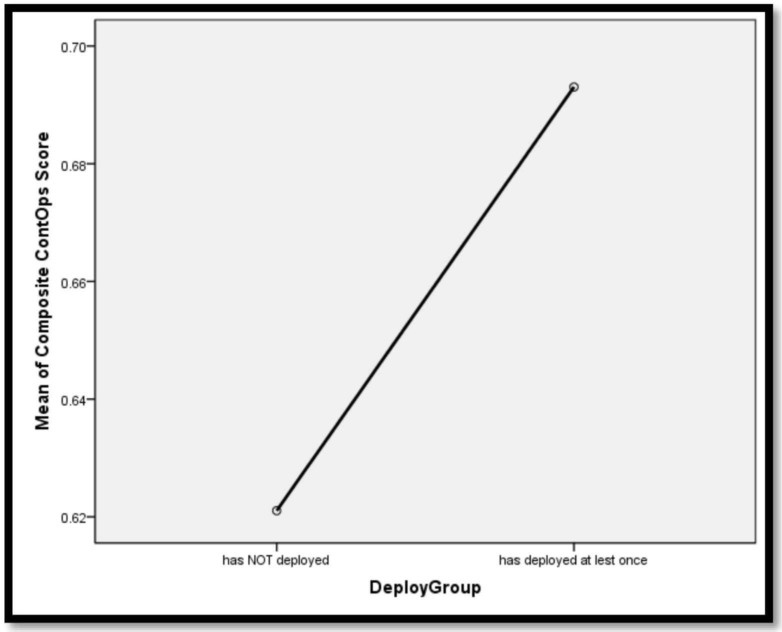


Figure 41: Means Plot – CO Composite by Deploy Group

Research Questions

The test instrument utilized in this research served the purpose of supplying answers to research questions three and four.

3. What level of contingency job knowledge do CE CGOs possess?

The test instrument sought to measure contingency job knowledge in my sample. The mean score on the test was approximately 74 percent for the main sample and 66 percent for the WMGT 101 sample. Overall, the mean score was 71 percent. In academic settings, the minimum passing score is typically 70 percent. If this same standard is applied to the contingency job knowledge test, then a clear opportunity for improvement exists for the majority of the sample. The highest score was an 86 percent and the lowest score was a 45 percent, but most scores were clustered just above or below 70 percent.

The standard deviation for the main sample was smaller than that of the WMGT 101 sample, indicating that the level of contingency job knowledge was more similar among CGOs in the main sample. The exploratory analysis indicated that a significant difference in overall test scores and in all composite scores except for construction management existed between the main sample and the WMGT 101 sample. This is a finding that is logical, as experience is a large contributor to knowledge.

4. What are the contingency job knowledge gaps in CE CGOs?

Collectively, Tables 9, 10, 11, 12, and 13 answer this research question by giving the overall scores achieved by the samples and the low-scores for each sub-construct, individual area, and test item. The sub-constructs that scored the lowest were contingency operations, construction management, and personnel management. If mean scores are separated by sample, the main sample scored below 70 percent only in contingency operations and the WMGT 101 sample scored below 70 percent in contingency operations, personnel management, general engineering, and construction management.

Low scores at the sub-construct level do not provide much utility in identifying the knowledge gaps in the samples, making it necessary to examine low scores at the individual area. At the individual area, Prime BEEF concepts, joint forces, enlisted CE AFSC knowledge, contingency construction standards, general construction activities, reach-back resources, deployed leadership, project scheduling, BOS-I and SAA, contingency base types, contract types, and construction inspection were all areas that scored below 70 percent. If the samples are separated, the main sample scored below 70 percent in the individual areas of Prime BEEF concepts, enlisted CE AFSC knowledge, joint forces, contingency standards, reach-back resources, general construction activities, project scheduling, and construction inspection. The low scores can be broken down to the item level, which is possibly the most valid way to show the knowledge gaps in the sample due to the results of the reliability analysis and Q-Sort.

Research questions three and four provided the information necessary to complete the training needs analysis by offering evidence of what CE CGOs know in regards to the aspects of the contingency environment focused on by this research. The deficiencies between what a CE CGO needs to know (or what was identified by the job analysis) and what a CE CGO does know (or which items were answered greater than 70 percent correct on average) represents the training needs. Chapter VII will expand upon the conclusions reached from the training needs analysis and offer recommendations for addressing the contingency knowledge gaps in CE CGOs.

Summary

This chapter provided the analysis and results of the test instrument utilized for this research. First, the results of the reliability analysis were presented and then the results of the Q-Sort were given. The reliability analysis found acceptable estimations of item reliability when measured at the overall test level or when using the confidence ratings as the measure of reliability. The Q-Sort found an overall moderate level of agreement on how the test items were categorized and identified several areas were items could possibly be re-categorized to improve the test instrument. Next, response rates and representativeness were shown. While overall response rates were lower than desired, the representativeness was satisfactory. Third, the sample was characterized with descriptive statistics and histograms. The sample met the sought after demographics of the population of interest, and represented both junior and senior CGOs. After describing the sample, the test scores were presented at the overall construct level, at the sub-construct level, at the individual area level, and at the item level. The mean test score was approximately 70 percent, indicating that knowledge gaps existed in the sample of CE CGOs. The low-scoring sub-constructs, individual areas, and items were shown. Lastly, the results of the exploratory analysis of the relationships between demographic information and test scores was presented. Of the five demographic areas, only two areas consistently had a significant effect on the scoring patterns of the sample with the two areas being years of service and number of deployments.

VII. Conclusions and Recommendations

Chapter Overview

This chapter provides the conclusions and recommendations resulting from the findings of this research. The conclusions from the job analysis and test instrument will be reviewed and expanded upon from previous chapters. The significance and contributions of this research to the civil engineer officer contingency training body of knowledge will be discussed. Recommendations for action based on the conclusions of this research will then be offered. The limitations of the research will be reiterated from Chapter I and added upon based on experiences encountered while completing the research effort. Lastly, recommendations for future research will be presented and concluding comments will be given.

Conclusions of Research

The purpose of this research was to meet the priorities and intent of the USAF strategic document set and the USAF's most senior leadership by utilizing the ISD system to take a current look at the training needs of CE CGOs in the contingency environment. This was done by first conducting a Job Analysis (JA) and then utilizing the results of the job analysis to create a test instrument designed to assess contingency job knowledge.

Job Analysis.

The method used to conduct the JA was the Task Inventory (TI). The TI resulted in a list of 36 critical tasks and 58 important Knowledge, Skills, and Abilities (KSAs) for CE CGOs operating in the contingency environment.

The most critical tasks were primarily associated with the successful completion of projects and included aspects of project management and construction management. Executing tasks related to the operations and maintenance of contingency bases were also rated very critical. Another prevalent theme was the criticality of recognizing problems, developing courses of action, and effectively communicating solutions to leadership. The task of communicating with leadership was rated both most important and most frequent which subsequently made it the overall most critical task.

The tasks rated least critical are also of interest. The ten lowest rated tasks were mostly ones that fell outside the core competencies of CE CGOs and included tasks such as mentoring host nation forces, executing basic combat tasks, and performing convoy planning and operations. Surprisingly, some tasks traditionally associated with Air Force civil engineers such as bare base planning and force beddown fell near the middle of the criticality index. Upon further investigation, these tasks were rated high on the importance scale but only average on the frequency scale. It is important to note that some tasks that are very important are performed infrequently because they occur during very specific points in contingency operations. These tasks should be retained within training curriculums but perhaps with less emphasis, especially if it is to the benefit of those tasks rated more critical.

The most important KSAs were ones that cross-cut many of the tasks that a CE CGO would perform in the contingency environment. Two KSAs were rated higher than all the others and they were the ability to work in teams and critical thinking. These two KSAs also had the lowest standard deviations indicating the highest level of agreement among the raters. Many of the KSAs rated most important were not unique to the civil engineer career field and were abstract concepts that could apply equally to any officer such as leadership and accountability. This reinforces the fact that civil engineer officers must be officers first and engineers second. Among the highest rated KSAs were stress tolerance and time management. These two KSAs, while important for the execution of in-garrison tasks, are especially important in the contingency environment.

Like the criticality index created for the tasks, it is meaningful to look at the KSAs rated least important. The KSAs with the lowest ratings included the ability to produce computer-aided drawings and the ability to use Geographic Information Systems (GIS) to aid in decision-making. These KSAs being rated so low was counter-intuitive to the seemingly often need for and importance placed on Common Operating Pictures (COPs) in the contingency environment. Also rated low were KSAs related to some of the lowest rated tasks such as knowledge of tactical convoy operations and knowledge of nighttime operations.

Test Instrument.

The purpose of the test instrument was to create a job knowledge test that would assess the knowledge level of CE CGOs on the tasks identified in the TI. In order to do so, the tasks needed to be categorized and grouped into sub-constructs and individual areas within the sub-constructs. The six sub-constructs that were created were project management, construction management, general engineering, contract management, personnel management, and contingency operations. Test items were written to assess the individual areas with the intent of being able to assess the sub-constructs and in-turn the overall construct of contingency job knowledge. The test instrument was administered to a main sample made up of CE CGOs with varying levels of experience and to a sample of

CE officers that were attending the civil engineer basic course. The test instrument primarily served to identify the contingency knowledge gaps in the sample but also uncovered several interesting relationships among the test scores and demographics of the samples.

The results of the test instrument were previously discussed at the construct and sub-construct area but it is also useful to bring the level of analysis to the item level. The main sample had 46 low-scoring items and the WMGT 101 sample had 64 low-scoring items. A low-scoring item was one that was answered correctly by less than 70 percent of the sample. Table 35 and Table 36 provide the full lists of low-scoring items for each sample. The samples had 43 low-scoring items in common. When looking at items answered correctly by less than 30 percent of the sample, there were 4 low-scoring items in common. The items were numbers 25, 24, 40, and 75. These items covered the topics of when to prepare a project schedule, the concept of crashing a project schedule, the primary design factors of an aircraft maintenance hangar, and the differentiation between a theater asset such as an EPBS and a base asset such as an ECES.

The items also received a confidence rating. It was found that the mean confidence rating was moderately correlated to the mean score for each item. Comparing the test score results in Table 28 to the confidence rating results in Table 29 confirms the moderate correlation. The areas of interest are those where the test score results and the confidence ratings differed. In the main sample, the confidence ratings for project scheduling, construction inspection, construction activities, and Prime BEEF concepts were above average despite the areas being low scoring. This could indicate the presence of over-confidence or areas were old information or misconceptions are widespread. A number of other areas had below average confidence ratings but were answered correctly by more than 70 percent of the sample, indicating guessing or answers where the distractor responses were operating poorly. The WMGT 101 sample generally had lower confidence ratings than the main sample, but was more confident in site safety, building types, and engineering functions. The mean score reflected the higher confidence in only the engineering functions area, where the WMGT 101 sample vastly outperformed the main sample. This could be due to recently learning the information or an update of civil engineer basic course curriculum. Common areas of below average confidence among both samples included contract types, enlisted AFSC knowledge, contingency construction standards, reach-back resources, contingency base types, BOS-I and SAA, joint forces, and deployed leadership. Test performance matched the below average confidence in the majority of these areas.

The relationship between the test scores and the demographic information was then explored. Table 39 and the mean plots that follow it fully described the significant results of the analysis. The majority of the results indicated that years of service and if the individual had been on one or more deployments significantly affected test scores in a positive manner. This finding reiterates that experience has a very large impact on level of knowledge. Some of the results were nonsensical such as the indication that more HST and attending Silver Flag lowers project management and contract management knowledge. Overall, the exploratory analysis of the demographic information did not result in useful information. No significant improvement in sub-construct test score due to the groups created for the three training mechanisms (HST, CE School courses, and Silver Flag) was found.

Significance of Research

This research contributes to the contingency training for CE CGOs body of knowledge by presenting a current look into the general opinion of a wide range of CE officers in the areas of contingency operations and contingency training. Furthermore, the research offered gaps in the knowledge areas that were deemed critical for a CE CGO.

Recommendations for Action

The results of the test instrument should be used to indicate the training needs that are not being met by the current training mechanisms offered to CE CGOs by the career field. The training needs should be implemented into the appropriate training mechanisms. Specific recommendations are offered below.

1. Increased emphasis on project management and construction management for junior CGOs should be explored. The in-garrison opportunities to gain experience in these areas are inconsistent and should not be relied upon as adequate preparation to perform the tasks associated with these areas in the contingency environment. WMGT 322, *Introduction to Project Management Course*, and WMGT 422, *Project Management Course*, offered by the Civil Engineer School should be mandatory training for CGOs with less than four years of commissioned service. Squadron commanders need to ensure that young CE officers under their command are given the opportunity to attend training courses. This is especially important given CGOs were overconfident in these areas.

2. CGOs should be introduced to contract management much earlier in their careers. WMGT 421, *Contracting for Civil Engineering Course*, should be part of deployment readiness or Just-In-Time (JIT) training for CE CGOs.
3. The CFETP 32EX should reflect the target audience of WMGT 590, *Joint Engineer Operations Course (JEOC)*, as the course description offered by the Civil Engineer School does. WMGT 590 should not be a course targeted at senior Captains and Majors, but rather one that is targeted at junior CGOs. Today's contingency environment requires our Air Force civil engineers possess the ability to effectively operate with and within joint services. This change in target audience should be clearly communicated to the career field.
4. The Deployed Leaders Guide (DLG) to the AEF should be required reading for all CE CGOs. A satisfactory demonstration of the knowledge contained in the DLG should be a pre-deployment requirement for all CE officers. This will require the DLG to be maintained with current and relevant information.
5. The reach-back resources available to all AF civil engineers should be better communicated to the career field. Standard career field documents should be created detailing the full capabilities of AFCEC's Reach-Back Center (RBC), USACE's Reach-Back Operations Center (UROC), and NAVFAC's Reach-Back Support. These invaluable resources are

available to engineers from any service component and have the potential to be a force-multiplier in the contingency environment.

6. Dwindling resources cannot be allowed to equal dwindling readiness. Squadron commanders, supervisors, and unit training managers must take on the responsibility to fill the knowledge gaps of their personnel in the absence of specialized training courses and available TDY funds. Furthermore, the officer has the overall responsibility and control over his/her readiness; opportunities to attend training and gain knowledge must be sought out by the individual. HST should be used as a robust training mechanism that captures lessons learned from personnel returning from the contingency environment and turns those lessons into current and relevant training for other personnel.
7. There is no replacement for experience. Hands-on training should be at the forefront of any training curriculum. Topics covered in computer-based training should be succeeded by an immediate opportunity to put gained knowledge into practice.

Limitations of Research

The test instrument used in this research only sought to measure job knowledge. Job knowledge is only a single facet of effective job performance. The JA indicated that many of the qualities and characteristics of CE CGOs are equally, if not more important than the possession of knowledge. The findings of this research should not be considered as a universal measure of the state of readiness of CE CGOs to operate in a contingency environment.

The task inventory and job knowledge test were exclusively administered in computer-based forms in situations where the environment of the participants could not be strictly controlled by the researcher. The environment or circumstances in which the participants responded to the survey or took the test could be sources of systematic variance that cannot be accounted for without researcher control.

The most widely used assessments in academic, employment, clinical, and research settings have been continually evaluated and refined over the course of many years leading to high measures of validity and reliability. The amount of time available to the researcher in the creation of the survey and test instrument limited the ability to conduct multiple pilot and pre-tests and subsequently make the necessary adjustment to improve the quality of the instruments.

This research focused solely on the tasks performed by CGOs in support of a Prime BEEF contingency mission and the KSAs needed in the performance of those tasks. CE CGOs operate in a number of other roles in the contingency environment that were not taken into consideration during this research due to time and scope limitations.

The results of the job analysis and the test instrument were based on the availability of useable responses. The overall response rate was lower than desired which led to a relatively small sample size. A small sample size places limitations on the types and strength of statistical analysis that can be conducted.

The generalizability of this research is restricted to a current snapshot of the tasks executed by CGOs in the contingency environment. One certain characteristic of the contingency environment is that it is always changing. The changes to the contingency environment can often be dramatic which demand that the civil engineer career field and its personnel adapt to that change. For this reason, this research has a limited period of usefulness in the career field.

The survey and test instrument were created solely by the researcher and as such are susceptible to a fair amount of bias, error, and subjectivity. The researcher's knowledge and professional education in the areas of organizational psychology and psychometrics was based on the literature review conducted as part of this research. Ideally, a highly trained group of job analysts and professional educators would be involved in the creation of the types of instruments utilized in this research.

Recommendations for Future Research

A wealth of data was generated from the open-ended questionnaire, the SME survey, and the test instrument. Future research could analysis any component of this research individually or as a whole. A parallel form of the test instrument could be created, administered, and compared against the results of the form used in this research. With a larger sample, aspects of Classic Test Theory (CTT) and Item Response Theory (IRT) could be utilized to further analyze the contingency job knowledge of CE CGOs. A regression model using additional demographic information could be created to attempt to find the most influential factors on contingency job knowledge.

Summary

The purpose of this research was to take a current look at the training needs of civil engineer CGOs in the contingency environment. This was done by first conducting a

Job Analysis (JA). The JA method utilized was the Task Inventory (TI), which involved an open-ended questionnaire and a survey administered to 27 SMEs. The TI resulted in a list of 36 critical tasks and 58 important Knowledge, Skills, and Abilities (KSAs) for civil engineer CGOs operating in the contingency environment. The results of the TI were then used to create a test instrument to assess the level of contingency job knowledge in a sample of 64 civil engineer CGOs. The lowest scoring areas of the test indicated the gaps in the contingency job knowledge of the sample. The knowledge gaps represent the training needs for civil engineer CGOs in the contingency environment. The identified knowledge gaps were then used to provide recommendations for action.

Appendix A: Open-Ended Questionnaire

Air Force Institute of Technology (AFIT) Research Survey – Phase 1

Sample: WMGT 400 Civil Engineer Commander / Deputy Course

Researcher: Captain Brian S. Greszler

Research Advisor: Major Gregory D. Hammond

Research Sponsor: The Civil Engineer School

You are being asked to participate in a short survey. This survey is part of research examining contingency training for Civil Engineer Officers (32EX). Please answer the questions on page 2 according to your personal experiences and body of knowledge. This should take approximately 15-20 minutes of your time.

This survey is phase 1 of 2; a second survey based on your responses will be developed and administered at another time. Your participation in this survey is voluntary. You may answer one, two, all, or none of the survey questions. There is no penalty for non-participation and no anticipated risks are associated with participation.

No personally identifiable information (PII) will be collected. The only demographic information that is being requested should you choose to participate is # of years of service and # of deployments.

# of years of service: ____________

# of deployments: ____________

This survey is also available online at: http://tinyurl.com/AFITCESurvey.

SEE REVERSE FOR SURVEY

1) What tasks are PRIME BEEF CGOs expected to perform in the expeditionary environment? (i.e. beddown, operations and maintenance, light construction)

2) What knowledge, skills, and abilities do PRIME BEEF CGOs need to possess in order to successfully meet all mission requirements in today's expeditionary environment? (i.e. knowledge of contingency construction techniques/methods, leadership skills, ability to prepare basic construction plans)

3) Does the curriculum of the current spectrum of CE Officer contingency training (HST, Silver Flag, CE School, etc) provide adequate, timely, and relevant information to CE Officers? Why or why not?

4) Please tell me any other thoughts you may have on Civil Engineer Officer (32EX) contingency training.

Appendix B: IRB Exemption Approval Letter – Open-Ended Questionnaire

2 March 2015

MEMORANDUM FOR MAJ GREGORY HAMMOND

FROM: Jeffrey A. Ogden, Ph.D.
AFIT IRB Research Reviewer
2950 Hobson Way
Wright-Patterson AFB, OH 45433-7765

SUBJECT: Approval for exemption request from human experimentation requirements (32 CFR 219, DoDD 3216.2 and AFI 40-402) for An Analysis of Civil Engineer Officer Contingency Training

1. Your request was based on the Code of Federal Regulations, title 32, part 219, section 101, paragraph (b) (2) Research activities that involve the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior unless: (i) Information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) Any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation.

2. Your study qualifies for this exemption because you are not collecting and reporting sensitive data, which could reasonably damage the subjects' financial standing, employability, or reputation. Further, you are not collecting and reporting any demographic data which could realistically be expected to map a given response to a specific subject.

3. This determination pertains only to the Federal, Department of Defense, and Air Force regulations that govern the use of human subjects in research. Further, if a subject's future response reasonably places them at risk of criminal or civil liability or is damaging to their financial standing, employability, or reputation, you are required to file an adverse event report with this office immediately.

3/2/2015

X Jeffrey A. Ogden

Jeffrey A. Ogden, Ph.D.
IRB Exempt Determination Official

Appendix C: Open-Ended Questionnaire Responses

Sample	Years of Service	Number of Deployments	Q1	Q2	Q3	Q4
WMGT 400	12	5	Beddown, retrograde, tactical actions and planning, heavy and light construction management, contract officer representative, title 2 supervision, planning, programming, acquisitions, environmental, mentoring host nation forces, convoy operations and planning	Bottom line: Home station duties and silver flag do not adequately prepare young leaders to competently execute engineering tasks relevant to austere contingency environments.	No. Combat Skills Training (CST) - trains basic military skills (i.e. shooting, Combat Life Saving, Counter-IED, etc.). No engineering skills taught at CST. Some leadership skills taught only if senior leadership fosters a permissive environment to allow this level of experience. Home Station Training (HST) - Computer Based Trainings (CBTs) don't teach how in terms of experience, this is tough to simulate without doing, which is why cradle to grave project management at home station is key and critical to teaching though learned experience at a crawl, walk pace with a goal of getting CGOs to pace at a light run for their careers (compared to the intensity of deployed marathon/sprint pace). Silver Flag - very limited to light contingency engineering training for project management/execution, this is due to time constrained and format of silver flag.	There's probably a need for two types of silver flag. Silver flag 1 - bed down an air base defense this is relevant and these skills are paramount because this is the Air Force civil engineer mission. Silver flag 2 - CST type because we are in the military there are perishable skills and learning them literally under fire gets people hurt or killed, a few hundred thousand dollars in training will save letters home and trips to Arlington Cemetery. Should include tactical convoy planning and operations, host nation mentoring and engagement, remote location project management simulation. Make a CST/JEOC hybrid.

WMGT 400	17	2	Project programming, project management, bed down planning, contracting officer representative, maintenance, repair, minor construction, administrative action, awards disciplinary paperwork, memorandums	Engineering and operations competencies, construction methods and inspection, project and construction management, military paperwork, know the tongue and quill, know how all of CE fits into prime beef mission, if you don't have knowledge or experience, get it.	As much as it can. Contingency environments are too uncertain to plan and receive training for everything, but current training curriculum well adequately prepare for most missions, so long as students are actively engaged and learning.	NR
WMGT 400	9	2	Project management, contract execution, resources management, O&M	Ability to execute projects, skills in managing resources.	Big yes, you train as you fight, provides opportunity to interact with enlisted forces, integrate all CE crafts.	Must focus in green solutions, energy reduction, water conservation. Must redirect training to domestic operations.
WMGT 400	17	5	Beddown, project management, project programming, operations and maintenance, light construction planning, inspection, contract negotiation, airfield damage repair, base recovery, casualty care	Estimation, construction management (expedient, temporary, host nation), critical thinking, decision-making	Yes it provides training for future contingency operations, bed down, airfield damage repair, emergency operations center, crisis action team, recovery etc. No, current OIF/OEF engagements require a set of training: negotiation, contracting etc. Deployment for CE troops lately includes Army type operations; our prime beef training does not prepare them well for that.	It is hard to peel away from day-to-day operations to do training. Training like Silver flag, Eagle flag, are invaluable because focus can be on training Vice day-to-day business.
WMGT 400	15	3	Design, product management, light construction oversight, run the damage control center	Leadership skills, construction oversight, auto CAD, problem solving, expeditionary equipment and facilities	NR	NR

WMGT 400	9	3	Project planning(independent government estimate, statement of work, documentation), contract management(contracting officer representative), construction surveillance, quality assurance, 35% designs	Simplified facilities principals, construction materials, design review skills, community planning, master planning, airbase bed down	Formal training does not replace on-the-job training and experience. However, as a lieutenant, a solid home station training plan on Prime BEEF days is viable for learning organic capabilities. CE school provides great training for professional technical skills overall, If a company grade officer takes advantage of all training opportunities it should prepare them.	DAU offers excellent training for COR duties and facility management that can and should replace some portions of formal training.
WMGT 400	14	4	Beddown planning, project management, 35% scope development, construction management, inspection, schedule, damage assessment, engineer assessment (structural, electrical, civil, and environmental), cost estimation, performance work statement writing for contracts, service contract oversight, COR duties	Estimation techniques, Basic construction understanding, contract writing, performance work statement experience, bed down understanding, weapons training, convoy planning, Aircraft movement, combat skills, contract management, Basic facility design, pavement evaluation and design, joint engineer capabilities, airfield damage repair	Home station training needs overhaul to provide timely and effective training that can cover demand of the expeditionary requirements. Basic levels of some AFIT courses (facility design, payment eval, airfield design, and programming) could provide the level necessary to remain current. Silver flag (new curriculum) is better, CE school training through webinars are good but class sizes delay ability to train up new lieutenants. We need additional vendor training to add a estimation and project management expertise.	Recommend adding more local and mission based classes to curriculum. I would include snow operations to educate CE officers on the process per snow and ice control plan development at Wing Commander level. Additionally, 2 troop training projects would be helpful and instead of one multi craft project. This could break training into one vertical and one horizontal. One per year does not provide enough training to meet requirements.

WMGT 400	14	2	Beddown planning, coordinate inputs from subject matter experts, OIC for tent city construction, project programming, simplified design, project management	Know processes to get contract projects programed, funded, awarded, and executed, know process to get funds to support day to day operations, know how the contingency unit mission fits into the larger Area of responsibility and CCDR's missions	Adequate, I normally see a lot of CBT's for 32E training with some hands-on but not the norm. Commander is too busy to develop a good 32E training plan and CEX flight chief is too junior to know what a good training plan is. Silver flag training is not frequent enough.	There is a need for structured standardized 32E home station training with more hands-on. Too many CBT's. Make the hands-on training integrated with enlisted training.
WMGT 400	16	5	Airfield damage repair, minimum airfield operating strip, large area maintenance shelter, prefabrication	Site survey requirements, BEAR equipment packages, construction management, environmental requirements	No, CE officers do not actively have a SME HST program or the curriculum/program areas are not codified in AFI 10-210.	Need AFIT's help to develop mini lessons, training should be more technical, training should incorporate some of the EA training
WMGT 400	15	4	Beddown, O&M, project management, base planning, simplified design, programming, readiness flight officer	Establish the base TTPs, knowledge of CE/BEAR force modules and UTCs, knowledge of joint/coalition partner agile combat support capabilities, ATSO (ability to survive and operate), weapons, convoy, communication, simplified design, project management, understanding of USAF agile combat support capabilities, team leadership	Not sure, never attended Silver Flag. Unfamiliar with current CE school curriculum.	CE contingency training must evolve to develop the required KSAs to operate and succeed in the future AOs. I'm very concerned that the contingency training for agile combat support airmen has not evolved to include Anti-access/Anti-denial operations in a distressed environment with limited resources and limited communication. A CE CGO maybe the ACE team lead at a dispersed/austere location with limited communication to the "mother ship". He/she will need to have the KSAs to include leadership to establish, operate, recover and divest the site with very limited resources.

WMGT 400	15	4	Beddown of forces, design and layout of tents, O&M on expeditionary assets, construction of expeditionary type facilities, program/schedule management of construction	know each CE enlisted career field, time management, basic programming, funding types, how to integrate missions into larger mission, critical thinking	Yes and no, most of our school training in general is geared to non-hands on textbook type training. OFE at 101 set me up for contingency deployments. Need more joint service training incorporated. Best training was deploying to support the Army or Navy. Unlike the Navy, we are not required to have a PE.	More joint training, more funding types training, more hands-on training
WMGT 400	12	4	Planning, limited design, construction management, project management, scheduling, materials ordering	knowledge of construction techniques, communication skills, acquisitions/logistics, project management	I've always had to figure stuff out on my own.	Needs to incorporate joint sills and systems and lingo. Also train flexibility, if possible, not just AF CE doctrine.
WMGT 400	14	5	Beddown planning and execution, operations planning, resources, execution, management, priority planning of projects to meet mission and customer needs vs. available resources, management of Ops functional, coordination with CEN planning requirements, money, resources, contracting	What resources are available locally. Contracting. Heavy equipment availability. Understand mission/customer needs and plan based on that, identify gaps and communicate. Leadership/followership. Know you and your team's strengths/weaknesses/capabilities and wok to fix weaknesses.	My initial thought is that it will be relevant for baseline training. The CE School provided the foundation, further reinforced by Silver Flag and honed by base level training in squadrons.	Training for contingency deployment should not be an afterthought. Units, from CC/DO down to airmen need to be engaged in contingency training. Scenario based, location/environment based, creative/innovative Ops, partnerships with base/wing assets and contracts.

WMGT 400	15	4	Beddown, operations and maintenance, light construction, leadership of small teams, small project team leadership is the way we deploy now, logistics of teams and supplies	Knowledge of contingency construction techniques/methods, leadership skills, ability to prepare basic construction plans, knowledge of how the Army does BOS. Many times our airfields are forward. JEOC is good for an orientation, but they need more knowledge on how these deployed processes work.	Somewhat. Silver Flag needs updating and continuous improvement to stay current and relevant. HST projects should be encouraged by leadership.	The main thing I wish I had more time doing was practicing what I learned at 101, seems like Korea is the only place this is emphasized. Not enough time is available to exercise wartime skills while at home station. AF engineers do it best, but we can do it better.
WMGT 400	14	3	QA flight oversight and management, operations and maintenance management, base planning and programming, beddown, light construction	Knowledge of programming and regulations/policies, knowledge of base planning and beddown, construction management, contracting for engineers, knowledge of USACE and their operations, familiarity with contingency construction techniques and methods	Adequate in what it teaches, timeliness and currency are more the issue. Something learned in 101 is often forgotten 5 years later during a deployment. Also, the material and methods change over time. CE officers need the baseline knowledge, but then just-in-time refreshers before deploying (and preferably somewhat customized to what the officer will be doing on the deployment.	Deployments vary widely, a deployment to Afghanistan is much different than a deployment to a field in Africa. Contingency training needs to be flexible and applicable to what is needed.

WMGT 430	10	3	Beddown, CEO functions, CEN functions, Master planning, programming, design, construction management, environmental, readiness, real property, resource advisor, cultural issues	The ability to critically think about a problem, understand where to find information, listen to advice, make a decision based on many facts as are available at the time.	No, OJT is a critical aspect of training not covered in the above list. However, all information is presented in an academic setting which is not necessarily the same thing as practical experience. Our officers are getting adequate, timely and relevant information at the right time, they just need to gain OJT/experience.	I was a second lieutenant with 10 months as I left to go on my first deployment. I had been to 101, ASBC, and spent time in CEOE and CER. My deployed commander assigned duties as necessary: programming, design, construction management, resource advisor, environmental. I reached out to my commander, supervisor, and back to home station to learn. In 4 months, I learned all of this and was exceptionally successful. I'm here to tell you CE is doing what we need to ensure our officers are ready. The rest is up to the individual officer.
WMGT 430	10	3	Programming and contract management, rarely beddown or operations	Contract vehicles and funding process, how to execute projects or buy stuff	No, it has been 10 years since I was at Silver Flag. 101 was death by PowerPoint. Pure academic for contingency training is not effective.	Train how we fight. Use New Horizons, Eagle Flag. Deploy to do troop training projects. Lead troops more.
WMGT 430	10	3	Beddown, light construction, O&M, construction inspection	The skills learned through MGT 101 and on-the-job training at home station. Other skills can be learned at pre-deployment training such as convoy operations, troop movements, marksmanship, etc.	Yes, because it covers what we need to be successful.	NR

WMGT 430	8	3	Beddown, master planning, O&M, simple construction, airfield repair, airfield upgrade planning, host nation simple construction, contract management	Simple facility design, contract quality assurance, host nation design standards, contingency equipment specifications and design, project design and project management, construction inspection	HST - very lacking varies from base to base. SF - haven't been since 2009, but was focused on base recovery. SF good for beddown plans and BEAR assets. CE School - WMGT 481 is really good.	Need to incorporate hands-on training through HST, kill CBTS. More convoy, tactical movements, etc in HST. Give Lts and EAs more design/survey/plan experience at base level.
WMGT 430	10	2	Beddown, O&M, real property, environmental, commander aide and exec, basic building and pavement design, general flight leadership (LOEs, Decs, discipline), construction management, contract administration, resource advisor	Generally, they need mental aptitude, intelligence, charisma, and drive. Specifically, KSAs to perform tasks answered in Q1 above.	HST Prime BEEF day is adequate, but varies greatly from base to base. I've never been to Silver Flag, so it isn't timely enough. CE School is great just-in-time training, but not offered enough to always attend based on timeline between deployment notification and departure. Too much reliance on CBTs instead of hands-on training.	There needs to be a better database to access lessons learned. All officers should be required to submit lessons learned at the end of deployments that is reviewed and consolidated by AFCEC/CX and then posted on SharePoint for review by all officers.
WMGT 430	14	5	I expect CGOs to be able to design, build, and maintain expeditionary bases including all major systems. I expect CGOs to be able to fall into an Army logistics unit with a minimum level of combat skills to be able to conduct all basic combat actions to defend their unit.	They need the basic skills to layout a bare base to include basic design of all utilities, structures, and security.	I don't feel qualified to comment. I have not been at the base level or Silver Flag in 8 years.	We need more training in combat arms. Our Airmen need to be proficient shooters, no minimally qualified just-in-time trained individuals.

WMGT 430	12	5	They may be expected to lead other Airmen in those things. Also, write statements of work, perform construction management or contract management to provide whatever is needed in the expeditionary environment.	Lessons learned from other efforts in the expeditionary environment and how today environment is different.	I've been on 5 deployments and have not had to participate in a real-world contemporary expeditionary environment. Deployments have focused on aid to host nations, support to the Army, downrange O&M. Most of the time, I depended on what I've learned in my day to day job. HST, Silver Flag, and MGT 101 have tended to be important, but only as background information.	Most of the recent contingencies have been related to asymmetric warfare and the need to establish training sites. Those sites have been preexisting locations that required new facilities. Construction during other deployments was related to direct AF requirements.
WMGT 430	10	2	Base planning, beddown, project management, quality assurance, quality control, manage service contracts, travel to different locations for site assessments, engineering simplified design	Know local construction procedures and procurement methods, become familiar with the CENTCOM sandbook, be familiar with AF contingency manuals, know who has BOS-I and properly coordinate with all affected organizations	Yes, but not every officer gets the advantage of attending specific courses due to deployments, TDY, funding, etc.	Overall, I think the 32E career field does an amazing job of making an effort to ensure all officers receive the proper contingency training when compared to most other career fields.
WMGT 430	12	3	Beddown, barebase construction, flight line maintenance, design, construction, hardening, convoy planning and execution, oversight and leadership of Airmen, operations center during attack, ADR, general and mission beddown planning	Leadership skills and communication of the mission is the most important skill. You do need to know contingency construction techniques, but if you can effectively lead and communicate to your Airmen then you'll have amazing support to get the mission done. CGOs can't know everything, leverage your CE enlisted craftsmen.	Yes, if you get mentorship from your commander about what courses you need and when, then they can prepare you for the future deployment you'll have. You can't learn or know everything along with your day job. Leverage the knowledge of the entire CE team.	Leadership is the most important skill in the contingency environment.

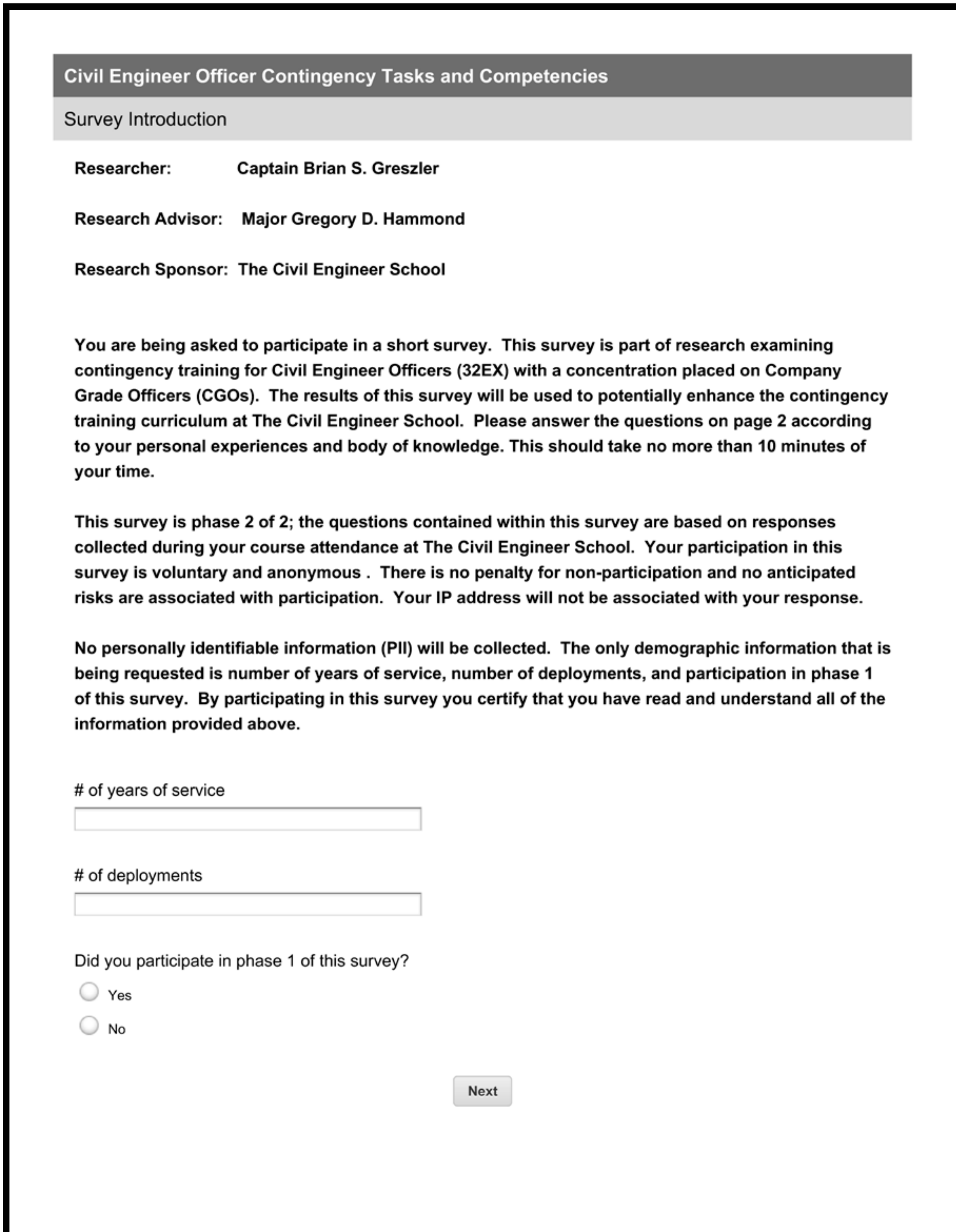
WMGT 430	11	4	Project management, programming, budgeting, execution actions	Knowledge and expectations of where you are going (bare base) and who you will work for (sister services). All of the above items and prepare yourself to know what will be required of you in the expeditionary environment.	Yes, but that is the basics of what you need to know. Read the joint pubs that govern CE capabilities and who our roles are in the joint environment.	NR
WMGT 430	12	1	Project programming, FUBs, how to build IPL	Knowledge of funding and programming	Yes, the management of resources.	Include more understanding of contract and warranty management.
WMGT 430	12	3	Installation layout, construction of temporary or permanent living quarters, utilities, operations centers, and airfields, maintenance of facilities and real estate	More technical design skills, particularly in electrical and HVAC design.	Yes, the AFIT options for design courses are a great option for young CGOs to improve their technical design skills.	The career field does a great job for contingency training, electrical and HVAC designs would be an improvement.
WMGT 430	11	3	Base planning, operations, leadership	NR	A more advanced bare base planning course would be helpful for officers. This is a skill that degrades quickly, but is the most important skill for future conflicts.	NR
WMGT 430	10	4	Design, construction management, BOS-I, lead troops	Know more than their degree, leadership methods to lead troops.	I think it is available, but few never take advantage and then claim their isn't education or training.	NR
WMGT 430	11	3	O&M, minor/major construction, base master planning, training mayor cells/DPW, engineering, project management, program management, personnel management, train & equip local nationals, COR duties, money management, awards/decs/EPRs/OPRs	Construction standards, timeliness, prioritization, organization, public speaking, effective communications, sister service regs, CENTCOM regs	No, it is geared towards old school bare base setup, antiquated equipment, doesn't cover joint regs and rules. CST should be one and done, course material does not keep up.	Needs to be AOR specific, taught by folks with experience.

WMGT 430	8	2	Beddown, project development, project management	Operating in a joint environment, intricacies of other services, construction management	I think performing ADR in gas masks developing a MOS is outdated training. It could happen but it isn't likely. I think training in all venues need to be updated to be relevant to what is happening in the AOR today.	The way we as a CE community exercise and train for an outdated scenario. 101 is adequate but the best training is time and OJT.
WMGT 430	10	2	Beddown, initial airfield setup, electrical laydown	I've never deployed to a bare base. Knowledge of all contingency construction and beddown requirements.	It has been since 2009 since I've gone to any of those courses. At that time all practices were relevant to how we deployed.	NR
WMGT 430	6	1	Beddown, BOS-I, light construction, quality assurance, special capabilities, rubber removal, paint striping, retrograde	critical thinking	Yes, information through playbooks, milsuite, and CE portal provides current information.	More relevant training, contingency QA course
WMGT 430	7	2	Base master planning, HN interaction, beddown, O&M, temporary facility construction or semi-permanent	Contract management; I spent most of my time dealing with contractors and CONS. It would be helpful to learn more about how to be a COR or supervise CORs.	Design reviews and contractor management need to be added. Training is important but more important is to know where to find answers.	We train a lot on bare base conditions or ADR, need to also train for the Al Udeids and Ali Al Saleems.
WMGT 430	11	3	O&M, minor construction, project management	Construction management skills	No, we are training for traditional operations.	NR
WMGT 430	9	2	Design, planning, and execution of beddown and projects. Running operations flights and engineering flights.	Know the expeditionary skills books and where to get the information. Understand how designs are to be organized and how to execute them. Know the environment you are going to.	HST would have to be so broad to cover the wide range of deployment types that the training would be behind. SF is useful at the shop level but at the CGO level, I am not sure it is extremely relevant.	NR
WMGT 430	10	2	Design, project management, O&M, beddown	NR	No, they are not able to teach the full spectrum of responsibilities.	There is not enough training to prepare 32EX. It would take almost full-time training to prepare a 32E to be fully ready for all the things they need to know.

WMGT 430	12	4	Project management, basic design, programming, close-out, inspections, progress reports	Cradle to grave project management, leadership and followership, basic joint knowledge, leading from the front, SANDBOOK familiarization, knowledge of CE contingency capabilities, UTCs, and equipment, understanding local contractor constraints, funding knowledge	It would be difficult to do due to the varied nature of all contingency locales. Key is OJT, proper changeover, and expectation to be flexible and learn and adapt quickly. Teach basics and learn in theater.	NR
WMGT 420	9	3	Beddown, planning base requirements, planning base closures	Maintenance knowledge to get projects complete, repair systems, ability to be flexible and find solutions to complex problems, know how money flows and how to get money, leadership and social skills, ability to reach out to others for help.	Theoretically, yes. However, the actual environment will truly tell if it does. From my experience, no it does not. The curriculum gets the 32E officer to about 40% ready in a contingency environment. Contingency is completely different from base level. The curriculum gets us up to 40%, it is when we are placed in the contingency environment that we reach 80% and 100%.	Surge, sustain, drawdown. Skills are the same through all phases. However, tasks are different from each phase. Just a thought, we need to focus more on "surge". The balance in our curriculum does not reflect what tasks are required of us.
WMGT 420	5	2	NR	Should know how to do a cradle to grave construction project, should know beddown planning	Some of it is a good recurring requirement, like Silver Flag that takes a while, but a lot of it can be just-in-time training and still be done even for short-notice taskings.	NR
WMGT 420	10	2	Planning, programming, light construction execution	Knowledge of contingency construction rules and techniques for the AOR they are visiting and working in.	In some cases it is adequate and timely and in others is isn't.	NR

WMGT 420	6	1	Project management, programming, construction inspection, QA/QC, COR	Knowledge of CE craftsmen abilities, COR responsibilities and basic knowledge of the FAR	Contract law for CE officers would be a good addition. SF is becoming more relevant. For the most part I think the answer would be yes though my experience is limited and specialized since I was on a PRT. I wish I had attended a construction management/inspection and a contracting course before though.	NR
WMGT 420	6	3	Programming, project management, construction management, inspection, minor design, cost estimating, troop labor and construction oversight, beddown planning	Knowledge of project folder requirements, required submittals, parametric estimating or the ability to extrapolate costs from other projects. Basic eye to identify problems on a construction project when performing inspections. Safety principles, management skills, ingenuity, courage to make a decision	Yes and no. All of those mentioned above are required, but a lot of what is learned through OJT and through experience. A lot of people learn more from mistakes and being thrown into the fire. However, if a CGO doesn't get experience on projects at home station and can't shadow engineers, inspectors, and sill operations personnel, then they won't have the necessary skills required for success when thrown into a deployed environment.	NR

Appendix D: SME Survey



Civil Engineer Officer Contingency Tasks and Competencies

Survey Introduction

Researcher: Captain Brian S. Greszler

Research Advisor: Major Gregory D. Hammond

Research Sponsor: The Civil Engineer School

You are being asked to participate in a short survey. This survey is part of research examining contingency training for Civil Engineer Officers (32EX) with a concentration placed on Company Grade Officers (CGOs). The results of this survey will be used to potentially enhance the contingency training curriculum at The Civil Engineer School. Please answer the questions on page 2 according to your personal experiences and body of knowledge. This should take no more than 10 minutes of your time.

This survey is phase 2 of 2; the questions contained within this survey are based on responses collected during your course attendance at The Civil Engineer School. Your participation in this survey is voluntary and anonymous . There is no penalty for non-participation and no anticipated risks are associated with participation. Your IP address will not be associated with your response.

No personally identifiable information (PII) will be collected. The only demographic information that is being requested is number of years of service, number of deployments, and participation in phase 1 of this survey. By participating in this survey you certify that you have read and understand all of the information provided above.

# of years of service

# of deployments

Did you participate in phase 1 of this survey?

- Yes
- No

Next

Civil Engineer Officer Contingency Tasks and Competencies

Task Importance

How important is this task for CGOs in the expeditionary environment?

	Not Important	Somewhat Important	Important	Very Important	Extremely Important
Prepare Cost Estimates, Budgets, and Work Timetables	○	○	○	○	○
Interpret and Explain Contracts to Others	○	○	○	○	○
Inspect Project Sites	○	○	○	○	○
Select, Schedule, and Coordinate Jobsite Activities	○	○	○	○	○
Respond to Work Delays, Emergencies, and Other Problems	○	○	○	○	○
Ensure Compliance with Requirements, Codes, and Regulations	○	○	○	○	○
Analyze Survey Reports, Maps, and Other Data to Plan Projects	○	○	○	○	○
Perform Project Risk Analysis	○	○	○	○	○
Determine Feasibility and Constructability of Projects	○	○	○	○	○
Use Design Software to Plan Projects	○	○	○	○	○
Present Information to Superiors through Formal and Informal Communications	○	○	○	○	○
Monitor Project Progress	○	○	○	○	○
Ensure Conformance to Project Design Specifications	○	○	○	○	○
Determine Project Design Specifications	○	○	○	○	○

	Not Important	Somewhat Important	Important	Very Important	Extremely Important
Provide Technical Advice to Colleagues and Superiors					
Organize, Plan, and Prioritize Work					
Discuss and Resolve Construction Issues					
Study User Requirements and Determine Construction Methods					
Help Prepare Contracts and Negotiate Contractual Agreements					
Investigate Damage, Accidents, or Delays at Construction Sites					
Develop and Implement Quality Control Programs					
Establish, Operate, and Maintain Installations					
Force Beddown					
Bare Base Master Planning					
Installation/Base Master Planning					
Command and Control of Civil Engineer Forces					
Perform Emergency Repairs					
Perform Base Denial Activities					
Develop, Monitor, and Brief Survivability Actions and Methods					
Perform Contracting Officer Representative (COR) Activities					
Mentor Host Nation Forces					
Perform Convoy Planning and Operations					

	Not Important	Somewhat Important	Important	Very Important	Extremely Important
Perform Military Administrative Actions (DECs, LOEs, Discipline, etc.)					
Prepare Performance Work Statements					
Collect and Apply Subject Matter Expert (SME) Inputs					
Order Construction Materials and Equipment					
Perform Base Hardening					
Perform Deconstruction Activities					
Perform Site Evaluations					
Develop Courses of Action for Engineering Problems					
Monitor the Air Force Civil Augmentation Program (AFCAP)					
Interact with Multi-National and Joint Forces					
Determine Project Personnel and Resource Requirements					
Plan and Establish Land Use					
Determine and Implement Environmental Protection Measures					
Execute Basic Combat Tasks					

Prev Next

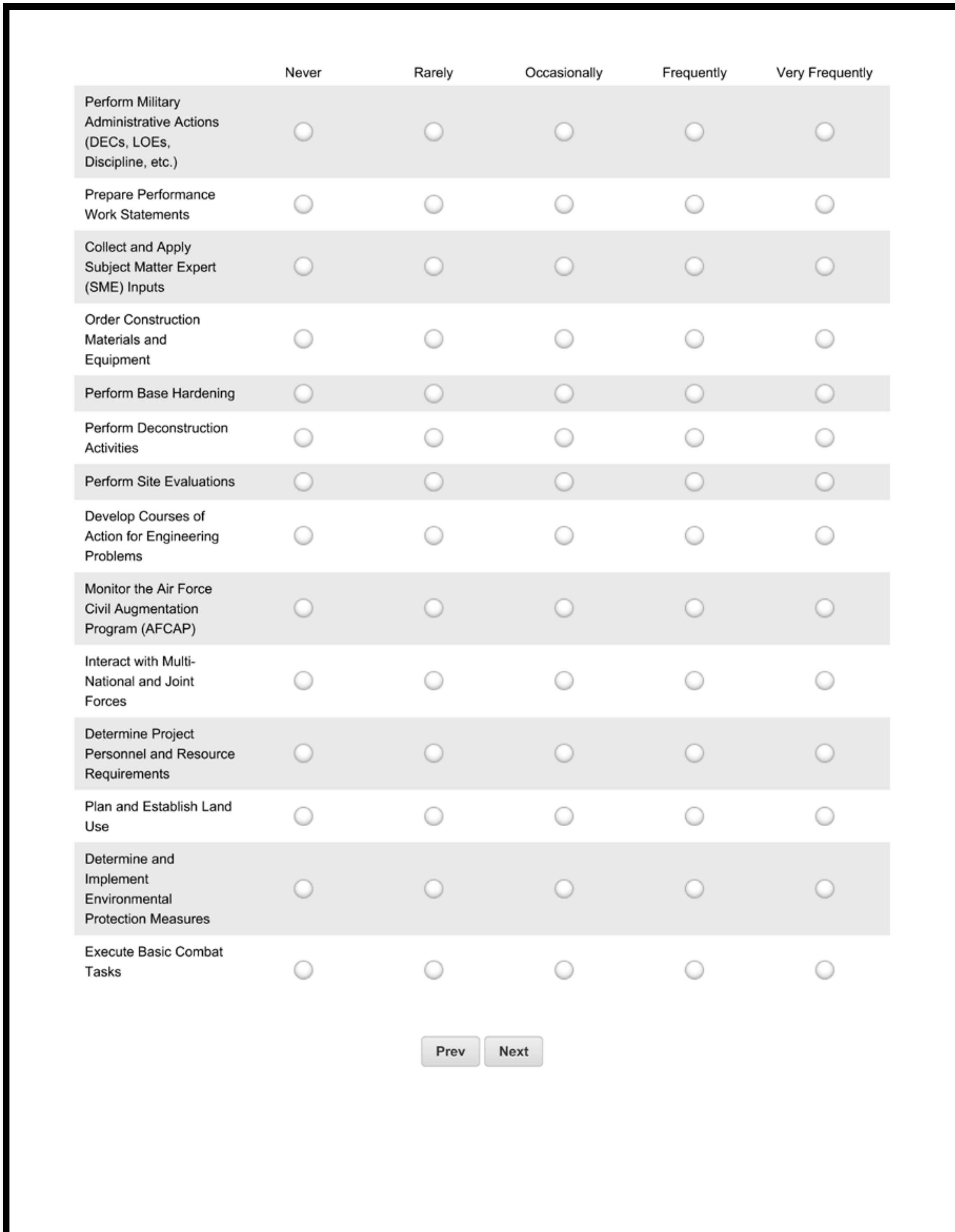
Civil Engineer Officer Contingency Tasks and Competencies

Task Frequency

How frequently do CGOs perform this task in the expeditionary environment?

	Never	Rarely	Occasionally	Frequently	Very Frequently
Prepare Cost Estimates, Budgets, and Work Timetables	○	○	○	○	○
Interpret and Explain Contracts to Others	○	○	○	○	○
Inspect Project Sites	○	○	○	○	○
Select, Schedule, and Coordinate Jobsite Activities	○	○	○	○	○
Respond to Work Delays, Emergencies, and Other Problems	○	○	○	○	○
Ensure Compliance with Requirements, Codes, and Regulations	○	○	○	○	○
Analyze Survey Reports, Maps, and Other Data to Plan Projects	○	○	○	○	○
Perform Project Risk Analysis	○	○	○	○	○
Determine Feasibility and Constructability of Projects	○	○	○	○	○
Use Design Software to Plan Projects	○	○	○	○	○
Present Information to Superiors through Formal and Informal Communications	○	○	○	○	○
Monitor Project Progress	○	○	○	○	○
Ensure Conformance to Project Design Specifications	○	○	○	○	○
Determine Project Design Specifications	○	○	○	○	○
Provide Technical Advice to Colleagues and Superiors	○	○	○	○	○

	Never	Rarely	Occasionally	Frequently	Very Frequently
Organize, Plan, and Prioritize Work					
Discuss and Resolve Construction Issues					
Study User Requirements and Determine Construction Methods					
Help Prepare Contracts and Negotiate Contractual Agreements					
Investigate Damage, Accidents, or Delays at Construction Sites					
Develop and Implement Quality Control Programs					
Establish, Operate, and Maintain Installations					
Force Beddown					
Bare Base Master Planning					
Installation/Base Master Planning					
Command and Control of Civil Engineer Forces					
Perform Emergency Repairs					
Perform Base Denial Activities					
Develop, Monitor, and Brief Survivability Actions and Methods					
Perform Contracting Officer Representative (COR) Activities					
Mentor Host Nation Forces					
Perform Convoy Planning and Operations					



	Never	Rarely	Occasionally	Frequently	Very Frequently
Perform Military Administrative Actions (DECs, LOEs, Discipline, etc.)					
Prepare Performance Work Statements					
Collect and Apply Subject Matter Expert (SME) Inputs					
Order Construction Materials and Equipment					
Perform Base Hardening					
Perform Deconstruction Activities					
Perform Site Evaluations					
Develop Courses of Action for Engineering Problems					
Monitor the Air Force Civil Augmentation Program (AFCAP)					
Interact with Multi-National and Joint Forces					
Determine Project Personnel and Resource Requirements					
Plan and Establish Land Use					
Determine and Implement Environmental Protection Measures					
Execute Basic Combat Tasks					

Prev Next

Civil Engineer Officer Contingency Tasks and Competencies

Competency Importance

How important is this competency for effective job performance by CGOs in the expeditionary environment?

	Not Important	Somewhat Important	Important	Very Important	Extremely Important
Ability to Asses Facility Damage					
Ability to do Design Reviews					
Ability to do Master/Community Planning					
Ability to do Simple Cost Estimation					
Ability to Negotiate					
Ability to Manage a Diverse Workforce					
Ability to Multitask					
Ability to Perform Customer Service					
Ability to Solve Complex Problems					
Ability to use AutoCAD/Develop Drawings					
Ability to use Computers					
Ability to use GIS systems for Planning Purposes and Decision Making					
Ability to use Standard Issued Weapons Proficiently					
Ability to use Radio Communications					
Ability to Work in Teams					
Ability to Write Effectively					
Accountability					

	Not Important	Somewhat Important	Important	Very Important	Extremely Important
Active Listening	◯	◯	◯	◯	◯
Attention to Detail	◯	◯	◯	◯	◯
Confidence	◯	◯	◯	◯	◯
Critical Thinking	◯	◯	◯	◯	◯
Deductive Reasoning	◯	◯	◯	◯	◯
Inductive Reasoning	◯	◯	◯	◯	◯
Interpersonal Skills	◯	◯	◯	◯	◯
Leadership	◯	◯	◯	◯	◯
Political Savvy	◯	◯	◯	◯	◯
Public Speaking	◯	◯	◯	◯	◯
Reading Comprehension	◯	◯	◯	◯	◯
Strategic Thinking	◯	◯	◯	◯	◯
Stress Tolerance	◯	◯	◯	◯	◯
Time Management	◯	◯	◯	◯	◯
Knowledge of Administration and Personnel Management	◯	◯	◯	◯	◯
Knowledge of Air Base Defense and Security Activities	◯	◯	◯	◯	◯
Knowledge of Air Force Facilities and Management	◯	◯	◯	◯	◯
Knowledge of Airfield Damage Repair	◯	◯	◯	◯	◯
Knowledge of Civil Engineer Enlisted AFSCs	◯	◯	◯	◯	◯
Knowledge of Bare Base Assets	◯	◯	◯	◯	◯
Knowledge of Building and Construction (temporary, semi-permanent, permanent, and host nation)	◯	◯	◯	◯	◯

	Not Important	Somewhat Important	Important	Very Important	Extremely Important
Knowledge of Contingency Construction Techniques					
Knowledge of Defensive Fighting Positions					
Knowledge of Engineering Technologies					
Knowledge of Field Sanitation Techniques					
Knowledge of Financial Management					
Knowledge of General Engineering					
Knowledge of Human Resource Management					
Knowledge of Job Site Safety					
Knowledge of Joint Force Structure, Organization, Mission, Capabilities, and Ranks					
Knowledge of Law and Government					
Knowledge of Expeditionary Shelters (AF, Joint Force, Multinational)					
Knowledge of Military Paperwork					
Knowledge of Military Resource Procurement					
Knowledge of Nighttime Operations					
Knowledge of Prime BEEF Structure					
Knowledge of Reach Back Support Resources (AFCEC)					
Knowledge of Simple Facility Design					

	Not Important	Somewhat Important	Important	Very Important	Extremely Important
Knowledge of Tactical Convoy Operations					
Knowledge of the Air Force Civil Augmentation Program (AFCAP)					
Knowledge of the Base Operation Support Integrator (BOS-I) and Senior Airfield Authority (SAA) system					
Knowledge of the CENTCOM Sandbook and other Theater Standards					
Knowledge of the Federal Acquisition Regulations (FAR)					
Knowledge of the Military Decision Making Process					
Knowledge of Theater Tactics, Techniques, and Procedures (TTPs)					
Knowledge of Vehicle and Equipment Operations					
Knowledge of Construction Management					
Knowledge of Project Management					
Knowledge of Bare Bases, Main Operating Bases, Joint Operating Bases, Forward Operating Bases, and Combat Outposts					

Prev Done

Appendix E: SME Survey – Open-ended Responses

Years of Service	Number of Deployments	Q - Please tell me any other thoughts you may have on Civil Engineer Officer (32EX) contingency training.
22	3	Civil Engineer Company Grade Officers need a thorough understanding of construction practices and project management. Our engineers must be fully qualified in engineering first, and then trained to operate in a joint contingency theater. If they cannot effectively and efficiently manage a construction project and lead a team of engineers, we should not place them in theater.
19	5	It may be worthwhile to incorporate portions of JEOC into our earlier training for CGOs like 101 and home based training. Engineers will likely be in joint environments for the foreseeable future, and getting an understanding as to where the AF and its engineers fit into the joint construct is crucial. We have been successful over the last 10 years or so due to our ability to deal with joint customers and to discern their requirements before providing them with solutions. As deployments draw down, we need to capture the lessons learned from the school of hard knocks and integrate them into our training.
19	6	The tasks officers will bump into the most while down range are: master planning (even at well-established bases), managing facility space and managing construction. Skills associated with these task should be emphasized. I also recommend emphasizing knowledge and skills associated with airfield pavement eval/repair...we end up focusing a lot on buildings and not on being competent at taking care of airfield pavements.
14	2	So my answers might be a little skewed since I was at AUAB. The survey doesn't distinguish between which skills are necessary at a FOB/bare base and which are necessary at something more enduring like Al Udeid, Al Dhafra, Ali Al Salem, etc. For instance, knowledge of convoy ops, Harvest assets, and bare base planning was completely irrelevant at Al Udeid, as was design knowledge since AFCAP provided design engineers. However, it was imperative that CGOs had the capability to understand typical main-base type issues, like project programming rules, master planning, land use, etc.
20	3	No Response
8	2	Knowledge of how Air Force money flows and the different "colors" of money are very key to a CGO's contingency training. OCO, O&M, NAF, and MILCON are different pots of money. Knowing the limits and funding sources from each pot are very important. Communication skills are huge... briefings, technical aspects, interpersonal, supervisory, peer-to-peer, and up and down the chain of command are a few communication skills necessary for every Civil Engineer.
19	3	No Response
26	8	My scoring sought to distinguish the required knowledge of CE CGOs from those in CONS. Likewise, I attempted to distinguish a level of CGO familiarization in contrast to the detailed knowledge of enlisted personnel in order to best focus CE CGO training and education. I trust we'll distinguish between the likelihood of a needed skill (ie ADR) from the consequence of failure and preserve fundamental wartime skills in our contingency training.
22	5	No Response
20	4	No Response
19	6	Home station training program does an abysmal job of preparing CGOs for potential deployment responsibilities. There is no common expectation for (or enforcement of) competencies – which means that a 32E CGO could be a smart design guy (electrical, civil, etc.), an experienced manager/leader (i.e. yrs as a CEX flight/cc) or a project programming SME. If we were pilots, we'd have people who could take off, land, or navigate the plane…but few that could do all three competently because we don't demand it. Not sure Silver Flag is much better as they use a lot of outdated equipment and TTPs; and their focus does not really correspond to the things that CGOs are currently deploying to accomplish. We have some truly great CGOs but we let them down by not establishing/enforcing clear standards to wear the CE badge.

Appendix F: IRB Exemption Approval Letter – SME Survey

11 May 2015

MEMORANDUM FOR MAJ GREGORY HAMMOND

FROM: Jeffrey A. Ogden, Ph.D.
AFIT IRB Research Reviewer
2950 Hobson Way
Wright-Patterson AFB, OH 45433-7765

SUBJECT: Approval for exemption request from human experimentation requirements (32 CFR 219, DoDD 3216.2 and AFI 40-402) for An Analysis of Civil Engineer Officer Contingency Training

1. Your request was based on the Code of Federal Regulations, title 32, part 219, section 101, paragraph (b) (2) Research activities that involve the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior unless: (i) Information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) Any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation.

2. Your study qualifies for this exemption because you are not collecting and reporting sensitive data, which could reasonably damage the subjects' financial standing, employability, or reputation. Further, you are not collecting and reporting any demographic data which could realistically be expected to map a given response to a specific subject.

3. This determination pertains only to the Federal, Department of Defense, and Air Force regulations that govern the use of human subjects in research. Further, if a subject's future response reasonably places them at risk of criminal or civil liability or is damaging to their financial standing, employability, or reputation, you are required to file an adverse event report with this office immediately.

5/11/2015

X Jeffrey A. Ogden

Jeffrey A. Ogden, Ph.D.
IRB Exempt Determination Official

Appendix G: Air Force Survey Control Number (SCN) Approval Letter

16 Jun 2015

MEMORANDUM FOR AFIT/EN
ATTENTION: MAJ GREGORY HAMMOND

FROM: AFPC/DSYS
550 C Street West, Suite STE 152
Randolph AFB TX 78150-4451

SUBJECT: Survey Approval – Air Force Civil Engineer Officer Contingency Tasks and Competencies Survey.

1. The survey is approved for use with the following population(s):

Population:	Number(s):
Air Force Officers	70
Air Force Active-Duty Enlisted	0
Air Force Civilians	0
Air Force Retirees and/or AF Family Members	0
Total Number to be Surveyed	70

The Survey Control Number **(SCN)** for this effort is **AF15-108AFIT**. This SCN is valid from **07/01/2015** through **12/31/2015**.

Please ensure compliance with the following guidance, as applicable, while administering your survey.

a. Invitations to participate in the survey must include:

(1) Survey title (as shown in the subject line of this memo).

(2) AF Survey Control Number (SCN).

(3) Statement that completion of the survey is voluntary.

(4) Link to the list of Air Force approved surveys: https://www.my.af.mil/gcss-af/USAF/ep/browse.do?programId=t2D8EB9D6297405FA012980243147010A&channelPageId=s5FDEA9F02134FFA70121351677C80048.

(5) Government contact name or office, with official contact information (e.g., e-mail address, telephone number, etc.), to provide a point of contact for questions about the survey.

(6) Identifying information of the survey's sponsor, to inform survey recipients under whose authority the survey is being conducted.

(7) All AF attitude and opinion surveys must include the following statement on the questionnaire: "We cannot provide confidentiality to a participant regarding comments

involving criminal activity/behavior, or statements that pose a threat to yourself or others. Do NOT discuss or comment on classified or operationally sensitive information."

b. This approval is exclusive to the Air Force community and does not constitute authority for administration to individuals from other federal agencies, sister services, etc. Surveys that include individuals from outside the Air Force community must be coordinated through the DOD/WHS/ESCD Information Management Division (commercial phone 703-696-5284).

c. The organization conducting this survey must contact the Civilian Personnel Office; Civilian Personnel Element, Manpower & Personnel Flight; for labor union notification prior to releasing this survey if any participants are civilian employees of a bargaining unit. If this survey involves bargaining unit civilians at more than one base, the organization conducting this survey must notify HQ AFPC/DPIECC, Air Force Program Management and Evaluation.

d. The organization conducting this survey must insure that if this survey requires any changes, request must be submitted to the Survey Office for review and approval prior to implementation in accordance with AFI 38-501.

e. If this survey requires an IRB, the PI must submit all proposed survey changes to the Survey and IRB Office for review and approval (minor changes do not require a change of SCN number) prior to implementation in accordance with AFI 38-501.

f. AFI 33-115, governs Web Management and Internet usage of websites hosted in the commercial environment (i.e., ".com", ".org", etc.). The organization conducting this survey is responsible for insuring compliance with web management and usage requirements. Questions should be directed to SAF/A6 (usaf.pentagon.saf-cio-a6.mbx.a3cs-a6cs-strategy-and-policy@mail.mil).

g. For information regarding digital certification of e-mails, refer to AFI 33-119, *Air Force Messaging*. The reference for PK enabling (PKE) information is https://afpki.lackland.af.mil/html/pkenabling.cfm. For information pertaining to ".mil" accounts, the reference is https://afpki.lackland.af.mil/html/help_desk.cfm. Information for systems that are not ".mil" can be found at http://iase.disa.mil/pki/eca/. For information on External Certificate Authority or to contact a representative, the reference is http://iase.disa.mil/pki/eca/contact_us.html.

h. The organization conducting this survey must ensure its Operations Security (OPSEC) manager reviews this survey prior to administration. References for the OPSEC Program include: DOD Directive 5205.02, *DOD Operations Security Program*; Joint Publication 3-13.3, *Operations Security*; AFPD 10-7, *Air Force Information Operations*; and AFI 10-701, *Operations Security (OPSEC)*.

i. The public may request survey results under provisions of the Freedom of Information Act (FOIA). Results released outside the Air Force require coordination with Air Force Public Affairs prior to dissemination.

j. Data collected under this survey may be subject to the Privacy Act of 1974. Please ensure compliance with this act as set forth in Title 5 United States Code (USC), Sec 552a; Title 10

USC, Sec 55 and 8013; Executive Order 9397; and Air Force Instruction 33-332, *Privacy Act Program*.

2. If you have any questions, please call the Air Force Survey Office at DSN 665-2776 or send an e-mail to afpc.dsys.af.surveyoffice@us.af.mil.

//Signed//
RENEE TEALER
Management Analyst
Air Force Survey Office

Appendix H: Contingency Job Knowledge Test Instrument

USAF CGO Civil Engineer Contingency Job Knowledge Test

This assessment is to be completed without any outside resources. Please answer all questions honestly according to your personal knowledge. Each question is followed by a scale item asking you to rate your level of confidence in the answer you provided. Please do not skip any questions. Thank you for your participation.

* Required

1. **Unique Identifier** *
   Please enter a unique identifier for your submission. This can be any combination of letters or numbers (e.g. the last four digits of your phone number). Do not use PII as your unique identifier.

   ____

2. **# of Years of Service** *

   ____

3. **# of Deployments** *

   ____

4. **How much time (in hours) do you spend on Home Station Training (HST) per month?** *
   Use your experience at your current assignment to answer this question.

   ____

5. **Please rate the quality of your Home Station Training (HST).** *
   Use your experience at your current assignment to answer this question.
   Mark only one oval.

	1	2	3	4	5	6	7	
Very Poor	⬭	⬭	⬭	⬭	⬭	⬭	⬭	Exceptional

6. **How many courses offered by the Civil Engineer School (in-residence and distance learning) have you completed?** *
   Do not include WMGT 101: Air Force Civil Engineer Basic Course.

   ____

7. **Please rate the quality of the training you have received from the Civil Engineer School.** *
Mark only one oval.

	1	2	3	4	5	6	7	
Very Poor	◯	◯	◯	◯	◯	◯	◯	Exceptional

8. **How many times have you attended Silver Flag?** *
Do not include Officer Field Education (OFE) at WMGT 101.

____

9. **Please rate the quality of the training you have received from Silver Flag.** *
Mark only one oval.

	1	2	3	4	5	6	7	
Very Poor	◯	◯	◯	◯	◯	◯	◯	Exceptional

10. **Please enter the current time.** *
This is your start time for the knowledge assessment portion of the test.

____
Example: 8:30 AM

11. **1) The best definition of a project is:**
Mark only one oval.

◯ A coordinated undertaking of inter-related activities directed toward a specific goal that has a finite period of performance.

◯ A large, complex undertaking with many objectives, multiple sources of funding and no discernible end point.

◯ An undertaking of inter-related activities directed toward a specific goal that can be accomplished in less than one year.

◯ A group of activities headed by a project manager who has cradle-to-grave life cycle responsibility for the end product.

12. **1) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

13. **2) Which of the following is NOT a project?**
Mark only one oval.

- Putting an award package together
- Building a bridge over a river
- Piloting an aircraft
- Writing a new AFI

14. **2) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	○	○	○	○	○	○	○	Very Confident

15. **3) Which of following is NOT one of the constraints of a project?**
Mark only one oval.

- Scope
- Resources
- Budget
- Accolades

16. **3) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	○	○	○	○	○	○	○	Very Confident

17. **4) During the construction phase of a project, as project manager you should focus on:**
Mark only one oval.

- Doing project work.
- Coordinating people and resources.
- Ensuring accountability for errors.
- Avoiding third-party influence.

18. **4) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	○	○	○	○	○	○	○	Very Confident

19. **5) Government cost estimates should be prepared as though the Government were a prudent and well-equipped contractor estimating the construction project.**
Mark only one oval.

- ◯ True
- ◯ False

20. **5) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

21. **6) At a basic level, construction cost estimates consist of all of the following EXCEPT:**
Mark only one oval.

- ◯ Descriptions of work elements to be accomplished (tasks)
- ◯ A quantity of work required for each task
- ◯ A level of difficulty for each task
- ◯ A cost for each task quantity

22. **6) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

23. **7) The main focus of life cycle costing is:**
Mark only one oval.

- ◯ To estimate installation costs.
- ◯ To estimate the cost of operations and maintenance.
- ◯ To consider installation costs when planning the project costs.
- ◯ To consider operations, maintenance and capital costs when planning the project.

24. **7) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

25. **8) The Work Breakdown Structure (WBS) is essential to the development of an accurate cost estimate.**
Mark only one oval.

- ◯ True
- ◯ False

26. **8) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

27. **9) Elements of a typical USAF construction project cost estimate include all of the following EXCEPT:**
Mark only one oval.

- ◯ Labor
- ◯ Materials
- ◯ Overhead and Profit
- ◯ Payback

28. **9) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

29. **10) Which method of cost estimating typically leads to the most accurate estimate?**
Mark only one oval.

- ◯ Cost by Order of Magnitude (Project Comparison)
- ◯ Cost by Unit Price (Quantity Takeoff)
- ◯ Cost by Assemblies (Parametric)
- ◯ Cost per Square Foot

30. **10) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

31. **11) You are responsible for creating a cost estimate for a new project. Your commander needs the cost estimate to move forward with advocating for funds in 2 days. The new project is nearly identical to a previously completed project but is smaller in overall size. Which method of cost estimating would be the best choice to use?**

Mark only one oval.

- ◯ Cost by Order of Magnitude (Project Comparison)
- ◯ Cost by Unite Price (Quantity Takeoff)
- ◯ Cost by Assemblies (Parametric)
- ◯ Cost by Square Foot

32. **11) How confident are you that your answer above is correct?**

Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

33. **12) You are responsible for creating a cost estimate for a new project. The project is unlike anything that has previously been constructed on base. Your commander wants to ensure an accurate estimate as any additional funding is very limited. Your commander has given you 45 days to get the estimate completed. Which method of cost estimating would be the best choice to use?**

Mark only one oval.

- ◯ Cost by Order of Magnitude (Project Comparison)
- ◯ Cost by Unite Price (Quantity Takeoff)
- ◯ Cost by Assemblies (Parametric)
- ◯ Cost by Square Foot

34. **12) How confident are you that your answer above is correct?**

Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

35. **13) Troop labor is an unfunded project cost.**

Mark only one oval.

- ◯ True
- ◯ False

36. **13) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

37. **14) During project planning, there is often a need to analyze several alternatives. Trade-offs are usually made among the following factors:**
Mark only one oval.

- ◯ Cost, Schedule, and Quality
- ◯ Risk and Reward
- ◯ Time and Money

38. **14) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

39. **15) Construction projects can have many sources of cost escalation and cost overrun including all of the following EXCEPT:**
Mark only one oval.

- ◯ Uncertainty and lack of accurate information
- ◯ Good Communication
- ◯ Economic and Social Factors
- ◯ Unforeseen Site Conditions

40. **15) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

41. **16) A stakeholder is someone who:**
Mark only one oval.

- ◯ Is involved in the project
- ◯ Is positively or negatively impacted by the project once it is complete
- ◯ Can influence the direction of the project
- ◯ Can impact or be impacted by all phases of the project

42. **16) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

43. **17) The ability of stakeholders to influence the project is typically highest during the ________ stage of a construction project.**
Mark only one oval.

- ◯ Initial
- ◯ Executing
- ◯ Closeout

44. **17) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

45. **18) An Economic Analysis (EA) is required for construction projects in the contingency environment exceeding $2,000,000.**
Mark only one oval.

- ◯ True
- ◯ False

46. **18) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

47. **19) Refer to Gantt chart #1 to answer this question. Which task(s) are behind schedule if the blue line represents the current date?**
Link to reference Gantt charts:
https://docs.google.com/presentation/d/1f74ETQrp90l3PsUH9AvOmASr9oUBsiiYaBcDbyKIbFo/pub?start=false&loop=false&delayms=60000
Mark only one oval.

- ◯ Task 1
- ◯ Task 2 and 3
- ◯ Task 1 and 4
- ◯ Task 4

48. **19) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

49. **20) Refer to Gantt chart #2 to answer this question. What task(s) is the predecessor task for Feature Planning?**
Link to reference Gantt charts:
https://docs.google.com/presentation/d/1f74ETQrp90l3PsUH9AvOmASr9oUBsiiYaBcDbyKlbFo/pub?start=false&loop=false&delayms=60000
Mark only one oval.

- ◯ Feature 1: Implementation, Feature 2: Implementation, and Feature 3: Implementation
- ◯ Market Analysis, Feature 1: Implementation, Feature 2: Implementation, and Feature 3: Implementation
- ◯ Market Analysis

50. **20) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

51. **21) "Float" in a project schedule is best defined as:**
Mark only one oval.

- ◯ A measurement of how much a task can move in the schedule without altering the project's completion date.
- ◯ The earliest a project can finish.
- ◯ The latest a project can finish.
- ◯ A measurement of how much task duration can be decreased in order to complete the project early.

52. **21) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

53. **22) The phases of a construction project can be intentionally overlapped in a practice called:**

Mark only one oval.

- ◯ PERT (Program Evaluation and Review Technique)
- ◯ Fast-Tracking
- ◯ Crashing

54. **22) How confident are you that your answer above is correct?**

Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

55. **23) Fast-Tracking a construction project has the potential for higher costs and schedule risk.**

Mark only one oval.

- ◯ True
- ◯ False

56. **23) How confident are you that your answer above is correct?**

Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

57. **24) Crashing describes a technique used to speed up a project by:**

Mark only one oval.

- ◯ Reallocating existing resources or assigning additional resources to the project.
- ◯ Overlapping activities which were originally planned to be done in sequence.
- ◯ Reducing the number of features of the product in order to reduce development work.
- ◯ Reducing the duration estimates for activities to increase the pressure applied to the staff.

58. **24) How confident are you that your answer above is correct?**

Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

59. **25) When should the project schedule be developed?**
Mark only one oval.

- ( ) As early into the project as possible. A committed schedule should be there before any initiating or planning processes are applied for the project.
- ( ) During initiating. The definite project schedule should be developed concurrently with the project contract.
- ( ) Scheduling should be avoided. Agile approaches with a backlog and a weekly to 4-weekly meeting cycle are sufficient for modern project management.
- ( ) When most planning processes from time, scope, and procurement management have been finished.

60. **25) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	( )	( )	( )	( )	( )	( )	( )	Very Confident

61. **26) A 2015 DoD IG report on military construction in the contingency environment identified reliance on contractors' technical expertise, lack of documentation, inadequate Government resources, and not holding contractors accountable for unsatisfactory performance as consistently present problems. All of these issues stem from a lack of ________.**
Mark only one oval.

- ( ) Quality Control
- ( ) Quality Assurance
- ( ) Contract Control
- ( ) Planning

62. **26) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	( )	( )	( )	( )	( )	( )	( )	Very Confident

63. **27) The OVERALL purpose of quality control and quality assurance is to:**
Mark only one oval.

- ( ) Assure that the completed project meets all quality requirement of the contract
- ( ) Ensure that construction is performed according to plans and specifications, on time, within budget, and without safety incident.
- ( ) Protect Government interests and assure that the end product complies with the quality established in project documents

64. **27) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	⬭	⬭	⬭	⬭	⬭	⬭	⬭	Very Confident

65. **28) Government QA personnel have the responsibility to do all of the following EXCEPT:**
Mark only one oval.

- ⬭ Examine quality control methods used by the contractor
- ⬭ Examine ongoing and completed work
- ⬭ Conduct construction inspection and surveillance
- ⬭ Authorize stop work orders

66. **28) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	⬭	⬭	⬭	⬭	⬭	⬭	⬭	Very Confident

67. **29) All of the following are primary indicators of the quality of a contractor's operation EXCEPT:**
Mark only one oval.

- ⬭ Workmanship and craftsmanship
- ⬭ Overall jobsite cleanliness and appearance
- ⬭ Number of personnel on the jobsite
- ⬭ Personal Protective Equipment (PPE) discipline

68. **29) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	⬭	⬭	⬭	⬭	⬭	⬭	⬭	Very Confident

69. **30) The preconstruction meeting is NOT the time to discuss potential change requests unless the changes have a direct impact on the mission.**
Mark only one oval.

- ⬭ True
- ⬭ False

70. **30) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

71. **31) A list of project defects and incomplete items that is generated at the pre-final inspection is called the:**
Mark only one oval.

- ◯ List of Corrections
- ◯ Punch-list
- ◯ Close-out List
- ◯ Deficiency report

72. **31) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

73. **32) Construction site safety is secondary to project completion in the contingency environment.**
Mark only one oval.

- ◯ True
- ◯ False

74. **32) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

75. **33) According to OSHA, what is the most frequently occurring type of construction injury?**
Mark only one oval.

- ◯ Fractures
- ◯ Dislocation
- ◯ Electrocution
- ◯ Over-exertion

76. **33) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

77. **34) According to OSHA, what is the most frequent cause of construction fatalities?**
Mark only one oval.

- ◯ Electrocution
- ◯ Struck by an Object
- ◯ Cave-ins or Crushes
- ◯ Falls from Elevations

78. **34) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

79. **35) The inclusion of safety features is most economical ________.**
Mark only one oval.

- ◯ During planning and design
- ◯ During construction
- ◯ After a safety incident

80. **35) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

81. **36) A SrA was told to check the condition of a manhole. The SrA comes out with eyes watering, coughing, and gasping for breath. What responsibility did the job site supervisor fail to perform that could have prevented the incident?**
Mark only one oval.

- ◯ Location of emergency equipment
- ◯ Hazard reporting
- ◯ PPE wear
- ◯ Location of safety literature

82. **36) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	⬭	⬭	⬭	⬭	⬭	⬭	⬭	Very Confident

83. **37) A building's function should strongly influence its design and construction.**
Mark only one oval.

- True
- False

84. **37) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	⬭	⬭	⬭	⬭	⬭	⬭	⬭	Very Confident

85. **38) The PRIMARY purpose of Ammunition and Explosive (AE) storage facilities are to:**
Mark only one oval.

- Resist the effects from an internal explosion
- Protect AE magazines and prevent propagation of an explosion
- Secure AE magazines from potential theft
- Provide a clearly marked facility for munitions

86. **38) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	⬭	⬭	⬭	⬭	⬭	⬭	⬭	Very Confident

87. **39) Armories are exempt from traditional life-safety and health concerns common to all buildings.**
Mark only one oval.

- True
- False

88. **39) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

89. **40) PRIMARY factors to consider when designing an aircraft maintenance hangar include all of the following EXCEPT:**
Mark only one oval.

- ◯ Type of aircraft that will populate the hangar
- ◯ Maintenance functions that will be performed in the facility
- ◯ Fire suppression and alarm system to be used
- ◯ Floor space required for office and administration areas

90. **40) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

91. **41) The use of ________ are encouraged in constructing non-permanent facilities in support of military operations.**
Mark only one oval.

- ◯ Unique Designs
- ◯ Complex Designs
- ◯ Local Designs
- ◯ Standard Designs

92. **41) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

93. **42) Common construction methods for non-permanent facilities in the contingency environment include all of the following EXCEPT:**

Mark only one oval.

- Wood Frame
- Relocatable
- Steel Frame
- Tension Fabric

94. **42) How confident are you that your answer above is correct?**

Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident								Very Confident

95. **43) You are the Contracting Officer's Representative (COR) for a project at a contingency base. The contractor is unable to perform on a consistent basis because of unusually large amounts of rainfall. This type of construction delay is:**

Mark only one oval.

- Excusable (time extension) and Compensable (more $ due)
- Excusable (time extension) and Non-Compensable (no $ due)
- Non-Excusable (no time extension) and Compensable (more $ due)
- Non-Excusable (no time extension) and Non-Compensable (no $ due)

96. **43) How confident are you that your answer above is correct?**

Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident								Very Confident

97. **44) You are the project manager for a project at a contingency base. The threat level at the base has increased. You are unable to answer Requests for Information (RFIs) according to the timeline in the contract because you are busy dealing with force projection issues. The project cannot move forward without resolution from the RFIs. This type of construction delay is:**

Mark only one oval.

- Excusable (time extension) and Compensable (more $ due)
- Excusable (time extension) and Non-Compensable (no $ due)
- Non-Excusable (no time extension) and Compensable (more $ due)
- Non-Excusable (no time extension) and Non-Compensable (no $ due)

98. **44) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	⬭	⬭	⬭	⬭	⬭	⬭	⬭	Very Confident

99. **45) A ________ ambiguity is obvious in the contract language and requires the owner to be informed of its presence.**
Mark only one oval.

- ⬭ Latent
- ⬭ Patent
- ⬭ Evident
- ⬭ Apparent

100. **45) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	⬭	⬭	⬭	⬭	⬭	⬭	⬭	Very Confident

101. **46) A ________ defect is one that is not obvious and can occur many days after construction is complete.**
Mark only one oval.

- ⬭ Latent
- ⬭ Patent
- ⬭ Evident
- ⬭ Apparent

102. **46) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	⬭	⬭	⬭	⬭	⬭	⬭	⬭	Very Confident

103. **47) Contract modifications should be considered for all of the following EXCEPT:**
Mark only one oval.

- ⬭ Differing/changed site conditions
- ⬭ Serious safety deficiencies
- ⬭ Major errors or omissions in design
- ⬭ Minor mission changes

104. **47) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

105. **48) The Federal Acquisition Regulation (FAR) is applicable in the contingency environment.**
Mark only one oval.

- ◯ True
- ◯ False

106. **48) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

107. **49) The ________ is what allows a Contracting Officer (CO) to obligate Government funds.**
Mark only one oval.

- ◯ Contracting License
- ◯ Financial Management Degree
- ◯ Warrant
- ◯ Grade/Rank

108. **49) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

109. **50) As a Civil Engineer Officer you may be appointed to be a Contracting Officer's Representative (COR). The duties of a COR include all of the following EXCEPT:**
Mark only one oval.

- ◯ Ensure the contractor and Government are meeting contract obligations
- ◯ Issue change orders for contract modifications
- ◯ Act as the Government's technical expert for a requirement
- ◯ Develop cost estimates and evaluate contractor claims

110. **50) How confident are you that your answer above is correct?**

Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

111. **51) A construction project contract that allows work to begin before the costs are fully determined best describes a:**

Mark only one oval.

- ◯ Fixed Price Contract
- ◯ Cost Reimbursement Contract
- ◯ Design-Bid-Build

112. **51) How confident are you that your answer above is correct?**

Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

113. **52) Match the construction type to the correct United States Code:**

Mark only one oval per row.

	Title 42	Title10	Title 22
US Military Construction	◯	◯	◯
Foreign Military Assistance	◯	◯	◯
Disaster Relief	◯	◯	◯

114. **52) How confident are you that your answer above is correct?**

Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

115. **53) Unspecified minor military construction (UMMC) projects are authorized by which United States Code?**

Mark only one oval.

- ◯ 42 U.S.C. § 1851
- ◯ 32 U.S.C. § 902
- ◯ 22 U.S.C. § 7501
- ◯ 10 U.S.C. § 2805

116. **53) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

117. **54) The Air Force wants to QUICKLY get a contract in place for the construction of a small addition to an existing facility. The best project delivery system for this situation would be:**
Mark only one oval.

- ◯ Partnering
- ◯ Design-Bid-Build
- ◯ Construction Management
- ◯ Design-Build

118. **54) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

119. **55) Which of the following contract formation principles are needed to form a valid contract?**
Mark only one oval.

- ◯ Offer, Acceptance, Meeting of the Minds and Mutual Consideration
- ◯ Performance, Technical Specifications, and Mutual Consideration
- ◯ General Conditions, Supplementary Conditions, and a Proposal
- ◯ Plans, Technical Specifications, General, and Supplementary Conditions

120. **55) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

121. **56) A contract that has low owner risk and high contractor risk best describes a ________ contract.**
Mark only one oval.

- ⬭ Cost Plus
- ⬭ Turn Key
- ⬭ Unit Price
- ⬭ Firm Fixed Price

122. **56) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	⬭	⬭	⬭	⬭	⬭	⬭	⬭	Very Confident

123. **57) A conflict arises between the documents provided below, which item will be given the highest priority?**
Mark only one oval.

- ⬭ Drawings (Contract Drawings)
- ⬭ Technical Specifications (Contract Specifications)

124. **57) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	⬭	⬭	⬭	⬭	⬭	⬭	⬭	Very Confident

125. **58) This document informs the contractor that the work on a project is being stopped:**
Mark only one oval.

- ⬭ Notice of Award
- ⬭ Stop Work Order
- ⬭ Stop Work Notice
- ⬭ Notice to Proceed

126. **58) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	⬭	⬭	⬭	⬭	⬭	⬭	⬭	Very Confident

127. **59) This document establishes the actual start date from which a contractor can begin work on a project:**
Mark only one oval.

- Notice of Award
- Notice to Proceed
- Contractor's Proposal
- Supplementary Conditions

128. **59) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident								Very Confident

129. **60) Requests for Information (RFIs) are a convenient and formal procedure to record, track, and monitor contractor questions concerning elements of the construction contract.**
Mark only one oval.

- True
- False

130. **60) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident								Very Confident

131. **61) A typical Performance Work Statement (PWS) has all of the following characteristics EXCEPT:**
Mark only one oval.

- The basic functions to be performed on a project
- The performance required on a project
- The exact methods of how to execute a project

132. **61) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident								Very Confident

133. **62) During project execution, a conflict arises in the team on both technical and interpersonal levels. An appropriate way of handing conflict is:**
Mark only one oval.

- ◯ Conflict should be handled in a meeting so that the entire team can participate in finding a solution.
- ◯ Conflicts should be addressed early and in private, using a direct, collaborative approach.
- ◯ You should use your coercive power to quickly resolve conflicts and then focus on goal achievement

134. **62) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

135. **63) A project manager can stay in touch with the work and the attitudes of project team members through:**
Mark only one oval.

- ◯ Observation and Communication
- ◯ Asking questions during team meetings
- ◯ Third-party assessments
- ◯ Relying on feedback from supervisors

136. **63) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

137. **64) At the beginning of project execution, you notice different opinions between team members relating to project work and deliverables and to the level of overall complexity. What should you do right now?**
Mark only one oval.

- ◯ Give your team members some time to develop a common understanding of the project scope and product scope. Upcoming interface problems may be resolved later.
- ◯ Use the risk management processes to identify and assess risks caused by misunderstandings and develop a plan with measures in order to respond to them.
- ◯ Organize meetings to identify and resolve misunderstandings between team members in order to avoid interface problems, disintegration and costly rework early in the project.
- ◯ Use interviews in private with each individual team member to inform them of your expectations and your requirements in an atmosphere of confidence.

138. **64) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	⬭	⬭	⬭	⬭	⬭	⬭	⬭	Very Confident

139. **65) You are managing an internationally dispersed project team. The members of your team have different cultural backgrounds and primary languages, but all are educated and able to communicate eloquently in English. You should nevertheless bear in mind that:**
Mark only one oval.

- ⬭ There are cultural differences. You should write one code of conduct for each nationality. You should then limit access to these codes.
- ⬭ You may have to accept that team members from one country may not be prepared to work with colleagues from certain other countries.
- ⬭ Spoken communications can cause misunderstandings you may not find in written communications. These may be hard to identify.

140. **65) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	⬭	⬭	⬭	⬭	⬭	⬭	⬭	Very Confident

141. **66) When deployed to an AOR, your responsibility to evaluate the performance of assigned personnel is waived.**
Mark only one oval.

- ⬭ True
- ⬭ False

142. **66) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	⬭	⬭	⬭	⬭	⬭	⬭	⬭	Very Confident

143. **67) You are deployed. A MSgt is under your command for 100 days. His or her performance should be informally documented using the:**
Mark only one oval.

- ◯ EPR
- ◯ LOE
- ◯ AFCM
- ◯ CRO

144. **67) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

145. **68) The letter of evaluation (LOE) is mandatory for non-commanders on deployments less than 180 days**
Mark only one oval.

- ◯ True
- ◯ False

146. **68) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

147. **69) You are on a 365 day deployment. Your performance at the end of your deployment should be documented using the:**
Mark only one oval.

- ◯ OPR
- ◯ LOE
- ◯ AFCM
- ◯ AFCAM

148. **69) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

149. **70) A number of air conditioning units servicing a small maintenance shelter are broken. Which airman under your command would you task with the repair?**

Mark only one oval.

- ◯ 3E2X1
- ◯ 3E1X1
- ◯ 3E7X1
- ◯ 3E6X1

150. **70) How confident are you that your answer above is correct?**

Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

151. **71) You have been tasked with preparing a set of drawings that shows the proposed layout of an Entry Control Point (ECP) renovation. Who should you seek assistance from?**

Mark only one oval.

- ◯ 3E1X1
- ◯ 3E3X1
- ◯ 3E5X1
- ◯ 3E6X1

152. **71) How confident are you that your answer above is correct?**

Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

153. **72) Several expeditionary shelters are having issues with electrical shortages. Who should you task with inspecting the problem?**

Mark only one oval.

- ◯ 3E0X1
- ◯ 3E0X2
- ◯ 3E3X1
- ◯ 3E4X1

154. **72) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	⬭	⬭	⬭	⬭	⬭	⬭	⬭	Very Confident

155. **73) As a leader, how should you deem ethical conduct?**
Mark only one oval.

- ⬭ You should ensure ethical conduct throughout the team by use of means including recognition and awards and in tight cooperation with the team members' line managers.
- ⬭ Ethical conduct is all right as long as it does not impact the achievement of objectives and does not damage the performing organization's immediate options for profits.
- ⬭ You are the role model for the team. Your personal integrity demonstrates the desired skills, behavior, and attitudes whose adoption may benefit team members.
- ⬭ There are often dilemma situations in business. Then you may have to suspend your integrity and do what is appropriate. There may be long term negative effects, but these are not your responsibility

156. **73) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	⬭	⬭	⬭	⬭	⬭	⬭	⬭	Very Confident

157. **74) The expeditionary Prime Base Engineer Emergency Force (PRIME BEEF) is best described as:**
Mark only one oval.

- ⬭ A USAF controlled unit that is focused on theater and regional priorities, with the flexibility to move among FOBs and across regions to satisfy the most pressing operational requirements of ground force commanders.
- ⬭ A USAF controlled unit that provides dedicated, flexible, airfield, and base heavy construction capability along with many other special capabilities in support of operation dictated missions.
- ⬭ A USAF controlled unit that provides the capability to minimize loss to lives, property, and the environment throughout all phases of military operations in the expeditionary environment.

158. **74) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	⬭	⬭	⬭	⬭	⬭	⬭	⬭	Very Confident

159. **75) An expeditionary PRIME BEEF squadron (EPBS) has the responsibility of conducting routine facility modification, maintenance, and operations at contingency bases.**

Mark only one oval.

- True
- False

160. **75) How confident are you that your answer above is correct?**

Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident								Very Confident

161. **76) The publication that provides guidance, responsibilities, and procedures for military contingency construction in the CENTCOM AOR is the:**

Mark only one oval.

- The "Red Book"
- The "Sand Book"
- The "Tiger Book"
- The "Blue Book"

162. **76) How confident are you that your answer above is correct?**

Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident								Very Confident

163. **77) The publication that provides guidance, responsibilities, and procedures for military contingency construction in the PACOM AOR is the:**

Mark only one oval.

- The "Red Book"
- The "Sand Book"
- The "Tiger Book"
- The "Blue Book"

164. **77) How confident are you that your answer above is correct?**

Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident								Very Confident

165. **78) The publication that provides guidance, responsibilities, and procedures for military contingency construction in the EUCOM AOR is the:**

Mark only one oval.

- The "Red Book"
- The "Sand Book"
- The "Tiger Book"
- The "Blue Book"

166. **78) How confident are you that your answer above is correct?**

Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

167. **79) Contingency construction, renovation, planning and design shall consider environmental, safety, and fire protection standards.**

Mark only one oval.

- True
- False

168. **79) How confident are you that your answer above is correct?**

Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

169. **80) The only United Facilities Criteria (UFC) requirements that apply to contingency construction for military operations are those found in UFC 1-201-01, Non-Permanent DoD Facilities in Support of Military Operations.**

Mark only one oval.

- True
- False

170. **80) How confident are you that your answer above is correct?**

Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

171. **81) The levels of construction for contingency military operations are primarily based on life expectancy of the facility.**
Mark only one oval.

- True
- False

172. **81) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident								Very Confident

173. **82) Match the facility type to the correct description:**
Mark only one oval per row.

	life expectancy of 2 to 10 years	life expectancy of up to 6 months	life expectancy of up to 24 months	life expectancy of more than 10 years
Initial				
Temporary				
Semi-Permanent				
Permanent				

174. **82) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident								Very Confident

175. **83) ________ construction standards are used for austere facilities requiring moderate engineer effort and offer an increased level of efficiency, safety, and durability.**
Mark only one oval.

- Initial
- Temporary
- Semi-Permanent
- Permanent

176. **83) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident								Very Confident

177. **84) ________ construction standards are used for facilities designed and constructed with finishes, materials, and systems selected for moderate energy efficiency, maintenance and life cycle cost.**

Mark only one oval.

- Initial
- Temporary
- Semi-Permanent
- Permanent

178. **84) How confident are you that your answer above is correct?**

Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident								Very Confident

179. **85) ________ construction standards are used for austere facilities requiring minimal engineer effort and are intended for immediate operation use by units upon arrival.**

Mark only one oval.

- Initial
- Temporary
- Semi-Permanent
- Permanent

180. **85) How confident are you that your answer above is correct?**

Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident								Very Confident

181. **86) A standard Barracks Hut (B-Hut) is best defined as:**

Mark only one oval.

- A large temporary facility used primarily for operations
- A small temporary facility used primarily to house personnel
- A medium semi-permanent facility used primarily for personnel support activities

182. **86) How confident are you that your answer above is correct?**

Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident								Very Confident

183. **87) An example of a suitable method for constructing a helipad to INITIAL standards would be:**

Mark only one oval.

- Hot Mix Asphalt
- Concrete
- AM-2 Matting
- Gravel

184. **87) How confident are you that your answer above is correct?**

Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident								Very Confident

185. **88) The quickest way to provide a facility to an organization in need is to:**

Mark only one oval.

- Erect a BEAR facility
- Share an existing facility
- Convert an existing facility
- Award a contract for new construction

186. **88) How confident are you that your answer above is correct?**

Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident								Very Confident

187. **89) All of the following are PRIMARY considerations when constructing facilities for host nation use EXCEPT:**

Mark only one oval.

- Cultural/Architectural Norms
- United Facilities Criteria (UFC) General Building Requirements
- Local Infrastructure Capacity/Capability
- Local Labor Maintenance Capacity/Capability

188. **89) How confident are you that your answer above is correct?**

Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident								Very Confident

189. **90) Joint Publication 3-34, Engineer Operations, categorizes engineer functions into three areas including all of the following EXCEPT:**
Mark only one oval.

- Combat Engineering
- General Engineering
- Construction Engineering
- Geospatial Engineering

190. **90) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

191. **91) General engineering is a PRIMARY engineering function that is performed by the:**
Mark only one oval.

- United States Coast Guard
- United States Air Force
- United States Marine Corps

192. **91) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

193. **92) Functions of general engineering include all of the following EXCEPT:**
Mark only one oval.

- Power Generation and Distribution
- Airfield Damage Repair
- Combat Road Maintenance
- Facility Construction

194. **92) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

195. **93) Combat engineering is a PRIMARY engineering function that is performed by the:**
Mark only one oval.

- United States Army
- United States Air Force
- United States Navy

196. **93) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

197. **94) Functions of combat engineering include all of the following EXCEPT:**
Mark only one oval.

- Route Clearance Patrols
- Gap Crossing using Military Bridges
- Construction of Defensive Fighting Positions
- Water Well Drilling

198. **94) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

199. **95) The command and control center for integrated defense (ID) operations during routine and emergency operations on a base is the:**
Mark only one oval.

- Base Defense Operations Center (BDOC)
- Security Forces Control Center (SFCC)
- Base Security Zone Control (BSZC)
- Defense Force Command Center (DFCC)

200. **95) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

201. **96) The preferred technique to reduce the effects of explosive attacks, particularly VBIEDs, is:**
Mark only one oval.

- Concrete Barriers
- Maximum Standoff Distance
- Soil-Filled Barriers (wire and fabric container)
- Entry Control Points (ECPs)

202. **96) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

203. **97) A structural analysis and materials evaluation is generally not needed before affixing force protection to a structure.**
Mark only one oval.

- True
- False

204. **97) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

205. **98) All of the following are PRIMARY considerations when selecting force protection and physical security measures EXCEPT:**
Mark only one oval.

- Threat Type
- Threat Severity
- Available Materials
- Desired Level of Protection

206. **98) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

207. **99) Deployed engineers should only seek reach-back support from their own service.**
Mark only one oval.

- ⬭ True
- ⬭ False

208. **99) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	⬭	⬭	⬭	⬭	⬭	⬭	⬭	Very Confident

209. **100) Reach-back resources available to Air Force engineers include all of the following EXCEPT:**
Mark only one oval.

- ⬭ USACE Reach-Back Operations Center (UROC)
- ⬭ AFCEC Reach-Back Center (RBC)
- ⬭ NAVFAC Engineer Reach-Back (ERB)
- ⬭ USMC Wing Support Center (MWSS)

210. **100) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	⬭	⬭	⬭	⬭	⬭	⬭	⬭	Very Confident

211. **101) A searchable online database of current and previously answered RFIs sent by deployed engineers is available through the:**
Mark only one oval.

- ⬭ USACE Reach-Back Operations Center (UROC)
- ⬭ AFCEC Reach-Back Center (RBC)
- ⬭ NAVFAC Engineer Reach-Back (ERB)
- ⬭ USMC Wing Support Center (MWSS)

212. **101) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	⬭	⬭	⬭	⬭	⬭	⬭	⬭	Very Confident

213. **102) An online library of standard designs for use in the contingency environment is available from:**

Mark only one oval.

- AFCEC
- USACE
- NAVFAC

214. **102) How confident are you that your answer above is correct?**

Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident								Very Confident

215. **103) A Forward Operating Base (FOB) or Forward Operating Site (FOS) is best defined as:**

Mark only one oval.

- An enduring location characterized by the presence of permanently assigned U.S. forces and robust infrastructure that typically includes command and control, highly-developed force protection measures, hardened facilities, and significant quality of life amenities.
- An enduring location characterized by the sustained presence of rotational U.S. forces, with infrastructure and QoL amenities consistent with that presence, capable of providing staging for operational missions and support to regional contingencies.
- An enduring location characterized by the periodic presence of rotational U.S. forces, with little or no permanent U.S. military presence or U.S. owned infrastructure, used for a range of missions and capable of supporting surge requirements for contingencies.

216. **103) How confident are you that your answer above is correct?**

Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident								Very Confident

217. **104) A Cooperative Security Location (CSL) is best defined as:**
Mark only one oval.

- ( ) An enduring location characterized by the presence of permanently assigned U.S. forces and robust infrastructure that typically includes command and control, highly-developed force protection measures, hardened facilities, and significant quality of life amenities.
- ( ) An enduring location characterized by the sustained presence of rotational U.S. forces, with infrastructure and QoL amenities consistent with that presence, capable of providing staging for operational missions and support to regional contingencies.
- ( ) An enduring location characterized by the periodic presence of rotational U.S. forces, with little or no permanent U.S. military presence or U.S. owned infrastructure, used for a range of missions and capable of supporting surge requirements for contingencies.

218. **104) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	( )	( )	( )	( )	( )	( )	( )	Very Confident

219. **105) A Main Operating Base (MOB) is best defined as:**
Mark only one oval.

- ( ) An enduring location characterized by the presence of permanently assigned U.S. forces and robust infrastructure that typically includes command and control, highly-developed force protection measures, hardened facilities, and significant quality of life amenities.
- ( ) An enduring location characterized by the sustained presence of rotational U.S. forces, with infrastructure and QoL amenities consistent with that presence, capable of providing staging for operational missions and support to regional contingencies.
- ( ) An enduring location characterized by the periodic presence of rotational U.S. forces, with little or no permanent U.S. military presence or U.S. owned infrastructure, used for a range of missions and capable of supporting surge requirements for contingencies.

220. **105) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	( )	( )	( )	( )	( )	( )	( )	Very Confident

221. **106) An Intermediate Staging Base (ISB) is best defined as:**
Mark only one oval.

- ( ) A temporary military encampment used to provide artillery fire support
- ( ) A temporary facility deployed to provide fuel and ammunition for aviation maneuver units
- ( ) A tailorable, temporary location used for staging forces, sustainment and extraction into or out of an operational area
- ( ) A location used to support tactical operations without establishing full support facilities

222. **106) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	( )	( )	( )	( )	( )	( )	( )	Very Confident

223. **107) A Contingency Basing Location supports immediate but temporary contingency operations.**
Mark only one oval.

- ( ) True
- ( ) False

224. **107) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	( )	( )	( )	( )	( )	( )	( )	Very Confident

225. **108) Match the contingency basing location type to the corresponding defining characteristics.**
Mark only one oval per row.

	Typically capable of providing local and regional operations, security, and/or humanitarian assistance relief with limited infrastructure and may be dependent on some contracted services.	Typically a C2 hub with advanced infrastructure for facilities and communications for the expected duration of the operation and may include a C-130 capable airfield.	Typically capable of quick response to operations, security, civic assistance, or humanitarian assistance relief with stark infrastructure and may be primarily dependent on contracted services or field facilities
Contingency Operation Base (COB)	⬭	⬭	⬭
Contingency Operation Site (COS)	⬭	⬭	⬭
Contingency Operation Location (COL)	⬭	⬭	⬭

226. **108) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	⬭	⬭	⬭	⬭	⬭	⬭	⬭	Very Confident

227. **109) The Base Operation Support Integrator (BOS-I) is responsible for:**
Mark only one oval.

- ⬭ Providing mission support to the JTF
- ⬭ Providing control, operation, and maintenance of the airfield
- ⬭ Providing engineer reconnaissance
- ⬭ Providing guidance for integrating operations and support functions

228. **109) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	⬭	⬭	⬭	⬭	⬭	⬭	⬭	Very Confident

229. **110) The Senior Airfield Authority (SAA) is responsible for:**
Mark only one oval.

- ◯ Providing mission support to the JTF
- ◯ Providing control, operation, and maintenance of the airfield
- ◯ Providing engineer reconnaissance
- ◯ Providing guidance for integrating operations and support functions

230. **110) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

231. **111) BOS-I and SAA responsibilities are generally designated to a service component based on the preponderance of force (number of personnel/equipment) and service capabilities at the operation location.**
Mark only one oval.

- ◯ True
- ◯ False

232. **111) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

233. **112) Additional maintenance ramps and facilities are required at a deployed location. The ramps and facilities are located adjacent to but within the airfield fence line. Who is responsible for the construction of the new ramps and facilities?**
Mark only one oval.

- ◯ BOS-I
- ◯ RED HORSE
- ◯ SAA
- ◯ LOGCAP

234. **112) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

235. **113) The engineering directorate in a joint contingency environment is typically organized under the:**

Mark only one oval.

- J-3
- J-4
- J-5
- J-1

236. **113) How confident are you that your answer above is correct?**

Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	⬭	⬭	⬭	⬭	⬭	⬭	⬭	Very Confident

237. **114) The Air Force organizational component Flight (e.g. engineering flight) is most closely the equivalent of the Army organizational component(s):**

Mark only one oval.

- Squad
- Battalion
- Brigade
- Platoon/Company

238. **114) How confident are you that your answer above is correct?**

Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	⬭	⬭	⬭	⬭	⬭	⬭	⬭	Very Confident

239. **115) The Air Force organizational component Squadron (e.g. Civil Engineer Squadron) is most closely the equivalent of the Army organizational component(s):**

Mark only one oval.

- Squad
- Battalion
- Brigade
- Platoon/Company

240. **115) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

241. **116) A Combined Joint Task Force (CJTF) is made up of:**
Mark only one oval.

- ◯ Multinational and Multiservice U.S. Forces
- ◯ Multiservice U.S. Forces
- ◯ Multiservice U.S. Forces and host nation forces

242. **116) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

243. **117) The main functions of the Personnel Support for Contingency Operations (PERSCO) team include all of the following EXCEPT:**
Mark only one oval.

- ◯ Coordinating and establishing in/out-processing procedures for all personnel at the deployed location
- ◯ Provide all of the necessary equipment to deployed forces
- ◯ Coordinate with deployed organizations to ensure inbound forces are provided all necessary briefings and documentation
- ◯ Personnel accountability and casualty reporting

244. **117) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

245. **118) When the mission of a UTC or individual member is complete, they should be returned home regardless of the tour length specified in the CED order.**
Mark only one oval.

- ◯ True
- ◯ False

246. **118) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

247. **119) Operational Control (OPCON) is best defined as:**
Mark only one oval.

◯ The authority limited to giving detailed direction and control of movements for maneuvers within the operational area necessary to accomplish assigned missions or tasks.

◯ The authority to organize and employ command, assign tasks, designate objectives and give authoritative direction necessary for mission accomplishment.

◯ The authority with respect to control of resources and equipment, personnel management, logistics, training, readiness, mobilization, and discipline.

248. **119) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

249. **120) Tactical Control (TACON) is best defined as:**
Mark only one oval.

◯ The authority limited to giving detailed direction and control of movements for maneuvers within the operational area necessary to accomplish assigned missions or tasks.

◯ The authority to employ command, assign tasks, designate objectives and give direction necessary for mission accomplishment.

◯ The authority with respect to control of resources and equipment, personnel management, logistics, training, readiness, mobilization, and discipline.

250. **120) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

251. **121) Administrative Control (ADCON) is best defined as:**

Mark only one oval.

- The authority limited to giving detailed direction and control of movements for maneuvers within the operational area necessary to accomplish assigned missions or tasks.
- The authority to employ command, assign tasks, designate objectives and give direction necessary for mission accomplishment.
- The authority with respect to control of resources and equipment, personnel management, logistics, training, readiness, mobilization, and discipline.

252. **121) How confident are you that your answer above is correct?**

Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	○	○	○	○	○	○	○	Very Confident

253. **122) The Air Force will maintain ________ over Air Force members assigned to a joint service mission unless assigned to special operations forces.**

Mark only one oval.

- ADCON
- OPCON
- TACON
- ADCON and OPCON
- OPCON and TACON

254. **122) How confident are you that your answer above is correct?**

Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	○	○	○	○	○	○	○	Very Confident

255. **123) You are a deployed 1st Lt that is assigned to an Army Brigade that has TACON over you. An Army Captain gives you a lawful order that you do not believe is best for mission accomplishment. You should:**

Mark only one oval.

- Not follow the order. An Army Captain cannot tell you what to do.
- Not follow the order. TACON does not allow the Army to give you orders.
- Follow the order and keep your thoughts to yourself.
- Follow the order and then seek guidance from your Air Force chain of command.

256. **123) How confident are you that your answer above is correct?**
Mark only one oval.

	1	2	3	4	5	6	7	
Not Confident	◯	◯	◯	◯	◯	◯	◯	Very Confident

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Appendix I: IRB Exemption Approval Letter – Test Instrument

8 Oct 2015

MEMORANDUM FOR Maj Gregory D. Hammond, Ph.D.

FROM: Brett J. Borghetti, Ph.D.
AFIT IRB Exempt Determination Official
2950 Hobson Way
Wright-Patterson AFB, OH 45433-7765

SUBJECT: Approval for exemption request from human experimentation requirements (32 CFR 219, DoDD 3216.2 and AFI 40-402) for "USAF Civil Engineer Contingency Job Knowledge Test", dated 24 Sep 2015

1. Your request was for exemption based on the Code of Federal Regulations, title 32, part 219, section 101, paragraph (b) (2) Research activities that involve the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior unless: (i) Information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) Any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation.

2. Your study **qualifies for this exemption** because you are using an anonymous educational test and are not collecting data which could place the subjects at risk of criminal or civil liability or could reasonably damage the subjects' financial standing, employability, or reputation.

3. This determination pertains only to the Federal, Department of Defense, and Air Force regulations that govern the use of human subjects in research. Further, if a subject's future response reasonably places them at risk of criminal or civil liability or is damaging to their financial standing, employability, or reputation, you are required to file an adverse event report with this office immediately.

10/8/2015

X

BRETT J. BORGHETTI, Ph.D.
AFIT Exempt Determination Official

Appendix J: Q-Sort Full Results

Item	Test Design	SME 1	SME 2	SME 3	SME 4	SME 5	SME 6
1	Project Management	Project Management	Project Management	General Engineering	Project Management	Project Management	Project Management
2	Project Management	General Engineering	Project Management	General Engineering	Project Management	Project Management	General Engineering
3	Project Management	Project Management	Project Management	Project Management	Project Management	Project Management	Project Management
4	Project Management	Construction Management	Project Management	Construction Management	Project Management	Project Management	Project Management
5	Project Management	Project Management	Project Management	Project Management	Project Management	Contract Management	Contract Management
6	Project Management	Project Management	Project Management	Project Management	Construction Management	Project Management	Project Management
7	Project Management	General Engineering	General Engineering	General Engineering	Project Management	Project Management	Project Management
8	Project Management	Project Management	Project Management	Project Management	Project Management	Project Management	Project Management
9	Project Management	Construction Management	Project Management	Project Management	Construction Management	Project Management	Project Management
10	Project Management	Project Management	Project Management	Project Management	Project Management	Project Management	Project Management
11	Project Management	Project Management	Project Management	Project Management	General Engineering	Project Management	Project Management
12	Project Management	Project Management	Project Management	General Engineering	Construction Management	Project Management	Project Management
13	Project Management	General Engineering	Construction Management	General Engineering	Construction Management	Project Management	Project Management
14	Project Management	Project Management	Project Management	Project Management	Project Management	Project Management	Project Management
15	Project Management	Construction Management	Project Management	Project Management	Project Management	Construction Management	Contract Management
16	Project Management	Project Management	Project Management	General Engineering	Project Management	Project Management	Project Management
17	Project Management	Construction Management	Project Management	Project Management	Project Management	Project Management	Project Management
18	Project Management	Contract Management	Construction Management	Project Management	Contingency Operations	Contingency Operations	Project Management
19	Project Management	Project Management	Project Management	Construction Management	Project Management	Project Management	Project Management
20	Project Management	Project Management	Project Management	Project Management	Project Management	Project Management	Project Management
21	Project Management	Project Management	Contract Management	Project Management	Project Management	Project Management	Project Management
22	Project Management	Construction Management	Project Management	Project Management	Project Management	Project Management	Project Management
23	Project Management	Project Management	Project Management	Project Management	Project Management	Project Management	Project Management
24	Project Management	Project Management	Project Management	Project Management	Project Management	Project Management	Project Management
25	Project Management	Project Management	Project Management	Project Management	Project Management	Project Management	Project Management
26	Construction Management	Construction Management	Contingency Operations	Contingency Operations	Project Management	Construction Management	Contract Management
27	Construction Management	Construction Management	Construction Management	Project Management	Project Management	Project Management	Contract Management
28	Construction Management	Personnel Management	Construction Management	Construction Management	Project Management	Construction Management	Contract Management
29	Construction Management	Project Management	Contract Management	Contract Management	Project Management	Project Management	Contract Management
30	Construction Management	Contract Management	Project Management	Project Management	Project Management	Construction Management	Project Management
31	Construction Management	Project Management	Project Management	Project Management	Construction Management	Construction Management	Construction Management

32	Construction Management	Construction Management	Construction Management	Project Management	Contingency Operations	Construction Management	Construction Management
33	Construction Management	Construction Management	Construction Management	General Engineering	Construction Management	Construction Management	Construction Management
34	Construction Management	Project Management	Construction Management	General Engineering	Personnel Management	Construction Management	Construction Management
35	Construction Management	General Engineering	Construction Management	General Engineering	Construction Management	Project Management	Construction Management
36	Construction Management	Construction Management	Personnel Management	General Engineering	Personnel Management	Construction Management	Personnel Management
37	General Engineering	General Engineering	General Engineering	General Engineering	Construction Management	General Engineering	General Engineering
38	General Engineering	Contingency Operations	General Engineering	General Engineering	General Engineering	General Engineering	General Engineering
39	General Engineering	General Engineering	General Engineering	General Engineering	General Engineering	General Engineering	General Engineering
40	General Engineering	General Engineering	General Engineering	General Engineering	General Engineering	General Engineering	Project Management
41	General Engineering	General Engineering	General Engineering	General Engineering	Construction Management	General Engineering	Contingency Operations
42	General Engineering	General Engineering	General Engineering	Contingency Operations	Construction Management	Contingency Operations	Project Management
43	Contract Management	Contract Management	Contract Management	Contract Management	Contract Management	Contract Management	Contract Management
44	Contract Management	Project Management	Contract Management	Contract Management	Contract Management	Contingency Operations	Contract Management
45	Contract Management	Contract Management	Contract Management	Contract Management	Contract Management	Contract Management	Contract Management
46	Contract Management	Contract Management	Contract Management	General Engineering	Contract Management	Contract Management	Contract Management
47	Contract Management	Contract Management	Contract Management	Project Management	Contract Management	Contract Management	Contract Management
48	Contract Management	Contract Management	Contract Management	Contingency Operations	Contract Management	Contingency Operations	Contract Management
49	Contract Management	Contract Management	Contract Management	General Engineering	Contract Management	Contract Management	Contract Management
50	Contract Management	Contract Management	Contract Management	Contract Management	Contract Management	Contract Management	Contract Management
51	Contract Management	Contract Management	Contract Management	Contract Management	Contract Management	Contract Management	Contract Management
52	Contract Management	General Engineering	General Engineering	General Engineering	General Engineering	General Engineering	General Engineering
53	Contract Management	General Engineering	General Engineering	General Engineering	General Engineering	Project Management	Contract Management
54	Contract Management	Contract Management	Contract Management	Project Management	Contract Management	Contract Management	Contract Management
55	Contract Management	Contract Management	Contract Management	Contract Management	Contract Management	Contract Management	Contract Management
56	Contract Management	Contract Management	Contract Management	Contract Management	Contract Management	Contract Management	Contract Management
57	Contract Management	Contract Management	Contract Management	Contract Management	Contract Management	Contract Management	General Engineering
58	Contract Management	Contract Management	Contract Management	Contract Management	Contract Management	Construction Management	Construction Management
59	Contract Management	Contract Management	Contract Management	Contract Management	Contract Management	Contract Management	Contract Management
60	Contract Management	Contract Management	General Engineering	Contract Management	Project Management	Construction Management	Contract Management
61	Contract Management	Construction Management	Contract Management	Contract Management	Project Management	Project Management	Contract Management
62	Personnel Management	Personnel Management	Contract Management	Personnel Management	Personnel Management	Personnel Management	Personnel Management
63	Personnel Management	Personnel Management	Project Management	Project Management	Project Management	Project Management	Project Management
64	Personnel Management	Construction Management	Project Management	Personnel Management	Personnel Management	Personnel Management	Construction Management
65	Personnel Management	Personnel Management	Personnel Management	General Engineering	Personnel Management	Personnel Management	Personnel Management

66	Personnel Management	Personnel Management	Contingency Operations	Contingency Operations	Personnel Management	Personnel Management	Personnel Management
67	Personnel Management	Personnel Management	Personnel Management	General Engineering	Personnel Management	Personnel Management	Personnel Management
68	Personnel Management	Personnel Management	Personnel Management	Personnel Management	Personnel Management	Personnel Management	Personnel Management
69	Personnel Management	Personnel Management	Personnel Management	Personnel Management	Personnel Management	Personnel Management	Personnel Management
70	Personnel Management	Personnel Management	General Engineering	General Engineering	Personnel Management	Personnel Management	Personnel Management
71	Personnel Management	Personnel Management	Personnel Management	General Engineering	Personnel Management	Personnel Management	Personnel Management
72	Personnel Management	Personnel Management	Personnel Management	General Engineering	Personnel Management	Personnel Management	Personnel Management
73	Personnel Management	Personnel Management	General Engineering	General Engineering	Personnel Management	Personnel Management	Personnel Management
74	Contingency Operations	Contingency Operations	General Engineering	General Engineering	Personnel Management	Contingency Operations	Contingency Operations
75	Contingency Operations	NR	Contingency Operations	Contingency Operations	General Engineering	Contingency Operations	Contingency Operations
76	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations
77	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations
78	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations
79	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations
80	Contingency Operations	General Engineering	General Engineering	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations
81	Contingency Operations	Construction Management	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations
82	Contingency Operations	General Engineering	Contingency Operations	Contingency Operations	General Engineering	General Engineering	General Engineering
83	Contingency Operations	Construction Management	Construction Management	Contingency Operations	General Engineering	General Engineering	General Engineering
84	Contingency Operations	Construction Management	Construction Management	General Engineering	Construction Management	General Engineering	Project Management
85	Contingency Operations	General Engineering	Construction Management	General Engineering	Construction Management	General Engineering	Contingency Operations
86	Contingency Operations	General Engineering	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations
87	Contingency Operations	General Engineering	General Engineering	Contingency Operations	General Engineering	General Engineering	Construction Management
88	Contingency Operations	General Engineering	Contingency Operations	General Engineering	General Engineering	General Engineering	Contingency Operations
89	Contingency Operations	General Engineering	General Engineering	Contingency Operations	Contingency Operations	General Engineering	Contingency Operations
90	Contingency Operations	General Engineering	Contingency Operations	Contingency Operations	General Engineering	General Engineering	Contingency Operations
91	Contingency Operations	General Engineering	General Engineering	General Engineering	Personnel Management	General Engineering	General Engineering
92	Contingency Operations	General Engineering	General Engineering	General Engineering	General Engineering	General Engineering	General Engineering
93	Contingency Operations	Contingency Operations	Contingency Operations	General Engineering	Contingency Operations	General Engineering	General Engineering
94	Contingency Operations	Contingency Operations	Contingency Operations	General Engineering	Contingency Operations	General Engineering	Contingency Operations
95	Contingency Operations	Contingency Operations	Contingency Operations	General Engineering	Contingency Operations	General Engineering	Contingency Operations
96	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations	General Engineering	Contingency Operations
97	Contingency Operations	General Engineering	General Engineering	Project Management	General Engineering	General Engineering	General Engineering
98	Contingency Operations	Contingency Operations	General Engineering	General Engineering	Construction Management	General Engineering	Contingency Operations
99	Contingency Operations	General Engineering	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations

100	Contingency Operations	General Engineering	Contingency Operations	Contingency Operations	Contingency Operations	General Engineering	Contingency Operations
101	Contingency Operations	General Engineering	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations	General Engineering
102	Contingency Operations	General Engineering	General Engineering	Contingency Operations	Contingency Operations	Contingency Operations	General Engineering
103	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations
104	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations
105	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations
106	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations
107	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations
108	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations
109	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations	Personnel Management	Contingency Operations	Contingency Operations
110	Contingency Operations	Personnel Management	Contingency Operations	Contingency Operations	Personnel Management	Contingency Operations	General Engineering
111	Contingency Operations	Personnel Management	Contingency Operations	Contingency Operations	Personnel Management	Contingency Operations	Contingency Operations
112	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations
113	Contingency Operations	General Engineering	Contingency Operations	Contingency Operations	Personnel Management	Contingency Operations	Contingency Operations
114	Contingency Operations	General Engineering	Contingency Operations	General Engineering	Personnel Management	Personnel Management	Contingency Operations
115	Contingency Operations	General Engineering	Contingency Operations	General Engineering	Personnel Management	Personnel Management	Contingency Operations
116	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations	Personnel Management	Contingency Operations
117	Contingency Operations	Contingency Operations	Personnel Management	Personnel Management	Contingency Operations	Personnel Management	Contingency Operations
118	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations	Contingency Operations	Personnel Management	Contingency Operations
119	Contingency Operations	Personnel Management	Contingency Operations	Personnel Management	Personnel Management	Personnel Management	Contingency Operations
120	Contingency Operations	Personnel Management	Personnel Management	Personnel Management	Personnel Management	Personnel Management	Contingency Operations
121	Contingency Operations	Personnel Management	Contingency Operations	Personnel Management	Personnel Management	Personnel Management	Contingency Operations
122	Contingency Operations	Personnel Management	Contingency Operations	General Engineering	Contingency Operations	Personnel Management	Personnel Management
123	Contingency Operations	Personnel Management	Contingency Operations	Personnel Management	Personnel Management	Personnel Management	Personnel Management

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Vita

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14. ABSTRACT The purpose of this research was to analyze the training needs of Civil Engineer (CE) Company Grade Officers (CGOs) in the contingency environment. This was done by first conducting a Job Analysis (JA). The JA resulted in a list of 36 critical tasks and 58 important Knowledge, Skills, and Abilities (KSAs). The tasks rated most critical were those associated with presenting information to superiors, project management, construction management, and operations and maintenance. The most important KSAs included the ability to work in teams, critical thinking, time and stress management, and leadership. These results were used to create a test instrument to assess contingency job knowledge in a sample of 64 CE CGOs. The lowest scoring areas of the test included Prime BEEF concepts, joint forces, enlisted CE AFSC knowledge, contingency construction standards, general construction activities, reach-back resources, deployed leadership, project scheduling, BOS-I and SAA, contingency base types, contract types, and construction inspection. The knowledge gaps represented the training needs for CE CGOs in the contingency environment. The career field should consider the findings of this research when making decisions regarding the content of future contingency training curriculums for CE CGOs.							
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