COMBAT ENGINEERS OF WORLD WAR II: LESSONS ON TRAINING AND MOBILIZATION

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by

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United States Army combat engineers were not properly trained to conduct their mission during World War II. Research of combat engineer training and operations during the interwar period and subsequently in the Pacific, North African, and European theaters revealed the extraordinary efforts required both to train new engineers and to develop selectees into capable combat engineer units. This research demonstrates that significant reductions to military personnel levels and readiness during the interwar period required a hasty fielding of forces in wartime that were not trained to previously established standards. Wartime engineer units consisted of soldiers who did not meet prerequisites for entry into the branch. These factors resulted in officers who were not prepared to lead combat engineer operations and soldiers who lacked basic engineering skills to efficiently conduct their missions. Shortfalls in selection and training often necessitated remedial training in the theaters of operation.

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ABSTRACT

COMBAT ENGINEERS IN WORLD WAR II: UNPREPARED FOR COMBAT, by MAJ Richard P. Koch, 107 pages.

United States Army combat engineers were not properly trained to conduct their mission during World War II. Research of combat engineer training and operations during the interwar period and subsequently in the Pacific, North African, and European theaters revealed the extraordinary efforts required both to train new engineers and to develop selectees into capable combat engineer units. This research demonstrates that significant reductions to military personnel levels and readiness during the interwar period required a hasty fielding of forces in wartime that were not trained to previously established standards. Wartime engineer units consisted of soldiers who did not meet prerequisites for entry into the branch. These factors resulted in officers who were not prepared to lead combat engineer operations and soldiers who lacked basic engineering skills to efficiently conduct their missions. Shortfalls in selection and training often necessitated remedial training in the theaters of operation.

ACKNOWLEDGMENTS

Words on this page cannot truly express the appreciation for those who supported me in my endeavor to complete this project. The opportunity to study the mobilization, training, and operations of combat engineers in World War II has been an enlightening and professionally rewarding experience.

William P. McNeill, my Great-Grandfather, your service as a combat engineer in World War II was the primary reason for the selection of this topic of study. You didn't share many stories, but this research has provided insight into the hardship you endured in service to our nation.

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Mrs. Venita Krueger of the Graduate Degree Program Office at Fort Leavenworth, your dedication to the students does not go unnoticed.

To my wife and children, your patience and understanding allowed me to complete my "paperwork," a rigorous study regimen and this life-long goal.

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ACRONYMS

ERTC	Engineer Replacement Training Centers
USAFFE	United States Army Forces in the Far East

ILLUSTRATIONS

CHAPTER 1

INTRODUCTION

Combat operations in Iraq have concluded and discussions of reducing or concluding operations in Afghanistan by the end of 2014 dominate the headlines. The future size of the nation’s military is being debated as a result of the end of combat operations and ongoing fiscal rebalancing. Concern amongst both military and civilian officials is present due to the impending drawdown. The strategic purpose of the future military force is undefined, resulting in the size of the force being dictated by budgetary constraints.[1] A similar atmosphere existed following World War I and resulted in a reduced military, constructed to serve as the foundation for future mobilization with uncertain strategic purpose.[2]

Reflecting on the current atmosphere of this country and the United States Army, I have conducted a study of the performance of combat engineers of World War II. My thesis intends to examine the trials and tribulations that may be faced by future generations of soldiers and leaders asked to serve as a base for rapid expansion of military forces to answer the nation’s calling. An analysis of combat engineers during the last full mobilization of the United States provides opportunities to assess both the technical aptitude and the ability of members of this branch to manage the stresses of combat with limited training. Depth is provided to this study through reflections on training and operations during the interwar period, the rapid expansion required by Hitler’s offensives in Europe and ultimately the attack at Pearl Harbor, and combat engineer operations in each major theater of war. The engineer training system of World War II was not able to prepare adequately the rapidly-formed combat engineer units for their primary role as specialized technicians and even less so for their secondary role as combat troops; a majority of this preparation was completed in-theater or under fire.

Structure

Chapter 1 defines the meaning of the two classifications of engineers during this time period, combat and service. It further describes how combat engineers were trained, equipped, and employed during this era. Additionally, chapter 1 will provide a literature review of the main sources utilized in this thesis.

Chapter 2 is the foundation for the study. It describes the United States Army Corps of Engineers during the interwar period. This chapter begins by providing the entry requirements for prospective engineers and then describes the advanced technical training received by both officers and enlisted soldiers during this period of relative peace. It then examines actions taken by the engineer branch as a result of the limited national emergency and further drastic measures to field an army in response to Pearl Harbor and the declaration of war.

Chapters 3 through 5 examine the training and operations of combat engineers in each major theater. This chronological approach of examination enables research of successive theaters of operation to investigate adaptations in training and leadership. Additional depth of analysis is conducted as a result of the diversity in terrain and opposition of each major theater. Chapter 3, Engineers in the Southwest Pacific, observes and critiques the preparation level of engineers at the very beginning of World War II, training leading up to the island hopping campaign, and preparation for the invasion of Japan. Chapter 4, The North African Theater, examines the planning and preparation by combat engineers for Operation Torch and subsequent operations in the desert environment concluding with operations in Tunisia. Chapter 5, Engineers in Europe, reflects on training and preparation in-theater prior to the invasion of Normandy and engineer operations during the drive for Germany. The conclusion is provided in chapter 6.

An Overview of Combat Engineers

According to the engineer manual of the period, engineers were separated into two classifications, combat units and service units.[3] The combat classification was reserved for those engineer formations "whose functions required close contact with the enemy."[4] These units classified as "combat units" included both general and special engineer units attached or assigned to divisions, corps, or armies.[5] Service engineer units conducted functions that were characterized more by service activities, rather than combat. General engineer and a majority of special engineer units attached to corps and higher headquarters fell into this category.[6] As a result they received less tactical training than combat units and were positioned in the zone of the interior or communication.[7]

Often the term "combat engineer" is utilized solely when referring to those members of the engineer combat battalions (Engineer Units, Combat, with Ground Forces) who were organic to the Infantry Division.[8] This is not incorrect, but negates the multitudes of other types of engineer units that would fall under the combat classification.[9] These included engineers within the various engineer aviation battalions (Engineer Units, Combat, with Army Air Forces).[10] The remainder of this thesis will focus upon the divisional engineers in the combat classification.

The primary purpose of combat engineers was to "increase the division's combat effectiveness by means of general engineer work."[11] General engineer work with ground forces included road and bridge work, river crossing support, removal or emplacement of mine fields and obstacles, preparation of defensive positions, and construction. These employment methods aided in attacks, rapid advance, withdrawal, and defense.[12] As part of Army Air Forces, combat engineers constructed and maintained airdromes, often in remote areas.[13] Engineers also supported the commander in reconnaissance roles by utilizing aerial photographs to identify enemy road blocks, stock piles, or best avenues of approach for operations.[14] Engineers were very resourceful, often infiltrating local libraries to obtain hydro-meteorological data, subsurface data for bridge foundations, road construction, or positioning of heavy equipment. In multiple cases, they were utilized to interrogate Prisoners of War, if the captured hinted at more than casual knowledge of engineering subjects.[15]

In addition to their technical training, combat engineers were also provided limited infantry training for security and survival when operating near the front. The fighting strength of an Engineer Battalion was slightly less than two infantry companies, less all heavy weapons.[16] When the tactical situation required and only in emergencies, engineers were committed as infantry. Engineers, as infantry, were most effective in the defense, their extensive training in mine warfare and demolitions could be capitalized upon in this mode of fighting. Regardless of their use and with limited training, they performed their infantry tasks creditably.[17] It is simple to comprehend that the employment as infantry of a specialist that required extensive training for their respective technical skill, is not a good utilization of this limited resource.

The engineer branch, prior to World War II, was composed of the top officers and soldiers available. The top graduates from West Point routinely chose to serve as engineers. In 1940, the Engineer Branch was given a quota of 40 officers.[18] This quota for engineers was filled by the 67th cadet on the order of merit list. In 1941, the quota of 50 officers was filled by the 69th cadet.[19] On the enlisted side, recruits sent to engineer units prior to and in the early days of World War II were selected based upon civilian credentials and were outstanding in their performance. Engineer recruits were required to have some of the highest aptitude scores of any of the operational specialties.[20]

In summary engineer training was reserved for the most able recruits and leaders. Combat engineers were expected to maintain the forward momentum of advancing units by conducting reconnaissance, clearing obstacles, and constructing bridges or airdromes. Their ability to provide a hasty defense, with obstacles and mines, during withdrawal made them an integral part of defensive combat. Additionally, the proximity of combat engineers to the front line required their employment as infantry when the situation dictated. The specialized capabilities of engineers and their ability to conduct many diverse mission sets made them an invaluable asset to commanders on the battlefield.

Literature Review

In order to provide an assessment of appropriate depth and context, analysis of combat engineers during the interwar period is conducted. To begin my research, I reviewed *The Technical Services, The Corps of Engineers: Troops and Equipment* (1958). This volume of the "green books" by Blanche D. Coll, Jean E. Keith, and Herbert H. Rosenthal provided an analysis of primary sources to build the foundation of understanding for this thesis. Files of unpublished manuscripts including A Survey of Source Materials for a History of the Schooling of Engineer Enlisted Specialists, Enlisted Men's School (1944) and A Survey of Source Materials for a History of the Engineer

Officer Candidate Course, Fort Belvoir, Virginia July 1941-June 1944 containing analysis of engineer training at The Engineer School and Engineer Replacement Training Centers (ERTC) can be found at the Combined Arms Research Library at Fort Leavenworth, Kansas. These files proved to be an invaluable resource when comparing information from the battlefield to the effects on training for engineers. Additionally, it appears that data from these files was restricted at the time of the writing of the green books, thus providing previously unavailable data and information for this writing.[21] Analysis in V. R. Cardozier's, *The Mobilization of the United States in World War II: How the Government, Military and Industry Prepared for War* (1995) provides perspective of the build-up and the challenges faced as a result of the minimal force and infrastructure available at the beginning of the war. An additional perspective was provided by Charles E. Kirkpatrick's, *An Unknown Future and Doubtful Present, Writing the Victory Plan of 1941* (1990). This work provided a detailed account of the true lack of preparedness of the United States military upon entering World War II. Christopher Gabel's *The U.S. Army GHQ Maneuvers of 1941* (1991) was used to assess the final training and preparation for combat in World War II. Field Manual 5-5, *Engineer Field Manual, Engineer Troops* (1943), provided insight into the organization of engineer units, training of engineers.

Chapter 3, Engineers in the Southwest Pacific, was anchored by the seven volumes encompassed in *Engineers of the Southwest Pacific*, *1941-1945* (1947-1950). Two were cited in this chapter volume two, *Organizations, Troops, and Training* and volume eight, *Critique.* Karl C. Dod's *Technical Services, the Corps of Engineers: War Against Japan* (1966) provided analysis of primary sources and. Major General Hugh

Casey's *Engineer Memoirs* (1993) provided his account of events in the Philippines and the Pacific Region.

Research for chapter 4, Engineers in North Africa, utilized the green books previously mentioned as initial references. Several primary sources were available in the Combined Arms Research Library including General Dwight D. Eisenhower's *Report on Operation Torch*. The *Lessons from Operation Torch* (1943) are scans of original documents and provided a compilation of lessons learned from the Task Force Commanders following the completion of Torch. Multiple observer reports from North Africa were also discovered in the digital library including Colonel John H. Carruth's observations for the period of 18 November 1942 through 14 February 1943 and Major Allerton Cushman's observations from 19 December 1942 through 1 March 1943. Several books and articles were also beneficial to this research, including Rick Atkinson's *An Army at Dawn* (2002) and David Rolf's *The Bloody Road to Tunis* (2001). Additionally, Dr. James W. Dunn's article in *Engineer Magazine*, "Engineers in North Africa" (1993), was informative.

While conducting research for Engineers in Europe, multiple sources provide primary accounts of training and operations. *Final Report of the Chief Engineer European Theater of Operations 1942-1945* (1949) is encompassed in two volumes and provides information on engineer operations in the European Theater from inception through V-E Day. *The Technical Services, The Corps of Engineers: The War Against Germany* (1985) provides a comprehensive account of engineer operations and training in the European Theater. *First Across the Rhine* (1989) describes the development and employment of the 291st Engineer Combat Battalion in Europe and provides a commander's perspective of engineer operations. Another valuable source was The Ninth United States Army's *Engineer Operations in the Rhine Crossing* (1945) which provides a detailed account of the planning and preparation followed by the execution of this historic crossing.

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[1]Representative Scott Rigell, "The Biggest Threat to the Pentagon's Budget is Entitlement Spending," *Defense One*, 5 March 2014, http://www.defenseone.com/ (accessed 5 March 2014).

[2]Charles E. Kirkpatrick, *An Unknown Future and a Doubtful Present: Writing the Victory Plan of 1941* (Washington, DC: Center for Military History, 1990), 44-49.

[3]Headquarters, Department of the Army, Field Manual (FM) 5-5, *Engineer Field Manual, Engineer Troops* (Washington, DC: Government Printing Office, 1943), 1.

[4]Headquarters, Department of the Army, FM 5-5, 1. Engineer Units, Combat, with Ground Forces include the armored engineer battalion, engineer motorized battalion, engineer mountain battalion, airborne engineer battalion, engineer light pontoon company, engineer heavy pontoon battalion, and engineer treadway bridge company. Engineer Units, Combat, with Army Air Forces include engineer aviation battalions, engineer aviation company, and airborne engineer aviation company.

[5]Headquarters, Department of the Army, FM 5-5, 1. Engineer service units with ground forces included the camouflage battalions, topographic battalions, and water supply battalions. Engineer service units with the air forces included the headquarters company and topographic companies.

[6]Headquarters, Department of the Army, FM 5-5, 1. Engineer units classified as service units.

[7]Headquarters, Department of the Army, FM 5-5, 1. In World War II, zones of operation were utilized to array forces. The Battle Zone was just that, the area where fighting took place. The next echelon to the rear was the Communications Zone, which is where administrative and support functions in theater took place. The furthest to the rear, the Zone of the Interior was outside of the theater of operations and mostly referred to the continental United States.

[8]Headquarters, Department of the Army, FM 5-5, 2.

[9]Ibid.

[10]Ibid., 4.

[11]The quoted statement was often mentioned when referring to the mission of combat battalions when assigned to various divisions from pages 48-89 in FM 5-5.

[12]A sampling of the different tasks completed by engineers observed when reviewing pages 48-89 in FM 5-5.

[13]Headquarters, Department of the Army, FM 5-5, 4.

[14]Ibid., 6.

[15]Ibid., 74.

[16]Ibid., 22.

[17]Major General C. R. Moore, *Final Report of the Chief Engineer European Theater of Operations 1942-1945*, 1949, World War II Operational Documents Collection, Combined Arms Research Library Digital Library, 142-143.

[18]Blanche D. Coll, Jean E. Keith, and Herbert H. Rosenthal, eds., *The United States Army in World War II, the Technical Services, the Corps of Engineers: Troops and Equipment* (Washington, DC: Office of the Chief of Military History, 1958), 3.

[19]Ibid.

[20]Ibid.

[21]As of 1 May 2014, these manuscripts were not catalogued. The plan is to scan and add them to the Combined Arms Research Library's digital collection. Mr. John Dubuisson was the archivist who located these manuscripts.

CHAPTER 2

THE CORPS OF ENGINEERS DURING THE INTERWAR PERIOD

To comprehend the true growth of the corps and challenges faced, one must first understand the origin of the problem. The negative popular reaction to World War I, antiwar sentiment, and the Great Depression led to a large decline in the United States military.[1] This decline was experienced in both size and expertise of the corps of engineers. The National Defense Act of 1920 authorized an Army of 280,000 men, but funding for the army during the interwar period only allowed for 125,000 enlisted personnel and 12,000 commissioned officers.[2] During this era, large militaries were seen as provocative, this drawdown was to contribute to an ideal of peace. In perspective, the Army was comparable in size to that of Portugal, Bulgaria, or the Netherlands.[3]

Relative to the size of the army, the Corps of Engineers was also small. In September 1939, the regular army had only 12 active engineer units. Eight were combat regiments on paper, but each regiment had as few as one company of soldiers. The other four engineer units were topographic battalions, whose primary duties were to create and update maps as needed.[4] In total, 786 officers and 5,790 enlisted engineers were available for service. A little more than a quarter of this total number was on duty in the field. A majority were assigned to the Office of the Corps of Engineers civil works districts and used to plan and design the major construction projects for the country such as dams, roads, bridges, and parks.[5]

These engineers were to serve as the foundation for units to form the initial protective force should the country be attacked. Experience and expertise maintained within this core would train the new recruits that would fill these skeleton units.[6] The Protective Mobilization Plan only anticipated defending the United States within the confines of the western hemisphere. It made no mention of growing beyond the aforementioned 280,000 man total force. The fact that the plan was defensive in nature, with limited projection, provides a basis for the small number of forces on hand.[7]

In the 1930s, assignment to the Corps of Engineers was reserved for the elite. Enlisted members were of the highest caliber, with reference to entry exams and demonstrated capabilities. The quotas for commissioning were filled by the top graduates from West Point and the Reserve Officer Training Corps of the nation's colleges. Appointments to the officer corps from civilian life were limited to only the top performers in the civilian sector. Few were selected for a direct commission into the engineer corps.[8] These appointments could be compared to the current direct commission of surgeons and highly trained medical professionals in today's army. The engineer corps of the army was the epitome of professionalism and technical skill. This level of aptitude and performance became the norm and was expected to continue.

After selection to the branch, as officer or enlisted, all engineers attended the Engineer School, at Fort Belvoir, Virginia. Its capacity allowed for about 40 officers and 55 enlisted students at any given time. The officers attended a nine month course and the enlisted personnel completed a four to eight month course, depending on specialty. The limited number of instructors and its supporting infrastructure prevented any large increase or surge in training.[9]

The Engineer School's curriculum was to provide a foundation for these future engineer professionals. The enlisted members were trained in a multitude of disciplines.

In the 1930s, as a result of the depression and reduced availability of employment, many enlisted members had formal education, but lacked experience in the field. The training received by these enlisted soldiers was further developed by the noncommissioned officers at their following assignment through hands on training, with experienced oversight.[10]

Following nine months at the engineer school, an officer's training was far from complete. The basic education of an engineer officer was not considered complete until he had two years with troops, a year of graduate work at a civilian engineering school, and two years on rivers and harbors duty. This resulted in close to six additional years of training following completion of an officer's Bachelor's degree. A large majority of the college degrees held by officers were also in an engineering discipline.[11] The time and dedication required to train personnel in this technical profession required that only those with an aptitude to conduct such work be entered into the program.

The perceived peaceful state of the world allowed for this dedication of time and limited military size. The corps of engineers concentrated on improving the nation's infrastructure, with little emphasis on actual fieldcraft. The training support required to maintain this small force of peacetime builders was sufficient and there was no perceived need to entertain thought of expansion.

The Limited National Emergency

In 1935 Adolf Hitler denounced the Treaty of Versailles and began to mobilize Germany. The United States still maintained an isolationist and non-intervention posture. Many felt that World War I was a European matter and that the United States should not get pulled into another of their affairs. Others in Washington were not so sure. Requests were made to begin growing the United States military in both size and capability. Multiple requests to increase funding for the military were rejected by Congress.[12]

On the morning of 1 September 1939, Hitler invaded Poland with 1.5 million troops. The total of the United States Army was a little more than 10 percent of this German force. The subsequent declarations of war by Britain and France resulted in the United States becoming more serious about its defensive posture.[13] The declaration of a limited national emergency one week later, by President Franklin D. Roosevelt alerted the country to the forthcoming danger and galvanized the nation into action to improve its military.[14]

The limited national emergency and additional offensive operations by Hitler resulted in a succession of congressional approvals and executive actions. On 16 May 1940, as a result of the fall of the Low Countries and France, Congress approved a one billion dollar request from President Roosevelt to build defense installations, purchase equipment, and increase the size of the Army to 255,000 personnel.[15] Sympathy grew for the war effort after the Battle of Britain. The Selective Service Act, requiring men 21 to 36 to register for the draft, was implemented in August 1940. The declaration of the limited national emergency and Selective Service Act began the United States' mobilization for the war. These two items were the catalyst to the rapid increase that would take place within the corps of engineers.[16]

The Development of the Engineer Replacement Training Centers

In 1940, the corps of engineers lacked housing, facilities, equipment, and instructors to support an increase of training. Land still had to be purchased or leased.

Once obtained, sites had to be developed. In the absence of these training centers, hastily classified and untrained “fillers” were sent directly to newly activated engineer units which were being increased to approximate war strength.[17] These fillers were civilians who simply reported for duty with the expectation that the unit of reception would provide all required training. The preferred soldier had prior engineer experience and simply had to be taught military drill and customs. This was usually not the case, resulting in leadership and training challenges for already strained organizations.[18]

Facilities required for training engineers were similar to those given to infantry, but also needed accommodations to allow for demolitions and explosive training. The optimal site would have varying terrain of rolling hills and mountains. Numerous road types would allow for demonstrations on road construction. In order to provide training for obstacles and lumbering, all sizes of standing timber would be required. The availability of streams and gullies of varying widths would allow for bridging and water purification training.[19] In 1940, the Engineer Corps began the construction of two training sites known as Engineer Replacement Training Centers (ERTC), located at Ft. Belvoir, Virginia and Fort Leonard Wood, Missouri. These sites would not be ready for training until spring of 1941.[20]

In order to accommodate the increased requirement for training at the ERTCs, additional instructors were needed. In July 1940, the Engineer School abandoned the nine month officer’s course and shortened the enlisted soldier’s course length. The curriculum for the next year and a half was dedicated to training instructors. Reserve and National Guard soldiers, who had some prior engineer training and civilian experience, received a four to five week refresher course. Officer candidates, few of whom had any engineering experience or schooling, completed a 12 week instructor's course. Following completion of these courses, a majority of the graduates were shipped to one of the ERTCs. This resulted in a large majority of instructors who had never been with soldiers in the field or served as engineers in the military.[21]

Engineers in Training: March 1941 to 7 December 1941

In March 1941, following the increased effort to train instructors, the Engineer School curriculum was again adjusted. During this period, officers and enlisted personnel were developed to supplement the rapidly expanding force. In six weeks, officers were given the high points of the nine month course received in peace time. Their instruction emphasized the theory and practice of military engineering and the instructional methods used in the Army. These officers were then either sent to newly formed units or to the ERTCs to serve as instructors. The new curriculum for enlisted soldiers resulted in graduation after only three months. The graduate of 1941 mastered only one skill, whereas the graduate of 1939 had mastered multiple skills including surveying, drafting, water purification, and mechanical equipment. The reduction in subjects covered and enlarged facilities at the Engineer School resulted in an increase of output from 87 officers and 66 enlisted men, in fiscal year 1940 to 1,528 officers and 260 enlisted men, in 1941.[22]

In the spring of 1941, the ERTCs opened to give basic military and engineer technical training to new recruits. Upon opening, the army now had two entities to train engineers: the ERTCs and the Engineer School. These centers and the Army were terribly unprepared to receive the increased amount of trainees. Only 25 of the first 308 officers trained at the ERTC at Fort Belvoir had all articles of clothing and equipment upon arrival.[23] Weapons were not available for training. The M1 Garand was unavailable at the training centers until December 1942 and the older Springfield was not available in large enough quantities to allow each soldier to have his own weapon. Carbines were first made available in August 1942, four were provided to each of the ERTCs to be used for demonstration purposes only. Many draftees in 1940 and 1941 used wooden rifles, due to the lack of actual weapons. In addition to a lack of weapons, there was a lack of ranges. Fort Leonard Wood had only one small 300 yard firing point and Fort Belvoir had only one suitable range that was 88 yards in length. The standard for qualification in rifle marksmanship for each class was 80 percent qualified. The ERTCs failed to approach this set standard for several months after opening, due to the lack of weapons and ranges.[24]

The dilemmas of a shortened timeline, limited facilities, and supplies were further aggravated by the quality of the recruits available for training. A survey of the source materials of the enlisted school at Fort Belvoir in 1941 stated, “That bricks cannot be made without straw is axiomatic. Neither can skilled specialists be made from material substandard mentally.” This was identified as the greatest problem faced by the corps of engineers. One engineer commander at the school complained that of the 500 recruits assigned to his regiment, 61 percent were class IV and V. Thirty-one percent of them were Class V, the lowest in aptitude and desirability for selection into the service. It was further noted that none of these trainees had any engineer experience or skill, not even “cookery.” This commander provided night classes to teach recruits to read and write.[25] This was a far contrast from the level of trainee provided prior to mobilization.

Available expertise within the officer candidate pool was also limited. The personnel available for selection did not have engineering degrees or prior military training. A majority did not have college degrees of any sort. The level of recruits was a concern to the Chief of the Corps of Engineers. He reported to the Army G-1, that only six percent of enrollees were engineering college graduates, which was resulting in low graduation rates and would have lasting effects on the capabilities of the engineering corps.[26]

To support the increased demand, the quota for engineer officer candidates was set at 230 men per officer course. This number could have been higher but was limited by the infrastructure to support a larger class.[27] As classes continued to grow, to meet increased quotas, any previous complaint of substandard recruits was nullified. There simply weren't enough able bodied men to even fill the required slots. Brigadier General Ulysses S. Grant III, commander of the ERTC at Fort Leonard Wood stated, "This action (of reduced standards to fill quotas) will result in numerous individuals with no prior engineering experience and with only high school education, being sent to the Officer Candidate School . . . a large number of candidates from the replacement center will fail to measure up to officer standards prescribed by the Ft. Belvoir School."[28] The chart below was constructed in 1944 to illustrate the level of education held by students in classes five through fifty-eight. Prior to the rapid mobilization for World War II, all prospective officers held engineering degrees.

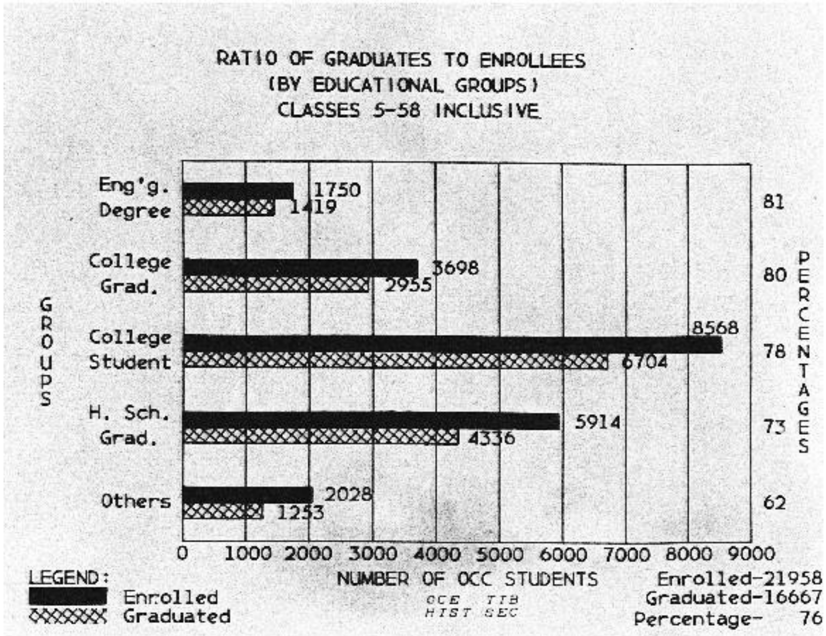

Figure 1. Ratio of Graduates to Enrollees, Classes 5 through 58

Source: George H. McCune and Outten J. Clinard, Historical Section, Technical Information Branch, Office of the Chief of Engineers, A Survey of Source Materials for a History of the Engineer Officer Candidate Course, July 1941-June 1944, The Engineer School, Fort Belvoir, VA, Unpublished Manuscript, Combined Arms Research Library, 38.

The lack of facilities, equipment, and reduced training standards continued to compound upon the level of training of future engineers. An evaluation of training received at the ERTCs from their opening in March through 7 December 1941 identified that the trainees were well equipped mentally and physically, but their training was lacking for multiple reasons. There was no provision for instructor guidance programs, inadequate provisions for constructing training aids, failure of higher echelons to provide suitable texts to enable the inexperienced instructors to present the subject matter effectively, and ultimately insufficient time for training at the ERTC. There were slight adjustments to the curriculum, but otherwise minimal changes in training or curriculum until Pearl Harbor.[29]

Unit Training and the General Headquarters Maneuvers of 1941

Upon arrival to their newly assigned units, graduates from the ERTCs and fillers conducted mandated training designed for general engineers, in accordance with MTP 5-1. This training was 13 weeks in length and included a two week basic period, followed by seven weeks to allow for emphasis on technical skills, and finally three weeks to learn to function as a team. After this 13 week period engineer units were expected to conduct training with other arms and services, including infantry, artillery, and direct support units. This phase included participation in the maneuvers and was scheduled to last an additional seven to eight months.[30]

The General Headquarters Maneuvers of 1941 in Louisiana and the Carolinas enabled formations as large as divisions to maneuver and practice field craft.[31] The maneuvers were effective in allowing engineers to demonstrate support to larger formations, under controlled conditions. The fact that the maneuvers were conducted within the confines of the civilian population prevented the actual destruction of bridges and utilization of explosives to practice breaching and demolitions.[32] There were, however, many opportunities for engineers to construct pontoon bridges to support movement of forces.[33] Pontoon bridges were the limit of construction for mobility purposes as travel was generally conducted along improved corridors to limit “rutted yards” and other damage to civilian property.[34] The practice of counter-mobility, by emplacing explosives and destroying bridges to prevent opposition maneuver was simulated.[35]

Aside from developing general concepts of support, the engineers also demonstrated the effectiveness of the steel plank, known as the "Marston mat" while building a 3,000 foot runway in 11 days near Marston, North Carolina. This rapid construction of runways would be utilized in every theater of the war.[36]

In total, the Army allowed for about a year to train a raw recruit from induction until training was considered complete at the unit level.[37] One week after General Lesley J. McNair, then Chief of Staff of General Headquarters and later Commanding General of Army Ground Forces, delivered the final critique of the Carolina maneuvers, the attacks at Pearl Harbor occurred. Future opportunities for refinement of techniques and procedures on such a large scale would take place against a more determined opponent on the battlefields of World War II.[38]

Pearl Harbor and the Declaration of War

Immediately following the attack at Pearl Harbor, a series of drastic increases were directed by the War Department to the Chief, Corps of Engineers. On 15 January 1942, based on a G-1 study, the engineer corps was informed that it "should plan to increase the capacity of the Officer Candidate Course to ten times its present size (230 officers)" in order to provide officers required for all units, overhead, attrition, and a pool of 2,100 engineer officers. The next day, the Army G-3 reported to the corps of engineers that a "new troop basis had been examined and directed the Office, Chief of Engineers to plan for an increase of the program to a capacity of 3,680 officers."[39]

To compensate for the increased volume and provide more rapid fielding of troops, time allocated for training of new engineer soldiers was shortened. The Army G-3 directed a cut of training from twelve to eight weeks while "eliminating as few subjects as possible." Subjects were maintained, but hands on training and the depth of instruction was reduced. After only two months, the ERTCs were directed to return to the 12 week program. This restored time for training in demolitions, bridging, road construction, and obstacles. The rapid movement of troops overseas made it clear that this training would be the only training received prior to arrival in-theater. A majority of these soldiers were being sent directly to line units to fill combat casualties.[40]

Conclusion

The engineering branch requires precision in construction and the aptitude to calculate the requirements of large building projects. Combat engineers were expected to execute these duties under fire. Prior to the limited national emergency declared by the President, the engineer corps was filled by enlisted members with only the highest aptitudes and officers who received at least six years of training in addition to their higher degrees in engineering. The requirement to hastily fill units resulted in fillers arriving to units with no prior military or engineering experience. Instructors were ordered from the schools to lead these newly formed units. These instructors were replaced with those who had no previous field or engineering experience following their shortened instruction. The inability to fill training quotas with able bodied men resulted in personnel with less than a high school degree reporting for officer training. In 1941, as a result of the draft, the enlisted strength of the engineer corps grew to 69,079.[41] These men were being groomed to lead this country's engineers into the next world war.

[1]V. R. Cardozier, *The Mobilization of the United States in World War II: How the Government, Military and Industry Prepared for War* (Jefferson, NC: McFarland and Company, 1995), 73.

[2]Ibid.

[3]Ibid., 5.

[4]Coll, Keith, and Rosenthal, 11.

[5]Ibid., 109.

[6]Ibid., 12.

[7]Kirkpatrick, 48.

[8]Coll, Keith, and Rosenthal, 3.

[9]Ibid., 111.

[10]Ibid., 110.

[11]Ibid., 109.

[12]Cardozier, 11.

[13]Ibid., 73.

[14]Ibid., 11.

[15]Ibid., 73.

[16]Ibid., 11.

[17]Leonard L. Lerwill, ed., CMH PUB 104-9, *The Personnel Replacement System in the United States Army* (Washington, DC: Center of Military History, 1954), 248.

[18]Coll, Keith, and Rosenthal, 125.

[19]Headquarters, Department of the Army, FM 5-5, 40.

[20]Coll, Keith, and Rosenthal, 125.

[21]Ibid., 124.

[22]Ibid.

[23]George H. McCune and Outten J. Clinard, Historical Section of the Technical Information Branch, Office of the Chief of Engineers, A Survey of Source Materials for a History of the Engineer Officer Candidate Course, The Engineer School, Fort Belvoir, VA, July 1941-June 1944, Unpublished Manuscript, 1944, Combined Arms Research Library, 6.

[24]Coll, Keith, and Rosenthal, 170-171.

[25]Outten J. Clinard, Historical Section of the Technical Information Branch, Office of the Chief of Engineers, A Survey of Source Materials for a History of the Schooling of Engineer Enlisted Specialists, Enlisted Men's School, The Engineer School, Fort Belvoir, VA, Unpublished Manuscript, 1945, Combined Arms Research Library, 72.

[26]McCune and Clinard, A Survey of Source Materials for a History of the Engineer Officer Candidate Course, 42-43, "cookery" was stated as an engineer task. In context of this source, perhaps the most basic skill expected of prospective engineers.

[27]Ibid., 7-8.

[28]Ibid., 45.

[29]Historical Section, of the Technical Information Branch, Office of the Chief of Engineers, The Training of Replacements, Fillers, and Cadres by the Corps of Engineers, 6 March 1941-30 June 1944, The Engineer School, Fort Belvoir, VA, Unpublished Manuscript, 1945, Combined Arms Research Library, 45.

[30]Coll, Keith, and Rosenthal, 125.

[31]Christopher R. Gabel, CMH Pub 70-41-1, *The U.S. Army GHQ Maneuvers of 1941* (Washington, DC: Center of Military History, 1991), 338.

[32]Ibid., 337.

[33]Ibid., 69, 71, 158.

[34]Ibid., 337.

[35]Ibid., 100.

[36]Ibid., 182.

[37]Historical Section, of the Technical Information Branch, Office of the Chief of Engineers, The Training of Replacements, Fillers, and Cadres by the Corps of Engineers, 45.

[38]Gabel, 182.

[39]McCune and Clinard, 7-10.

[40]Coll, Keith, and Rosenthal, 162-166.

[41]Ibid., 116.

CHAPTER 3

ENGINEERS IN THE SOUTHWEST PACIFIC

In December 1941, the United States was reflecting on the assessment of forces after the completion of the GHQ Maneuvers in Louisiana.[1] Military leadership was debating the effective size of the United States Army with regards to the Protective Mobilization Plan.[2] The Pacific Theater, including what would eventually be designated the Southwest Pacific Area, was also in a state of mobilization. Study of this theater offers an opportunity to analyze the proficiency of combat engineer operations and training immediately following the attacks on Pearl Harbor. An assessment of the status of combat engineers at the beginning of the war, prior to full mobilization of the United States military, during operations in the Philippines is invaluable to this thesis. The subsequent regrouping in Australia and island hopping towards Japan provides both a unique opportunity to assess combat engineer training and operations in a tropical environment.

Mobilization in the Pacific

On 26 July 1941 the War Department established the United States Army Forces in the Far East (USAFFE) as the headquarters in charge of the Philippines. Lieutenant General Douglas MacArthur, who was serving as the military advisor to the Philippine Army, was recalled to active duty as the Commanding General of USAFFE. All United States and Philippine military units were placed under his command.[3] The mobilization of the Philippine Army began in September 1941.[4] General MacArthur planned to form a total of 12 Philippine Army divisions.[5] Lieutenant Colonel Hugh Casey (later Major

General), Chief Engineer, USAFFE, arrived in the Philippines on 8 October 1941.[6] Shortly after his arrival, MacArthur ordered him to build an engineer force "equipped and trained to meet the heavy demands now required of the engineers in modern warfare."[7] Each of the 12 divisions would include a combat engineer battalion of 500 soldiers, a total of approximately 6,000 combat engineers.[8] Additional engineer units were planned to provide support for the intended 160,000 man army, which was to be fully mobilized by October 1942.[9] Two army engineer units, the 803rd and 809th Engineer Aviation Battalions, had arrived from the United States by October 1941.[10] These units were crucial to the construction of airfields on the islands and later would be employed as infantry in the defense of Bataan.

Engineers on Luzon

Before the arrival of the 803rd and 809th, there was only one engineer unit in all of the Philippines, the 14th Engineer Combat Battalion (ECB) Philippine Scouts.[11] The Philippine Army divisional engineer combat battalions had little or no engineer training.[12] Most Filipino officers didn't have the educational or occupational background to serve as leaders of technical units.[13]As a result, training programs were established at Camp O' Donnell and Camp Murphy, both for officer and enlisted soldiers. Instructors were provided by the 14th ECB.[14] Enlisted soldiers were provided limited training in water supply operations, use of hand tools, and pioneer equipment. A later course provided training in hasty bridging, field fortifications, demolitions, and camouflage. There was also limited small arms training, but no trainee fired more than 20 rounds.[15] An officer course structured to provide training in engineer subjects was abruptly canceled at the outbreak of the war. Of the 1,200 engineer officers projected, only 150 officers actually received training.[16]

On 1 December 1941, the divisions' combat engineer battalions had almost 400 of the planned 500 soldiers.[17] There were shortages, however, of basic items such as explosives, searchlights, and pontoon bridges.[18] Equipment used by Philippine Army units consisted primarily of hand tools and there were not enough to supply all units.[19] Additional units and supplies from the United States were anticipated, but the Japanese blockade of the Philippines prevented their arrival.[20] Engineer forces and equipment would have to be acquired through innovation.

A New Plan and Innovative Preparations

The build-up in the Philippines thus far had been based upon the 1938 revision of War Plan Orange.[21] War Plan Orange provided a minimal force to make a six month stand with a fallback position at Bataan Peninsula and Corregidor, if they could not defeat a beach invasion.[22] According to the plan, this six month period would allow time for reinforcements from the United States to arrive to provide relief.[23] In October 1941, MacArthur requested to revise War Plan Orange. The establishment of the USAFFE had resulted in more resources than War Plan Orange had envisioned. Given the time to fully mobilize the anticipated 160,000 man Philippine Army, in combination with the increasing number of B-17s available to him, MacArthur believed he would be able to defend the entire archipelago. General George C. Marshall, Chief of Staff, approved his request to revise the plan in November 1941.[24]

The attack on Luzon, at midday on 8 December, prevented the new plan from being completed. Only a few hours after the attack at Pearl Harbor, 54 Japanese bombers attacked Clark and Iba Fields on Luzon. Japanese fighters destroyed a majority of the USAFFE air forces. The remaining B-17s were evacuated to Australia.[25] As a result of the attacks, Lieutenant Colonel Casey developed a hasty plan to best employ the forces currently available for the defense of Luzon and Corregidor. While discussing his plan with Major General Richard K. Sutherland, Chief of Staff, USAFFE, in Casey's office, MacArthur stopped in. He read Casey's plan and approved it on the spot, signing "Okay, Mac." This approval provided the guidance necessary for Casey to take action in preparation for the defense of Luzon.[26]

Casey's plan considered three main points. First, it identified that the forces on Luzon shouldn't oppose the landing force due to limited numbers of personnel. If they did oppose a landing, the few personnel that would be available would probably be cut off by a force that landed further south on the island. Next, it established a defensive position on the Lingayen Gulf coast area and defended the mountain passes eastward. Finally, it incorporated a partnership between the military and the civilian population to maximize the defenses on the island. Casey would issue instructions to the civilian engineers and to the Philippine military district commanders to destroy bridges and ferries between the landing areas and the northern defense line.[27]

Casey utilized innovative ways to maximize his engineer force and its capabilities, as he prepared the defense of the island. He was given the full cooperation of the Philippine public.[28] The Bureau of Public Works assisted, 2,000 civilians were mobilized within two days after the attack and put to work on road projects to supplement the defensive plan.[29] He commandeered the railroad company, utilizing its resources to move supplies and personnel.[30] To secure more officer personnel, retirees and reservists who had not previously been called up, were activated.[31] Casey identified and promoted 10 enlisted personnel within the ranks who had sufficient engineer training.[32] Additionally, several Filipino mining engineers volunteered for service. Casey questioned them on their type and scope of work and summarized the process as, "One might say he was a superintendent or a foreman. I said, right, you're a Captain, you're a lieutenant, you're a sergeant."[33] He commissioned them directly and personally, subject to later approval and confirmation. These men would become known as "Casey's Dynamiters."[34] These experts were sent to draw uniforms and given weapons.[35] They were then teamed up with necessary manpower from the regular army to accomplish demolition objectives such as rigging bridges and emplacing mines.[36] In total, from December 1941 through May 1942, approximately 90 men were commissioned as engineer officers from civilian life or enlisted ranks to Second Lieutenant through Major.[37]

Colonel Casey, promoted on 19 December 1941, also used innovative means to address the shortages of engineer supplies, specifically explosives and munitions. To improvise for grenades, "Casey Cookies" were developed using a stick of bamboo, dynamite, and glass or nails.[38] Some were built with time fuses, others percussion fuses. A handle was attached to allow them to be thrown.[39] A shortage of antipersonnel (antitank) mines resulted in the development of "Casey Coffins." Thousands of these small wooden boxes were manufactured locally, and fitted with batteries, electric contacts, and dynamite. They were developed so that they wouldn't explode under the weight of one man, but two men or a vehicle would set them off.[40]

The Fall of Bataan

On 22 December 1941 the Japanese landed at Lingayen Gulf, resulting in MacArthur ordering the withdrawal to Bataan.[41] This phased withdrawal was accomplished through a successive defense. The Philippine army fell back on previously prepared fighting positions as it destroyed bridges and other stores of value.[42]

While working on a construction project near Quinauan Point, Bataan on 25 January, A Company, 803rd EAB was forced into action as infantry, when the Japanese made a thrust to cut off the only line of communication and road leading to the service command on Corregidor.[43] These engineers, along with miscellaneous Filipino and air force troops, held off the Japanese assault for two hours in the jungle until reinforcements could arrive.[44] They performed valiantly, but upon relief, the company of 92 men had experienced 50 percent casualties.[45] Brigadier General Casey, promoted on the same day as the defense by the 803rd, stated, “They were not especially trained for combat and incurred heavy losses, so much so that it almost destroyed the effectiveness of the unit.”[46]

In February 1942, during the siege of Bataan and Corregidor, the need for engineers to serve as infantry became urgent. In an effort to teach the Filipinos the essentials of combat engineering, officers of the 14th ECB and 803rd EAB provided each engineer battalion two four-hour periods of intensive infantry combat training with emphasis on scouting, patrolling, security, and defensive combat in the jungle.[47] By the end of February, the situation on Bataan had deteriorated to the point that MacArthur ordered all combat engineers to train to fight as infantry.[48] As late as March, training was provided in an attempt to improve the efficiency of the Filipino soldiers. This training covered basics such as proper use of tools and equipment, digging trenches and foxholes, emplacing machine guns, and preparing beach defenses.[49]

On 11 March 1942, as a result of instructions from the War Department, General MacArthur, with designated members of his staff, including Casey, left the Philippines for Australia to establish a new headquarters.[50] Upon the departure of the Commanding General and staff, the engineer command in the Philippines was designated as the Engineer Section, United States Forces in the Philippines. Subsequently, as Japanese forces closed in, this command and its troops were reassigned to either I or II Philippine Corps for a final defense.[51] As a last resort, engineers from the 803rd and 14th engineer battalions were assigned to II Philippine Corps for combat in the first week of April.[52]

On 9 April 1942, overwhelmed by Japanese attacks, forces on Bataan surrendered. A small remnant of the Engineer Section, United States Forces in the Philippines and one company of the 803rd Engineers remained on Corregidor Island. These forces were annihilated by heavy air raids and pounding artillery. The surrender of all remaining United States Forces in the Philippines forces occurred on 6 May 1942. All organized engineer efforts halted in the Philippines.[53] The efforts of the engineers and other defenders at Bataan had eliminated a sizable portion of the Japanese military.[54] The delay they created allowed for follow-on forces and supplies to arrive at Australia to conduct a successful defense.[55] A number of engineers avoided capture and worked with Filipino guerrillas throughout the Japanese occupation.[56]

The combat engineers, at this early stage of the war, were hampered by their lack of training. Multiple engineer units participated in the defense of the Philippines, though only the 803rd EAB and the 14th ECB were considered adequately trained to perform their mission at the time of the Japanese invasion.[57] The 14th ECB was the only unit that had participated in a battalion level exercise. At best, the remainder of the units had conducted company level exercises prior to facing Japanese forces.[58] The sudden, unexpected attack by the Japanese prevented the full mobilization of the USAFFE and resulted in the cancellation of training courses developed to improve engineer operations. The fact that civilian Philippine engineers did not have military training is evident, but their expertise was vital in the defense of Luzon and Bataan. Aside from the few identified units, a majority of the engineers in the Philippines in 1941 were not prepared to conduct their combat mission, ultimately resulting in a shortened defense in the face of overwhelming odds.

Build-up and Training in Australia

Training of inbound engineers in combat operations was deemed a top priority for arriving units by the Office of the Chief Engineer, General Headquarters, Southwest Pacific Area (hereafter OCE).[59] These training programs emphasized the use of small arms, security operations, and defensive combat. The OCE suggested that units devote at least one day per week to these subjects.[60] The 808th Engineer Aviation Battalion, in addition to its construction missions, allocated seven weeks to intensive combat training.[61] The 114th and 116th Engineer Combat Battalions completed extensive training in combat and combat engineering between July and December 1942.[62] Conversely, urgent construction and other operational requirements prevented a majority of the engineer units from completing training in combat related subjects. As a result, many engineer units stated that they had no time to allocate to training.[63] The disparity between training of units appeared to be a result of the prioritization of the commanders, to set aside time from critical construction requirements to train in combat operations.

Often requirements and tasks given to engineer units were conducted with no prior experience. Thus, on-the-job training was the primary method utilized to train engineers during this period.[64] To remedy this shortfall, several engineering schools were developed in Australia. These schools and courses provided training in bomb disposal, camouflage techniques, and advanced military construction techniques for company commanders.[65] Two to four officers from each Engineer Unit attended the bomb disposal course. After returning to their units, these leaders formed the nucleus of the bomb disposal sections.[66] Three officers attended the two week course in camouflage training provided at Sydney. The camouflage techniques taught were similar to those given at West Point and Fort Belvoir.[67] The School of Military Engineering at Liverpool provided advanced instruction for company commanders. Although the prerequisites were fairly simple (officers needed to possess an engineering education or experience), the technical nature of the course and unfamiliarity with Australian nomenclature resulted in only six United States officers attending the course.[68] These training opportunities resulted in engineer combat units receiving large amounts of training at the schools provided in Australia. The engineer service units, however, were too busy to attend in mass, but often sent officers and enlisted leadership to the courses.[69]

Throughout the war, engineer replacements were never received in adequate numbers, with very few aviation and service unit replacements.[70] By the end of 1942, OCE recognized that there were adequate numbers of combat engineers.[71] The problem was the shortage in total number of engineers to accomplish the variety of construction needs, including airfield construction, base development, and road construction.[72] To make up for shortages, the theater took "engineer units for which there was no great need," such as combat groups and non-divisional combat engineer battalions and reorganized them into construction or maintenance battalions.[73] This reorganization of combat engineer units resulted in additional training requirements for units receiving new soldiers.

In 1943, as in 1942, there was little time for formalized training as a result of the large amount of construction work to be completed.[74] The need for engineer officers remained critical, resulting in an Engineer Branch of the Officer Candidate School being opened in early 1943 at Brisbane, Australia. There were few candidates available within the USAFFE. Enlisted members had been screened repeatedly while stateside to determine if they were officer material. Those men who may have been suitable candidates in-theater were retained by their unit due to the heavy operational commitments.[75] The three month Officer Candidate Course was rigorous. Initially, all candidates completed five weeks of basic training. At the end of the basic period a board was held to remove the unfit. Engineer students then received training in field fortifications, bridging, water supply, and demolitions. After this phase, another board was held to remove those not expected to graduate. In the first year, approximately 125 students enrolled in the course and "a large number of them failed."[76]

New Guinea's Effect on Combat Engineers

The pace of operations conducted in New Guinea exposed a shortcoming in the training of logistical support and the heavy requirement for engineers to "transition from combat to construction."[77] The combat engineers' organization and equipment were developed with an emphasis on mobility as a result of experiences in World War I.[78] During The Great War, engineers had well-developed railroads, highways, ports, and industrial areas.[79] In much of the Southwest Pacific Area, engineers were faced with nearly impenetrable jungles with no modern facilities. Colonel Thomas Lane, Operations Officer for Brigadier General Casey, felt engineers had inadequate training for the construction demands of the Southwest Pacific.[80] Instruction on logistical support to engineer operations prior to deploying to theater were based upon the fixed base, trench warfare of World War I.[81] World War II was much more mobile, requiring a "combat engineer phase," followed by requirements for engineers to build roads, provide utilities, and prioritize construction.[82] There was no experience in the requirements to conduct combat operations in an undeveloped, jungle environment.[83]

The General Headquarters Maneuvers during peacetime further confirmed the false assumptions applied from World War I. During the maneuvers, facilities were available along easily traveled terrain, if not improved roads. Little road construction was required during these maneuvers due to an already established highway system. Bridges were not destroyed during the maneuvers, preventing an accurate assessment of manpower requirements for reconstruction. The combination of high mobility corridors and unrealistic manpower projections of the maneuvers resulted in combat engineer units being undermanned and underequipped to operate in the dense jungles of the Southwest Pacific Area. Realistic work requirements necessitated at least three shifts of workers to support infantry units in the challenging terrain.[84]

As a result of the increased need for manpower to support division requirements in these dense jungle areas, every division commander who served under the Sixth Army in New Guinea stated that a minimum of two engineer combat battalions was required to support the operations of the new triangular division.[85] This shortage of manpower was compounded by officers with limited engineering experience, resulting in the inefficient execution of construction operations.[86] It wasn't until 1945, after feedback from the field, that the War Department authorized an increase in personnel and equipment allowing for three shifts of engineer operations.[87]

Island Hopping, Return to the Philippines

Initial planning for the return to the Philippines began in Brisbane, Australia on 25 July 1944.[88] Prior to entering combat, all engineer units received instruction in amphibious operations, jungle warfare, and combat engineering tactics in-theater. At Toorbul Point, Australia, the 114th, 116th, and 8th Engineer Squadron (organic to the 1st Cavalry Division) conducted amphibious assault training that included landing operations on hostile shores, ship to shore, and shore to shore operations with small landing craft. Exercises were realistic and included combat planes, aerial bombings, and firing of explosive charges to simulate artillery and aerial bombardment.[89]

Following this refresher training, engineers participated in several key amphibious landings and follow-on combat in the advance to the Philippines. The United States and Australian forces conducted landings on New Guinea, New Britain, Los Negros, Biak, and the Monotai Islands.[90] These landings set the conditions for the return to the Philippines, a landing at Leyte Island on 20 October 1944.[91]The multiple iterations of amphibious landings provided an opportunity for commanders to reflect on shortcomings in the execution of operations on each island.[92] At the request of the Brigadier General Casey, the engineers of various commands in-theater presented their views on the adequacy of the Zone of Interior training.[93] These commanders identified the need for improved skills in map reading and interpolation of aerial photography. It was suggested that all pioneer training be removed at the replacement centers, to allow for instruction in more relevant tasks. Additionally, instruction on mines and booby traps should be given more emphasis, to counter the new types of antitank mines and charges used by the Japanese.[94] Finally, engineers should conduct additional exercises in amphibious operations, to include beach organization and operations during landing.[95]

In 1944, Casey, now a Major General, decided an engineering school should be opened in-theater to correct serious deficiencies in both officer and enlisted engineers.[96] The instruction would be more advanced than unit level training. He estimated that an adequate school should have at least 70 officers and 350 enlisted men in attendance.[97]Commanders in-theater felt this school would divert critical resources of men and equipment from the already heavy needs of the engineers.[98] Regardless, Casey continued the development of the school, including staffing estimates, assigning personnel, and gathering material. The school was activated on 11 February 1945 but didn’t begin instruction until 3 September 1945, the day after V-J Day.[99]

The Assault on the Japanese Homeland

In May and June of 1945, engineer replacements from the European Theater began to arrive in the Pacific.[100] Commanders carried out unit training programs to exercise weak areas and to familiarize their reconstituted units with requirements of the Pacific. The Sixth and Eighth Armies conducted exercises that better prepared combat engineers to conduct construction planning, mine removal, hasty mine field preparation, bridging and beach operations.[101] This training was as realistic as possible. In one four-hour block of instruction on deactivation of improvised mines, actual enemy material was used.[102]

During unit training and build-up, several operations were in planning for an assault on the Japanese homeland. Operations OLYMPIC and CORONET were scheduled for November 1945 and March 1946 respectively, with the purpose of ending all effective Japanese resistance.[103] These amphibious assaults were never executed, due to the atomic bombs dropped on Hiroshima and Nagasaki. On 2 September 1945, the government of Japan signed the surrender document aboard the *Missouri* in Tokyo Bay.[104]

Conclusion

The limited combat engineer expertise of units on Bataan required senior officers to provide direct oversight to operations. The Chief of Engineers walked the defensive line while other staff officers provided input to their Philippine counterparts to enhance tactical positions.[105] These officers were able to capture constructive comments that would shape the future training and development of engineer officers in this theater and throughout the allied military.[106]

Following the heroic efforts on Bataan, engineer officers in the Pacific demonstrated a lack of initiative and an inability to organize work. Combat engineer leaders were unable to manage the large and diverse amounts of projects and wide range of specialties within their formations, required by the transition from combat to construction. This resulted in delays in completion of projects and an underutilization of their assigned soldiers. The lack of experience was overcome by leaning on the few officers who had previous engineering experience.[107] Enlisted members were also improperly trained in the realms of equipment operation and maintenance and in general matters such as coping with heat, unfavorable weather, and tropical diseases.[108]

The best indicator of the status of engineer training during World War II, was the establishment of General Casey's engineering school (first day of class provided after victory in Japan was declared). In the final days of the war, this senior engineer felt that a majority of engineers were not properly trained to conduct their mission in combat.[109]

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[1]Gabel, 283-314.

[2]Kirkpatrick, 48.

[3]George A. Meidling, ed., *Engineers of the Southwest Pacific, 1941-1945, vol. 2, Organizations, Troops, and Training* (Reports of Operations, Office of the Chief Engineer, General Headquarters, Army Forces, Pacific, 1947), 1.

[4]Karl C. Dod, *United States Army in World War II, The Technical Services, The Corps of Engineers: The War Against Japan* (Washington, DC: Office of the Chief of Military History, 1966), 68.

[5]Ibid.

[6]Meidling, vol. 2, 4.

[7]Dod, 68.

[8]Ibid.

[9]Ibid.

[10]Ibid., 63.

[11]Meidling, vol. 2, 4.

[12]Ibid., 14.

[13]Dod, 68.

[14]Meidling, vol. 2, 14.

[15]Ibid.

[16]Ibid.

[17]Dod, 68.

[18]Ibid., 70.

[19]Ibid., 68.

[20]Meidling, vol. 2, 7.

[21]Mark S. Watson, *United States Army in World War II, The War Department, Chief of Staff: Prewar Plans and Preparations* (Washington, DC: Department of the Army Historical Division, 1950), 477.

[22]Ibid.

[23]Dod, 55.

[24]Ibid., 57.

[25]Samuel A. Goldblith, "The 803rd Engineers in the Philippine Defense," *The Military Engineer* 38, no. 250 (August 1946): 323.

[26]Hugh J. Casey, *Engineer Memoirs* (Washington, DC: Office of History, U.S. Army Corps of Engineers, 1993), 161.

[27]Ibid., 160-161.

[28]Ibid., 165.

[29]Meidling, vol. 2, 12.

[30]Casey, 165.

[31]Meidling, vol. 2, 7.

[32]Ibid.

[33]Casey, 161.

[34]Ibid.

[35]Ibid.

[36]Ibid.

[37]Meidling, vol. 2, 8.

[38]Casey, 163.

[39]Ibid.

[40]Ibid.

[41]Ibid., 164.

[42]Ibid.

[43]Clarence E. Campbell, “A Tribute to the 803rd Engineers,” *The Quan* 59, no. 1 (June 2004): 9-10, http://philippine-defenders.lib.wv.us/QuanNews/quan2000s/June2004.pdf (accessed 15 May 2014).

[44]George A. Meidling, ed., *Engineers of the Southwest Pacific, 1941-1945*, vol. 8, *Critique* (Reports of Operations, Office of the Chief Engineer, General Headquarters, Army Forces, Pacific, 1950), 15.

[45]Ibid.

[46]Casey, 174.

[47]Meidling, vol. 2, 17.

[48]Dod, 98.

[49]Meidling, vol. 2, 16.

[50]Ibid., 17.

[51]Ibid., 17-18.

[52]Ibid., 17.

[53]Ibid.

[54]Meidling, vol. 8, 20.

[55]Ibid.

[56]The Historical Division and the Public Affairs Office, Headquarters U.S. Army Corps of Engineers, Engineer Pamphlet 360-1-21, *The History of the US Army Corps of Engineers* (Alexandria, VA: Headquarters U.S. Army Corps of Engineers, 1986), 84.

[57]Meidling, vol. 2, 14, an interview with LTC Peters, Chief Engineer of Army Forces Pacific, 23 November 1945.

[58]Meidling, vol. 2, 14. LTC Casey was promoted to COL on 19 December 1941 and to BG on 25 January 1942.

[59]Ibid., 52.

[60]Ibid.

[61]Ibid.

[62]Ibid.

[63]Ibid., 56.

[64]Ibid., 108-109.

[65]Ibid., 56.

[66]Ibid.

[67]Ibid.

[68]Ibid., 57.

[69]Ibid., 110.

[70]Ibid., 150.

[71]Ibid., 57.

[72]Ibid.

[73]Ibid., 150.

[74]Ibid., 108.

[75]Ibid., 208.

[76]Ibid., 208-209.

[77]Ibid., 143.

[78]Ibid.

[79]Ibid.

[80]Casey, 221.

[81]Ibid.

[82]Ibid.

[83]Ibid., 221-222.

[84]Meidling, vol. 2, 144; Gabel.

[85]Meidling, vol. 2, 144.

[86]Ibid., 143-144.

[87]Ibid., 144.

[88]Meidling, vol. 8, 236.

[89]Meidling, vol. 2, 109.

[90]The Historical Division and the Public Affairs Office, Headquarters U.S. Army Corps of Engineers, Engineer Pamphlet 360-1-21, 88.

[91]Meidling, vol. 8, 237.

[92]Meidling, vol. 2, 158.

[93]Ibid., 205. In World War II, zones of operation were utilized to array forces. The Battle Zone was just that, the area where fighting took place. The next echelon to the rear was the Communications Zone, which is where administrative and support functions in theater took place. The furthest to the rear, the Zone of the Interior was outside of the theater of operations and mostly referred to the continental United States.

[94]Meidling, vol. 2, 206.

[95]Ibid.

[96]Ibid., 151.

[97]Ibid.

[98]Ibid.

[99]Ibid.

[100]Ibid., 207.

[101]Ibid.

[102]Ibid.

[103]Ibid., 213.

[104]Ibid.

[105]Meidling, vol. 8, 18.

[106]Ibid., 19-20.

[107]McCune and Clinard, 55.

[108]Meidling, vol. 2, 151.

[109]Ibid.

CHAPTER 4

ENGINEERS IN NORTH AFRICA

Introduction

In June 1941, as contingencies were being developed to address the ongoing offensives of the Axis powers in Europe, the earliest date the War Plans Division expected the United States armed forces to be mobilized, trained, and equipped for extensive operations was 1 July 1943.[1] The attack at Pearl Harbor, some 18 months earlier than this proposed date, prevented the full mobilization prior to entry into the war. As a result, planners would forego the idea of landing on the European continent and instead conduct operations in North Africa to open another front to both relieve pressure on the Soviet Union and prevent the Axis capture of the Suez Canal.

During the North African Campaign, from November 1942 through May 1943, United States army engineers executed their primary missions of road maintenance and mine warfare and also their secondary mission as infantry. Additionally, they were first exposed to amphibious operations.[2] Unlike the surprise attacks in the Pacific, causing engineers to react with what was available in the field, military operations in North Africa would be conducted by engineers who had a limited opportunity to plan and prepare for the operation. The operations against Axis forces in North Africa provide another major theater to observe and assess engineer training and preparation for combat. Combat engineers in this theater would face a highly trained, combat tested adversary.

Training in the Continental United States

Like many selectees, Sergeant Frederick Peters, received a telegram to report for duty. His telegram arrived in December 1942 with orders to report for combat engineer training on 1 January 1943.[3] Peters' military development was the most comprehensive path available to selectees being prepared for combat. He initially completed basic training to build soldiering skills, followed by engineer training, then assignment to a unit for additional development in his engineering tasks, and training with larger echelons.[4] The requirement for unit level training resulted in the establishment of bases such as Camp Claiborne, Louisiana, Camp Ellis, Illinois, and Camp Sutton, North Carolina. These centers provided a training area to accommodate the 13 week unit training program prescribed in the Army Ground Forces' plan.[5]

Engineer units were composed of soldiers who had volunteered, selectees with basic training, and fillers who were ordered to report directly to units without any prior military experience or training.[6] Peters' experience, from selection to arrival at his unit, is an example of a soldier who was selected and received basic training. To ensure all soldiers within a formation were at a similar skill level, the first five weeks of the formation of a new unit were utilized to conduct basic military training. Following this basic training period, the next eight weeks were utilized to further develop engineer skills and other areas deemed critical by the unit. This included engineer tasks such as bridge construction and road building.[7] During the final two weeks skills were tested in team level tasks including defensive security against attacks, night convoys, village fighting and day field operations.[8] Units developed cohesion, established battle drills, and developed trust between leaders and subordinates during their train-up.

The opportunity to develop a group of engineers into a unit during the 13 week training period was the preferred method, but not common. Accelerated requirements to execute Operation Torch resulted in many hastily-formed units being deployed. Several engineer units were brought up to strength just prior to sailing for Europe, including commanders being transferred to other units after reaching the port.[9] Engineer officers from general service regiments and combat battalions were transferred to fill alerted units.[10] The 830th Engineer Aviation Battalion added 50 percent of its officers and 82 percent of its enlisted men between 29 July and 9 August 1942 before departing for Fort Dix, New Jersey to embark two days later.[11] The 397th Engineers added 104 enlisted men to its established ranks of four officers and 68 enlisted men at Fort Dix just prior to deployment.[12]

Many senior engineer leaders recognized the lack of training and insisted that before troops were sent into theater, they should at least complete unit level training. Brigadier General Thomas B. Larkin, Chief Engineer of the Western Base Section in Europe, was in conflict with this standard; his belief was that a half-trained man was better than no man.[13] Unit cohesion and training were nonexistent for a majority of units prior to deploying. It was expected that engineers would conduct all required training upon arrival in-theater. This included basic and combat training and developing construction experience to be able to operate efficiently as an engineer unit.[14]

Training in Europe

The expectation for units to make up shortfalls in training after arrival in-theater rarely occurred. Training for engineers in the United Kingdom consisted primarily of physical training and instruction in infantry fundamentals.[15] The construction requirements to build bases for follow on forces in England provided necessary training for green engineers that had no prior construction experience, but prevented any chance of specific preparation for the perceived requirements of Operation Torch.[16] These engineers were conducting construction seven days a week, working on both day and night shifts.[17] The general lack of mission training was formally recognized by the Chief of Engineers, but combat related skills were to be conducted with “minimum interference to unit duties and tasks.”[18] This loophole resulted in time dedicated to training as little as one hour per ten hour work day. Some units would train one battalion for a week while the other battalion conducted construction work. Regardless of the scheduling, it was widely recognized that the training had little actual meaning.[19]

The 19th Engineer Combat Regiment, which would become infamous at Kasserine Pass, conducted plenty of physical training, but received no ammunition or mines for training and no instruction in the use of the Bailey Bridge, British explosives, or antitank mines.[20] The 16th Armored Engineer Battalion, stationed in Northern Ireland, took advantage of its time and received extensive bridge and ferry training. Officers attended the British Engineering School and became familiar with other British equipment including the Sommerfeld track, mines, booby traps, and demolitions.[21] For most units, combat skills such as laying and removing mines, booby traps, and other obstacles or rapidly emplacing airfields and building bridges would go untrained until combat required such tasks.[22] The level of training and preparation was directly attributed to the leadership of each individual unit. Some units could barely maintain their construction requirements, while others not only completed their construction requirements but also completed additional training to prepare them for combat.

Eight Weeks until Execution

In his report on Operation Torch, General Dwight D. Eisenhower stated that on 14 August 1942 he received a directive from the Combined Chiefs of Staff that "combined military operations be directed against Africa as early as practicable, with a view to gaining, in conjunction with the Allied Forces in the Middle East, complete control of North Africa, from the Atlantic to the Red Sea."[23] The decision to attack on 8 November was determined during the middle of September and the outline of the plan was issued on 20 September.[24] This November date was selected as the earliest possible date and was based on strategic and broad political views and consideration of weather conditions in the Atlantic Ocean and the mountain passes of Algiers and Tunis.[25] Engineer units had, at most, eight weeks from alert for the operation until landing on the beaches of North Africa. The limited training opportunities faced by engineers, would now be further constrained by a condensed timeline.

In order to field officers for the engineer units alerted for Torch, the offices of the Chief of Engineers, Services of Supply, and the European Theater of Operations, United States Army provided a total of 65 engineer officers.[26] Removal of these 65 leaders decimated an already inexperienced staff. Of the 271 engineer officers available in the listed headquarters, 84 had no previous military experience.[27] Of the remaining 187 officers, 170 were from the National Guard or Reserves with little Active Duty experience.[28] After the reorganization, only seven experienced engineer officers remained within these headquarters to fill 11 critical jobs, including the Chief of Engineers and supervisor of engineer schools.[29]

After the alert for the impending invasion, engineers in both the United States and Europe began to prepare. Engineer units completed invasion rehearsal drills for the Western Task Force, which would land in the vicinity of Casablanca, in both the United States and United Kingdom.[30] It was noted that the rehearsals lacked rigorous night training and often took place in near ideal weather and surf conditions.[31] Additionally, these training events did not properly stow loads aboard ships or rehearse loading or unloading fuel or ammunition, due to fear of explosions.[32] This limited their loading and unloading experience to vehicles and other bulky items.[33] The combination of ideal weather conditions during training while executing very simple load plans failed to prepare these soldiers for success during the first deliberate offensive operation to be conducted by the United States in the European Theater.

The Central and Eastern Task Forces held similar training events on 19 and 20 October near Loch Linnhe, Scotland. Engineers during these rehearsals gained experience in laying out shore installations and communications, but learned little about unloading vehicles and supplies.[34] Amphibious training for the landings was additionally limited by the requirement to overhaul and conserve landing craft. Lack of training and familiarization with the landing craft created issues in loading, disembarkation, and movement.[35]

The Landings

On 8 November 1942 three division-sized task forces landed simultaneously at Algiers, Oran, and Casablanca to begin Operation Torch.[36] At each site a company from the Division Engineer Battalion was attached to each regimental landing team.[37] Serving as shore parties for each of the landings, combat engineers executed several diverse tasks.

The 36th Engineer Combat Regiment served as the shore party for the Eastern Task Force at Algiers. North of Casablanca, as part of the Western Task Force, elements of the 15th Engineer Combat Battalion helped seize an airfield adjacent to the port after removing obstacles in the Sebou River.[38]

The 19th Engineer Combat Regiment, a total of 1,200 engineers, landed as part of the Center Task Force at Oran. Their after action review from the landings described a serious lack of preparation for this operation. Prior to execution of Torch, the regiment had no opportunity to complete unit training in weapons, because of the lack of time, ranges, and ammunition.[39] The men of the 19th were unfamiliar with anti-tank mines, British explosives, the Bailey Bridge, and other engineer equipment which would possibly be employed in the operation.[40] The report also stated that the regiment's primary mission was not assigned until after it had partially landed and that the operators of the landing craft were unfamiliar with the landing plan and given no specific mission.[41] This prevented them from preparing any detailed plans in advance of the operation.[42] The handling of landing craft by this unit was generally poor, resulting in unnecessarily high casualties during the landing.[43] Troops were unfamiliar with the landing craft themselves. Prior training would have allowed for more efficient disembarkation.[44] As a result of their lack of preparation and training, a large percentage of landing craft were left stranded upon beaches due to improper handling.[45] The conditions experienced at landing included rough surf and deep water, which resulted in the loss of men, vehicles, and equipment due to inexperience of handling the landing craft in such conditions.[46]

The evident confusion of the purpose and mission of the engineers prior to the landings was clearly portrayed in an intercepted letter. This letter, written by a Major who was part of the landings at North Africa and intercepted by the United States Military Censorship, indicates that his unit had orders indicating they were to land at North Africa, but were given booklets and information on “Irak and Syria” as they boarded their ship for departure from the United States.[47] The officer who typed the letter questioned the booklets, “if they desired to drag a red herring across the trail, why bother to print several million dollars’ worth of booklets?”[48]

The engineers charged with executing the landings on North Africa were faced with shortages in manpower and training, a lack of time to execute mission rehearsals and in some cases units had no idea of their mission upon arrival. Some units may not have been aware of their true destination! It is difficult to assess how such issues could have been prevented in such a tumultuous environment given General George S. Patton’s reflection on preparations for Operation Torch, “In many cases units arrived in training and staging areas just prior to embarkation. The sub-force commanders had no opportunity prior to sailing to train or evaluate the units which he was to lead ashore.”

Operations at Kasserine Pass, North Africa

As the United States military and its allies prepared defensive positions at Kasserine Pass, General Eisenhower visited II Corps Headquarters on 12 February 1943.[49] After observing how General Lloyd R. Fredendall, Commander of II Corps, had scattered the American troops under British and French command, Eisenhower started out on an all-night inspection of the front. During his inspection of the 1st Armored Division, 1st Infantry Division, and 34th Infantry Division positions (none of which had ever seen battle), he spoke with officers who failed to grasp elementary tactical lessons of preparing defensive positions and mine laying.[50] This factor is evidence of shortfalls in training and preparation at multiple echelons. Engineers in higher headquarters didn't provide proper guidance in the locations of the establishment of defensive positions. At the lowest levels, men were unable to prepare defensive positions to be effective during the fight at the pass.

Colonel Anderson T.W. Moore, Commander of the 19th Engineer Combat Regiment, pointed out serious defects in the preparation and conduct of the defense of Kasserine Pass. Foxholes and gun emplacements had not been dug deep enough, few alternate positions had been prepared, and barbed wire was delivered late and used little.[51] Moore's engineers were desperately short on combat experience; only one man in the unit was known to have had combat experience.[52] These 19th Engineers were the same who stated they had no opportunity to conduct any weapons training prior to the landings. The lack of training and combat experience was terribly evident on 18 February when engineers of the 19th set off in panic at the first site of enemy forces. These men had to be rounded up and returned to their post.[53]

In defending Kasserine Pass, the 19th Engineers' casualties were 11 killed, 28 wounded, 88 missing.[54] Their three-day holding action provided a steep learning curve for the unit, but also allowed time for reinforcements to take up positions in the hills beyond the pass. The 19th Engineers' experience at Kasserine underscored a lesson taught repeatedly in Tunisia: "engineer units sent to meet German veterans in combat required hard, realistic training."[55]

As the Germans withdrew, they left mines and demolitions that were described as a "screen of a thousand mines."[56] Mine detection teams removed 10,750 enemy mines during the slow pursuit of German forces after their withdrawal.[57] The Germans used emplacement methods that were unfamiliar to the inexperienced engineers. Mines were placed in the shoulder of roads, some were emplaced with pieces of metal spread around them to hinder detection, and others were buried too deep to be detected and would explode after vehicle ruts triggered the fuse.[58] The enemy was able to break contact and withdraw without any threat from allied forces.

Mine Warfare in North Africa

Combat engineers had only received a few hours of instruction in mine warfare, but found this to be one of their principal duties in North Africa. In Tunisia, a large part of the combat engineer's time was spent laying, lifting, and clearing mines. Division engineers spent as much as half of their available time clearing mines.[59] Untrained engineers made fatal mistakes, instances of mines being fused at ammo dumps before being loaded and transported was common.[60] This lack of training resulted in several unfortunate accidents, simply from a lack of experience in handling mines.

Captured or swept ordnance was too dangerous to transport to the United States for training purposes, resulting in many engineers first seeing the mines they would have to defuse when they met them on the battlefield.[61] Engineers of the 190th and 19th Engineer Combat Battalions had never seen a German mine, picture, or model before entering combat in Tunisia.[62] To counter this lack of training, one noncommissioned officer that had attended a British mine school in-theater, trained company officers and key men days prior to encountering their first live minefield.[63]

Lack of training with mine clearing equipment prior to operations in North Africa resulted in combat engineers using the slow and tedious method of probing for mines with their bayonets. Engineers later incorporated the SCR-625 mine detector, which was very effective and improved the efficiency of detection.[64] As engineers became more familiar with mine warfare in North Africa, innovation and experiment resulted in the development of “snakes” which were long sections of explosives pushed into mine fields and detonated to clear a path wide enough for a tank.[65] Another improvement, the “scorpion,” was created from lengths of chain attached to a revolving axle suspended well in front of a tank. As the tank moved forward, the chain flailed the ground. The scorpion was countered with wire obstacles and delayed action mines which would destroy following vehicles.[66] In spite of all the improvements, the magnetic mine detector, a sharp eye, and bayonet were relied on most by the engineers, resulting in over 39,000 mines being found between February and April 1943.[67]

The lack of training in mine warfare caused the loss of lives as a result of mishandling and lack of familiarity of enemy emplacement procedures. Engineers were forced to learn how to defuse and clear mines once faced with the obstacles on the battlefield. Allied defensive positions and efficiency in pursuit of enemy forces could have been greatly improved from the outset of the war with improved instruction on mine warfare prior to deployment to North Africa.

Northern Tunisia, the Last Offensive

The final offensive in Northern Tunisia began on 24 April 1943. The 20th Engineers supported the French Corps d’Afrique and the 9th Infantry Division on one flank. The 19th Engineers supported the 34th and 1st Infantry Divisions on the other.[68]

During this offensive engineers provided forward reconnaissance, helped artillery displace throughout the fight, and maintained almost 100 miles of macadam (primitive asphalt road) and 250 miles of dirt road to ensure mobility.[69] They also built almost 75 miles of new roads to support infantry units in the mountains by connecting main supply routes to pack mule trails.[70] In the final defeat of the Axis forces in North Africa, the engineers demonstrated their ability to serve as a force multiplier for both infantry and artillery, while excelling at tasks involving construction and road repair.

Reflections from North Africa and Effects on Training

Reports from North Africa were positive when the engineers were required to conduct only bridging and road building. While serving as infantry or in any combat capacity, especially in the early engagements, they were as unprepared as the men from other branches.[71] Many believed this to be a result of the unrealistic training environment that the engineers had experienced. Private Frank B. Sergeant, an engineer, stated:

> I know well those men who were cut to ribbons at the Kasserine Pass, and I know why they were thrown into confusion, panicked by attacks, and accepted their fate almost paralyzed. When they jumped into foxholes to let the tanks roll over them, and were bayoneted in these foxholes by the infantry that came behind the tanks, they died with an astonished look on their faces.[72]

Lieutenant General Lesley McNair, who was responsible for the training of Army Ground Forces, visited the Tunisian front in April 1943. His observations led him to believe that "only battle could produce battle-wise divisions."[73] McNair began to make immediate changes to prevent future divisions from being untrained and unprepared for the conditions they would face in combat. Recommendations from the field were to train with live ammunition and real mines, include more night operations, and extended field operations during bad weather and under extreme fatigue.[74] Requests for tanks to be incorporated resulted in engineers training with and against tanks. Hasty defense techniques were reinforced when live tanks rolled over trainees as they crouched in their foxholes.[75]

Prior to combat operations in Tunisia, the ERTC had contended with restrictions that prevented them from using realistic scenarios for recruits. Live ammunition and artillery simulators were not used; instead firecrackers were used in place of artillery, mine charges, and booby traps.[76] The small pop of a firework was not very authentic when simulating rolling into a minefield. A War Department Circular, dated 29 April 1943, stated that every trainee "so far as practicable . . . be subjected during training to every sight, sound, and sensation of battle."[77] New training courses required soldiers to crawl over rough terrain with full gear and incorporated explosives, detonating cord, firing devices, mine detectors, smoke, tear gas, and blank ammunition. Munitions and effects were also used in assault problems which required engineers to move through small villages to train in house to house fighting. No longer would firecrackers pop when soldiers picked up an item off the ground, the triggered booby traps exploded. Detonations simulating mortar and artillery fire shook the surrounding area.[78]

To address increased night operations training, five night problems were added to the ERTC curriculum. These problems increased in complexity and incorporated larger elements with each evolution. In the first exercise, cadre demonstrated how to patrol at night. Next, four platoons worked together on a night outpost problem. In the third training iteration, engineers conducted a bridging operation in total darkness with noise and light discipline. The bridging exercise was followed by constructing a road at night and culminated with a night reconnaissance mission using a compass.[79]

These improvements to training were critical to meet the training needs of engineers who would be sent to replace combat losses. No longer were the replacement centers simply providing fillers for units that would provide additional training upon arrival of the new recruits, in secure training areas. These trainees would now be replacements for actual battle losses. Additional training would not be readily available, until they were on the front lines.[80]

Conclusion

The North African Campaign, beginning with the landings of Operation Torch, ended on 13 May 1943.[81] In this six months of fighting, engineers gained valuable experience in 20th century mobile warfare. The lessons learned during the amphibious landing of Operation Torch, throughout the fighting and mine warfare of Kasserine Pass, and the requirements for construction and repair of roads to support infantry operations, were reflected in future training and engineer operations. The engineers were not prepared for combat in North Africa, as a result of unrealistic training and insufficient equipment to utilize in preparation for this campaign. These two critical factors were further compounded by the short duration given for units to prepare for the invasion. The engineers made the most of these hard lessons learned and adapted training to prepare future formations. The increased resources and more realistic training improved the survivability of future engineer replacements.

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[1]Watson, 340-341.

[2]James W. Dunn, "Engineers in North Africa," *Engineer* 23, no. 2 (April 1993): 46.

[3]Frederick Peters, *Memoirs of A World War II Combat Engineer*, http://www.genealogycenter.info/fam_petersmemoirs.php (accessed 6 May 2014), 5. SGT Frederick Peters served in Alpha Company, 237th Engineer Combat Battalion and landed at Oran, during Operation Torch.

[4]Ibid., 6-19.

[5]Coll, Keith, and Rosenthal, 271-313.

[6]Ibid., 294. In these first five weeks, 76 of the first 240 hours of training were programmed for rifle marksmanship.

[7]Ibid.

[8]Ibid.

[9]Alfred M. Beck, Abe Bortz, Charles W. Lynch, Lida Mayo, and Ralph F. Weld, *The Technical Services, The Corps of Engineers: The War Against Germany* (Washington, DC: Center of Military History, 1985), 39.

[10]Ibid.

[11]Ibid.

[12]Ibid.

[13]Ibid., 26 and 39. Brigadier General Larkin was initially the Chief Engineer of the Western Base Section of the ETOUSA. In September, 1942 he was called from this job to help plan Operation Torch and then commanded the Services of Supply in North Africa.

[14]Beck et al., 40.

[15]Ibid., 67.

[16]Ibid.

[17]Ibid., 40.

[18]Ibid.

[19]Ibid.

[20]Arthur J. Lazenby, 19th Engineer Combat Regiment to the Commanding General, Center Task Force Eastern Assault Force, 29 December 1942, *Lessons from Operation Torch*, World War II Operational Documents Collection, Combined Arms Research Library Digital Library, 25-27.

[21]Beck et al., 68.

[22]Ibid., 40.

[23]Dwight D. Eisenhower, *Report on Torch*, World War II Operational Documents Collection, Combined Arms Research Library Digital Library, 2.

[24]Ibid., 6.

[25]Ibid.

[26]Beck et al., 38.

[27]Ibid.

[28]Ibid., 39.

[29]Ibid., 38. These jobs included chief engineer, chief engineer's deputy, executive, division's chief, supervisor of engineer schools, and three base section engineer posts.

[30]Ibid., 68.

[31]1st Engineer Amphibian Brigade to the Commanding General, Allied Forces, 30 December 1942, *Lessons from Operation Torch*, World War II Operational Documents Collection, Combined Arms Research Library Digital Library, 28-29.

[32]Beck et al., 68.

[33]Ibid.

[34]Ibid.

[35]Eisenhower, 10.

[36]Dunn, "Engineers in North Africa," 46.

[37]Ibid.

[38]Ibid., 46-47.

[39]Lazenby, *Lessons from Torch*, 26.

[40]Ibid.

[41]Ibid.

[42]Ibid.

[43]Ibid.

[44]Ibid.

[45]Ibid., 28.

[46]Ibid.

[47]*Letter obtained from U.S. Military Censorship, Written by a Major in North Africa*, 1942, World War II Operational Documents Collection, Combined Arms Research Library Digital Library, 1.

[48]Ibid., 1.

[49]Lazenby, *Lessons from Torch*, 28.

[50]David Rolf, *The Bloody Road to Tunis: Destruction of the axis Forces in North Africa, November 1942-May 1943* (London: Greenhill Books, 2001), 123.

[51]Beck et al., 97.

[52]Ibid.

[53]Rolf, 135.

[54]Dunn, "Engineers in North Africa," 47.

[55]Beck et al., 98.

[56]Ibid., 100.

[57]Ibid., 107.

[58]Ibid., 101.

[59]Ibid., 103.

[60]Coll, Keith, and Rosenthal, 346.

[61]Beck et al., 564.

[62]Beck et al., 100. There were several attempts to bring defused German mines from the front to training sites. In one instance, General Clark, Fifth Army CG, utilized his own plane to fly samples back to his Army's mine school. Beck et al.,106.

[63]Beck et al., 100.

[64]Ibid., 103.

[65]Ibid., 104.

[66]Ibid., 105.

[67]Ibid., 107.

[68]Dunn, "Engineers in North Africa," 48.

[69]Ibid.

[70]Ibid.

[71]Coll, Keith, and Rosenthal, 254.

[72]Ibid.

[73]Robert R. Palmer, Bell I. Wiley, and William R. Keast, *The Army Ground Forces, The Procurement and Training of Ground Combat Troops* (Washington, DC: Historical Division Department of the Army, 1948), 454.

[74]Coll, Keith, and Rosenthal, 254.

[75]Ibid., 255.

[76]Ibid., 254-255.

[77]War Department Circular, 29 April 1943, quoted in Coll, Keith, and Rosenthal, 255.

[78]Coll, Keith, and Rosenthal, 250-255.

[79]Ibid., 256.

[80]Ibid., 256-257.

[81]Dunn, "Engineers in North Africa," 48.

CHAPTER 5

ENGINEERS IN EUROPE

Introduction

By August 1943, the United States military had attained its planned strength of 90 divisions and surpassed the planned date to be "mobilized, trained, and equipped for extensive operations."[1] Engineer operations following these milestones would have the advantage of full mobilization of the military, with the forces proposed in accordance with prewar plans. Engineers in Europe would also benefit from the lessons learned during combat operations in North Africa. This recent action resulted in both veteran engineer formations and improved training at the ERTC. Another key output of the North African Campaign was improved leadership at division level and above. In the spring and summer of 1943, the War Department implemented criteria requiring division commanders, assistant commanders, and artillery commanders to have held command positions in a theater of operations.[2] As veteran leaders, their employment of engineers would be more efficient and based upon recent combat experience.

Improved training and leadership as a result of the North African campaign, in combination with the achieved mobilization of the United States military provides an opportunity to observe the engineer operations of a more seasoned force. Engineer preparations for the initial invasion of Normandy was greatly improved, when compared to the hasty and uninformed training executed in advance of Operation Torch. The actions taken by the 291st Combat Engineer Battalion, to train in-theater, illustrates a method that could be utilized to train formations without exposing engineers to unnecessary risk. The Ninth Army's Rhine River Crossing Operation during the rapid advance through Germany was exemplary and demonstrates the advanced planning, preparation, and training of engineers in this theater when provided the time and resources to prepare adequately for such a complex tasking.

Planning for the Invasion

In mid-April, 1942 General George C. Marshall, United States Army Chief of Staff, and Harry Hopkins, President Roosevelt's personal representative, won British approval for a cross-channel invasion in 1943. The build-up of forces and equipment to cross the channel in 1943, code named Bolero, maintained momentum until as late as November 1942.[3] After several delays and multiple revisions, to accommodate Operation Torch and other Mediterranean operations, the plan was shelved.[4] The delay in the cross channel assault, however, was ultimately beneficial to the engineers. It provided an early plan that was continuously developed and revised from April 1942 until final execution. Additionally, training areas were developed and mission requirements were refined.

As operations in the Mediterranean were reduced, the Bolero plan reemerged. Several meetings were conducted involving the "Big Three" (Roosevelt, Churchill, and Stalin) to discuss future strategy. Discussions at the Trident Conference in May 1943 called for a strategic bombing campaign leading up to an invasion of Europe on 1 May 1944.[5] This bombing and invasion plan would take place while continuing operations in the Mediterranean. Later in 1943, during the Sextant and Eureka meetings, the build-up (Bolero) and cross channel invasion, now known as Operation Overlord, were deemed the top priority. This prioritization resulted in the rapid growth of Allied forces, to 1,446,000 soldiers, and expanded infrastructure in the United Kingdom.[6]

Training and Preparation for the Invasion

Combat engineer units arriving in the United Kingdom in 1943 and 1944 had varying amounts of proficiency in the tasks expected to be conducted in-theater. Assessments of engineer units' training status upon arrival in-theater ranged from "extremely satisfactory" to "needing extensive training."[7] In order to measure an engineer unit's proficiency, training tests were given in tasks including establishing a water point, setting up camouflage material, road construction, and building bridges.[8] Following these tests, most units generally needed only minor adjustments to bring the engineer unit up to "Military Training Program" standard.[9] In simple terms, once a unit achieved this standard it was deemed capable of successfully conducting its combat mission.[10] Prior to the invasion, units were earmarked for specific jobs based on performance on the proficiency tests.[11]

In March 1944, time was set aside for extensive training amongst engineer units.[12] The Troops Division, Office of the Chief of Engineers, suggested one to two months for many units after reviewing performance records. Engineers utilized this time to complete training in demolitions, bridging, and reconnaissance.[13] Full time training during this period consisted of 12 to 15 hour days to allow both day and night iterations of practiced tasks.[14] Training aids were designed, assembled, and made available to troops in the field to conduct refresher training deemed necessary by each unit.[15] To address areas of highest deficiency, four Bailey Bridge Training Centers, two heavy equipment schools, and mobile training teams to provide instruction on mines and booby traps, camouflage, and road repair were created.[16] The completion of training in the United Kingdom facilitated units arriving in the combat zone sooner and receiving instruction on engineer subjects, that focused on the European Theater.[17]

In addition to refresher-type training to improve basic engineer skills, an Assault Training Center, commanded by Colonel Paul W. Thompson, an engineer, was established on the northwest coast of Devonshire at Illfracombe. After its completion in March 1944, two months were available for training prior to the invasion. Reconnaissance of the French coastline resulted in underwater obstacles and demolitions being incorporated at the center to simulate expected German defenses. Training ranged from lectures on subjects associated with an assault landing, up to a series of full-scale unit exercises.[18] Another training opportunity provided in the United Kingdom facilitated "exchange parties" with British engineer counterparts. The exchange parties consisted of an officer and 10 enlisted men utilizing 15 days to learn the techniques, weapons, tools, and tactics of the other country.[19] Increased comradeship and understanding between the United States and United Kingdom was an additional by-product of such training events.

In addition to training to support the invasion, a replacement depot was established to "round out" replacements before they continued to their forward unit to support combat operations. An engineer training officer, cadre, light equipment, and training aids were procured to provide this theater-specific instruction. The training center later lost its importance after being moved onto the continent. Engineer replacements were in high demand, which curtailed their training as a result of the short stay at the depot.[20]

Combat Engineers in the Normandy Invasion

As engineers headed for the Omaha shore on the initial wave for landing at the beaches of Normandy, heavy shells from the naval bombardment whistled overhead, minutes later bombers flew over dropping an estimated 1,300 tons of bombs on the beach defenses. Next, a British "rocket ship" unleashed a barrage of 9,000 missiles at the fortifications the men would face upon landing.[21] This display gave credence to the briefing they were given aboard the transport ship, "There will be nothing alive on the beach when you land."[22] Unfortunately, this statement was overly optimistic. Cloud cover required the bombers to drop their bombs using blind bombing techniques, only two sticks of bombs landed within four miles of the beach defenses. The British rockets missed altogether and destroyed the ground behind the cliffs and the naval barrage had great effect on inland German communication, but did little to damage German fortifications on the beach.[23]

Engineer "gapping teams" were the first to land on the Normandy beaches known as Omaha and Utah. The 146th and 299th Engineer Combat Battalions would assault Omaha and the 237th Engineer Combat Battalion would clear Utah. In accordance with the invasion plan, these engineers would have just under 30 minutes to open holes in the obstacle belts to allow the following main body of infantry to make safe approaches to the landing sites.[24] Each engineer was weighted down with gear required to execute his specific mission. Aside from their basic load, the unique items carried by engineers to breech obstacles added to the challenge of getting to cover under withering enemy fire.[25] Inside each landing craft, engineers had two rubber boats containing 500 pounds of explosives and 75 to 100 cans of gasoline, among other items to support the mission of this initial wave. These boats were prime targets for the defending Germans and were quickly abandoned.[26]

In early planning, Utah Beach was identified as the landing that would incur the most casualties because the beach provided less cover and the Germans were expected to flood the exit avenues from the beach.[27] Sergeant Frederick Peters, an engineer with the 237th Engineer Combat Battalion (who had previously landed at Oran in North Africa) and squad leader of a gapping team, strained to identify the windmill that was to serve as his landmark. He didn't see the windmill on approach and assumed it had been destroyed during the initial barrage. He later realized Allied forces had missed their planned landing site by about a mile and in doing so avoided two batteries of German soldiers and a majority of the 13 German 88s that had been registered on their intended beach.[28]

The landings at Omaha weren't as fortunate. They arrived at a heavily fortified beach with high cliffs.[29] Landing craft were hit by mortar shells and 88s as soon as the ramps dropped; others were mowed down as they attempted to clear the tide to reach cover. Some engineers sank into the ocean and drowned while expeditiously exiting craft which were unable to reach shallower areas due to enemy fire or obstacles.[30] On D+5, when the Army elements of the gapping teams at Omaha reverted back to the control of their respective higher headquarters, they had lost nearly 40 percent of their original strength. The extraordinary efforts of the gapping teams, to establish Allied beachheads, came at a heavy cost and resulted in the awarding of 15 Distinguished Service Crosses.[31]

The preparation for the invasion of Normandy was far superior to engineer initiatives in the past. In-theater assessments of each unit's strengths and weaknesses maximized the potential for success of this historic mission. Unlike the previous amphibious assaults in North Africa, resources were available for training and full scale unit rehearsals. These rehearsals were further enhanced by training areas that were developed to mimic the intended landing areas. The training in-theater ensured engineer units were competent in their invasion tasks and able to adjust to challenging conditions to establish the beachheads.

The 291st from the Breakout at Normandy to the *Bocage*

The 291st Engineer Combat Battalion, formed in April 1943, was not unlike other engineer units of this era. This unit consisted of traditionally trained engineers, fillers, and inexperienced officers. Few had any formal or informal engineering experience or training and no one had served in combat.[32] The only officers in the battalion above the rank of Second Lieutenant were the battalion commander and executive officer. Only three Lieutenants had college degrees (one was in engineering), several had two or three years of college, but a majority had only high school diplomas.[33] Although inexperienced and as-yet untrained, the 291st Engineer Combat Battalion utilized innovative means to prepare for combat, which ultimately led to multiple successes on the battlefield.

To offset the lack of military experience, the 291st utilized news from units in combat to stress key aspects of combat engineering in preparation for their deployment. As a result, they emphasized small unit, company, and battalion level training exercises utilizing both wire and radio communications.[34] Soldiers at all levels were trained to operate efficiently during “hit and run” operations. These tactics were utilized to delay enemy forces in advance of infantry and armor units. To improve leadership and decision-making, time was spent developing leaders by emphasizing combat leadership traits in subordinates.[35] Another unique aspect of this unit's preparation was its detailed cross-training program. Expecting heavy casualties, the commander wanted to mitigate the effects of casualties on unit performance. Prior to entering theater, all members were provided instruction on the use of each weapon within their squad. Each engineer learned to detect, lay, and clear mines and to operate all tools large and small. Additionally, each engineer was proficient in building the three main types of bridges (Bailey, timber trestle, and pontoon).[36]

In final preparation for deployment, the unit completed a large scale maneuver with the newly formed Third Army in Louisiana. Major David Pergrin, the Executive Officer, learned of his unit's "excellent" rating during the maneuvers, while at the same time being informed by the Brigade Commander that he would replace the Battalion Commander who had injured his back.[37] Pergrin, at 26 years of age, would be leading a battalion of engineers into combat.[38]

The 291st had conducted all training required for deployment, and scored well in evaluations, still Pergrin felt his unit was unprepared for the hardships it was about to endure.[39] Prior to arriving at Omaha Beach on 23 June 1944 (D+19), the 291st had no combat veterans. In less than six months, these engineers would help prevent *Kampfgruppe Peiper's* attempted capture of Antwerp during the Battle of the Bulge and be the first to cross the Rhine River.[40] In his initial guidance to officers and staff after arriving at Normandy, he stressed that "we were not in France to confront Germans as infantry and that we would not become embroiled in direct combat unless we had to in support of our engineer mission."[41] This guidance and Pergrin's leadership allowed engineers to incorporate disciplined initiative to accomplish missions on a graduated scale, without risking personnel and equipment unnecessarily.

The 291st operated within 30 miles of the coast for the first 25 days in-theater. During this period the engineers were able to perfect techniques and procedures without facing small arms or machine gun fire. Operations requiring road construction, mine clearing, defeating booby-traps, and bridge building, further improved the untested engineers.[42] The unique development of the staff officers was also notable. Officers were sent forward to join engineer units conducting operations in direct contact with enemy forces. These officers captured detailed descriptions of the required preparations for various missions and shared these lessons with other members of the 291st.[43] The battalion's intelligence officer displayed further initiative when he secured a ride with an artillery spotting Piper airplane and noted artillery positions, blown bridges, and obstacles that could effect future operations.[44] Engineer soldiers became tactically proficient and staff officers prepared for forward operations while maintaining responsibility for a rear area. Initiative on this scale to correct shortfalls in training, by both officers and soldiers, was rarely documented during combat operations in World War II.

After observing combined infantry and engineer operations attempting to break through the *bocag*e near Vierville, France, now Lieutenant Colonel Pergrin envisioned using the engineer's organic bulldozers to break through the nearly impenetrable growth. He ordered his B and C Company Commanders to find a way to protect bulldozer operators with makeshift armored driving compartments. By the next afternoon, the "armored bulldozers" were crashing through the vegetation followed by infantry rushing into often startled German defenders. This new technique was passed throughout the allied line and utilized until replaced by tanks fitted with prototype hedgerow penetrators.[45]

The opportunity to execute tactical tasks under mild conditions near the beachhead allowed this untried unit to gain experience without having to stake its survival on the outcome of the mission. The 291st took full advantage of this opportunity to train and would serve with distinction in future operations including their contribution during the Battle of the Bulge and the crossing of the Rhine River. The leadership provided by Pergrin encouraged initiative and empowered all officers and soldiers to excel in combat.

The Ninth Army Bridging the Rhine

As Allied forces approached the Rhine River, the discovery of the intact Ludendorff Bridge at Remagen was a surprise. Allied intelligence incorrectly assumed the Germans had destroyed all bridges. The Germans had rigged the Ludendorff with explosives and had to resort to engaging the fuse by hand after their ignition switch failed, as United States forces closed within visual range. The resultant explosion did not completely destroy the bridge, leaving a capable footbridge, which was reinforced for vehicle traffic by the Allies before it finally succumbed to blast damage and collapsed. In the vicinity of the Ludendorff Bridge both the 51st and 291st Engineer Combat Battalions hastily built bridges to exploit the crossing site. Their efforts were noteworthy and resulted in the first crossing of the Rhine River, but historical documents left by the Ninth Army provide a detailed account of the requirements to execute an opposed crossing elsewhere without any established foot bridges.[46]

The Ninth Army's planning and preparation for the crossing of the Rhine River began in October 1944, with a targeted crossing date of 15 December 1944. This date was pushed successively later due to delays in the advance across Europe.[47] On account of the magnitude and unusual features of the Rhine crossing, it was considered a major operation, second only to the channel crossing and establishment of beachheads.[48] To prevent each corps from preparing a separate crossing plan, the XVI Corps was selected to design the operation.[49] This planning strategy retained maximum flexibility within the Ninth Army, since it was impossible to predict which corps would be available for the initial assault and crossing two months prior to the proposed execution date. Additionally, it allowed the other corps to devote maximum resources to their combat operations without contemplating the inevitable crossing. Planning guidance included that crossings would be made by two corps, each would provide two battalions for the initial assault.[50] Seven total bridges would be constructed with netting to supplement the construction, to defend against German floating mines and Gamma swimmers.[51]

In order to train units for this operation, the Ninth Army established the "Army Stream Crossing School" in November 1944, on the Maas River in the vicinity of Roermand and Maeseyck. Supervised by the 1143rd Engineer Combat Group, the school taught all skills required to execute the crossing, from construction of bridges to operation of all water craft to be utilized.[52] Engineers operated the school continuously until March, with occasional interruptions caused by enemy action, floods, and lack of engineer troops due to operational requirements.[53] To address training in pile driving, which was not possible at the school, select engineers were attached to other units that were executing heavy bridge construction projects.[54]

After crossing the Roer River and as progress for the attack permitted, the 30th and 79th Infantry Divisions were withdrawn from the line to conduct dedicated training in preparation for the Rhine crossing.[55] Engineers from the 1153rd and 1148th Engineer Combat Groups were chosen to support the infantry divisions during the crossing and trained with them during this period. Together infantrymen and engineers learned the capabilities and limitations of the respective assault craft that would be utilized. Their assault training culminated in full scale rehearsals, in both daylight and darkness. All guides and beachmasters were utilized and the infantry that would execute the assault were crossed by the same engineers that would later support them at the Rhine River.[56] This deliberate training was aimed to correct any shortfalls experienced in previous amphibious landings. The ability to build unit cohesion through combined arms training was critical to the success of the future operation.

As soon as the west bank of the Rhine was secured by the Allies, all intelligence sections of the XVI Corps' engineer units were detached and placed directly under the Corps Engineer. This group of experienced intelligence engineers reconnoitered the entire area of the Ninth Army's section of the Rhine to identify portions of the flood plain that could be negotiated by vehicles and tanks. They also located possible ferry and bridging sites.[57] This consolidation facilitated rapid collection of information, avoided duplication of effort, and minimized disclosure of intention to the enemy by minimizing the exposure of the reconnaissance elements.

On 11 March 1945, after XVI Corps was assigned the crossing mission, road construction and improvement began on the approaches to the river. Constant enemy artillery fire required construction to take place at night. To prevent enemy forces from identifying the true crossing sites, XIII Corps increased road improvement activity to the south of the actual crossing area as part of the deception plan.[58] All possible work which would expedite the crossing was accomplished prior to the proposed execution date. Key vehicles were staged as close as possible to crossing sites, including 100 dump trucks filled with rock for final construction of the approaches and the storm and assault boats to be launched on the initial wave. Communication was addressed by installing dual signal lines to allow crossing sites to speak with higher headquarters while also communicating laterally to other crossing sites. Pneumatic floats to build the bridges were inflated and loaded onto trucks, minimizing the time needed to float them at the water's edge. Initial protection was accomplished by emplacing tank destroyers near the sites to deal with anything the Germans might send downstream (barges, boats, submarines), employing barrage balloons and anti-aircraft battalions to counter aircraft strafing, and smoke generating units to camouflage the initial approaches and crossing elements.[59] Such care was taken to account for every detail, medical department chemical heating pads were utilized to warm the engines of the assault boats to ensure they would start on the morning of the crossing.[60]

On 18 March, XVI Corps issued its mission order to subordinate units. It indicated that D-Day would be 24 March and H-hour 0200.[61] The 79th Infantry Division was directed to attack on the right, the 30th to the left, supported by the same engineers they had trained with during the rehearsals.[62] The assaults would be offset by one hour (30th at 0200 and 79th at 0300) and preceded by a one hour artillery prep of the far shore.[63] As soon as the artillery fire was shifted to support the 79th, all 150 landing craft of the first wave easily started and launched near simultaneously.[64] An engineer river patrol consisting of two motor propelled boats operated continuously upstream of the crossing site. Armed with two 50 caliber machine guns, two "bazookas," a radio with communication to the tank destroyers and prefabricated five pound demolition charges, their mission was to intercept any enemy barges or other large floating objects and to prevent Gamma swimmers from reaching the bridges. During hours of darkness in the initial stages of construction, charges were detonated every five minutes in the water to discourage any possible swimmers from sabotaging the bridge.[65] By 1500 on D+1 engineers were instructed to begin work on the bridging sites. Over 600 truckloads of bridging material arrived without interruption throughout the operation, in accordance with a detailed traffic plan.[66]

The challenges endured during this operation included constant enemy artillery fire, and requiring bridgeheads to be relocated on multiple occasions. Strafing by enemy aircraft occurred once, without damage, and the plane was shot down. Several errant barges and other boats that lost engines floated into the bridges causing damage.[67] The first of the seven bridges completed was a 1,284 foot long M2 treadway bridge that was open for traffic at 0405 on D+2.[68] The preparation for the Rhine River crossing from the independent planning, development of the training area, reconnaissance of bridging sites, deception operations, and the staging of equipment and supplies resulted in the near seamless execution of one of the largest river crossings in history. The successful completion of this complex operation is indicative of the capability of combat engineers given the time and resources to conduct proper training, and experienced leadership to make the correct tactical and operational decisions.

Victory in Europe, 8 May 1945

After the Allied crossing of the Rhine, the defeat of the German military was all but assured. A rapid pursuit of the Germans from the west by Allied forces concluded in a link up with Soviet Union forces from the east at the Elbe River on 25 April 1945.[69] On 30 April 1945 Hitler committed suicide in his Berlin bunker.[70] His successor, Admiral Karl Doenitz, sent General Alfred Jodl to the Supreme Allied Headquarters in Reims to meet with General Dwight D. Eisenhower to seek terms to end the war. On 7 May, Jodl signed the unconditional surrender of German forces on both fronts. V-E Day was celebrated after the surrender went into effect on 8 May 1945.[71]

Effects of Victory in Europe and Japan on Engineer Training

The end of hostilities in Europe and Japan (celebrated as Victory in Japan Day, 2 September 1945) brought about a rapid declination of trainees within the engineer schools. The authorized capacity of officer trainees on 1 October 1945 was 1,504. This authorization was reduced to only 95 officers on 31 December of the same year.[72] Fort Belvoir attempted to capitalize on the drawdown in-theater, 34 officers with overseas experience were received between June and December 1945 to serve as instructors. However, the rapid attrition caused by the "Point Release System" left only four of these officers at the school by the end of the year.[73] Any attempt to maintain experienced tactical officers was limited by the rapid reduction of forces. Instructors for replacements and fillers were also lacking at the end of the war. The men with low war time points, those released from line units, and men who required limited assignments were employed to teach aspiring engineers. Captured in the assessment of the replacement training center, “The choice was small, and some instructors were selected and trained who at other times and under better conditions, would not have been chosen.”[74]

Following V-E Day and for a short time after V-J Day, all training concentrated on operations in the Pacific. This training was replaced by the requirements of an occupational army and peace time training.[75] Efforts were made to remove all mention of Japan as a specific enemy during instruction and training in tactics related to the Pacific were deemphasized.[76] Subjects focused less on amphibious operations and more on basic items such as military discipline and appearance, leadership, security, and field training.[77] The training requirements of an occupation army did not have to be as stringent as an army on the offensive. This allowed a limited number of replacements to be sent overseas to receive their technical phase of instruction, thus reducing students at the school house, while providing manpower to allow those veterans with higher points to redeploy sooner.[78]

Experienced gained in four years of war brought about changes in areas deemed critical to engineer training. An increased focus on leadership for officers was apparent by the introduction of qualitative evaluations given to each officer to assess their leadership potential. Any engineers found to be “borderline” or “unsatisfactory” were sent to a three week troop leadership course. After successful completion, they were returned to a later class to complete engineer training.[79] Operational experience in all theaters indicated that heavier bridges were used far more than light bridges, hence more emphasis was placed on training in heavy bridging (class 40 and heavier). Familiarization was provided in the utilization of the 25-ton pontoon and M2 treadway bridges, while the Floating Bailey and M3 bridges were removed from training.[80]

The end of the war also brought about reductions in training deemed “hazardous.” Hazardous training for officers included throwing live hand grenades, use of fireworks attached to fuses in mine training, transition firing exercises, and infiltration courses.[81] The replacement center had similar reductions in training. Instruction in “village fighting” was removed, blank ammunition replaced live ammunition in all fire and movement problems, and the detonation of explosive charges near troops in training was discontinued. On a positive note, training that was deemed dangerous was revised to include additional safeguards to limit exposure during demolitions and operation of heavy machinery.[82]

Despite the removal of explosive devices and live ammunition from training events and the high turnover of instructors as a result of rapid demobilization, training standards were maintained. This assessment is supported by the continuous inspections and evaluation of recruits and officers by combat experienced senior engineers. Training timelines were also increased from six to nine weeks which increased available time for subjects. Morale of trainees improved due to the reimplementation of legal holiday observation and a reduction of training hours from a minimum of 48 to only 40 hours a week.[83]

Conclusion

Unlike other theaters, available manpower, equipment, and time allowed for planning and rehearsals for operations as engineers closed in on major objectives in the final advance into Germany. The concerted effort to train for the landings at Normandy, the effective development of the 291st in combat, and the detailed planning and preparation for crossing of the Rhine by the 9th Army, are three examples of training and preparation in the European Theater by engineers. The extensive training and detailed preparation required to conduct successful engineer operations was acquired after multiple refinements to operational plans and intensive study to learn from past successes and failures of engineers in other theaters. The War Department's adjustment in selection of senior leaders quantified the value of combat experience in key positions. The intangible effect of military leadership on operations was cultivated in engineer training following the war, a trait that seems to be reintroduced often during drawdowns following major combat operations.

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[1]Watson, 340-341. In a typed note to General Marshall, dated 2 June 1941, General Maloney made the following estimate, "July 1, 1943 as the earliest date when the US armed forces can be mobilized, trained, and equipped for extensive operations."

[2]Palmer, Wiley, and Keast, 440-441.

[3]Beck et al., 22.

[4]Beck et al., 22-24. Bolero's third revision accounted for adjustments to support Operation Torch while simultaneously executing the cross-channel invasion in 1943.

[5]Ibid., 256.

[6]Ibid., 257.

[7]Moore, 148. Also see Beck et al., 289 for the variation in training and readiness of engineers.

[8]Moore, 150.

[9]Ibid., 149.

[10]Ibid.

[11]Ibid., 153.

[12]Beck et al., 290.

[13]Ibid., 290-291.

[14]Ibid., 290.

[15]Moore, 151.

[16]Ibid., 153.

[17]Ibid.

[18]Beck et al., 293.

[19]Ibid, 293.

[20]Moore, 153.

[21]Beck et al., 320.

[22]From Fane and Moore, *The Naked Warriors*, 50, quoted in Beck et al., 320-321.

[23]Beck et al., 321.

[24]Ibid, 319.

[25]Peters; Beck et al., 320. Each man carried a forty-pound bag of Hagensen packs, wire cutters, a gas mask, cartridges, an inflatable life belt, a canteen, rations, and a first aid pack. Each had either a carbine or Garand rifle or Bangalore torpedoes to handle wire obstacles on the beach. To accomplish their specific tasks, some carried mine detectors, heavy wire reels wound with 800 feet of primacord, others carried bags of fuse assemblies. Over his uniform each engineer wore coveralls impregnated against gas and over them a fur lined jacket. SGT Peters and his engineer squad assaulted Utah Beach and each carried 76 pounds of TNT.

[26]Beck et al., 320. Inside each landing craft, engineers had two rubber boats containing 500 pounds of explosives, extra bangalores and fuses, mine detectors, gap markers, buoys, and 75 to 100 cans of gasoline.

[27]Peters, 34.

[28]Ibid., 33.

[29]Peters, 34. The "German 88" was an eight-eight millimeter artillery piece that was utilized in many applications, including indirect fire and anti-aircraft and anti-tank targeting.

[30]Beck et al., 321-326.

[31]Ibid., 326.

[32]David E. Pergrin and Eric M. Hammel, *First Across the Rhine, The 291st Engineer Combat Battalion in France, Belgium and Germany* (New York, New York: Macmillan Publishing Company, 1989), 7.

[33]Ibid., 8-9.

[34]Pergrin and Hammel, 7-8. Effective communication between units was identified as a key component of the German Blitzkrieg operations by the staff of the 291st.

[35]Ibid., 18.

[36]Ibid.

[37]Ibid., 10.

[38]Pergrin and Hammel, 10. These exercises began on 26 July 1943. The primary duty of the unit was to serve as the army-level support asset.

[39]Ibid., 21.

[40]Pergrin and Hammel, 7. The 291st's exploits, to defend Antwerp against the German assault during the Battle of the Bulge, are captured in the intriguing book *Those Damned Engineers* by Janice Holt Giles.

[41]Ibid., 27.

[42]Ibid., 29-51.

[43]Ibid., 42.

[44]Ibid.

[45]Ibid., 33-34.

[46]Michael D. Doubler, *Closing with the Enemy, How GIs Fought the War in Europe, 1944-1945* (Lawrence, KS: University Press of Kansas, 1994), 160-165. Additional details about the discovery of the Ludendorff Bridge and its collapse can also be found in *The Last Offensive*, 225-230.

[47]Richard U. Nicholas, *Ninth US Army 1945, Engineer Operations in the Rhine Crossing* (unknown binding, 30 June 1945), World War II Operational Documents Collection, Combined Arms Research Library Digital Library, 5.

[48]Ibid., 170.

[49]Ibid., 5.

[50]Ibid., 7.

[51]Nicholas, 7. The list of bridges to be constructed included two M2 treadway bridges, two 25-ton pontoon bridges, two Class 40 floating Bailey Bridges, one semi-permanent two-way class 40, and a one way Class 70 pile bridge. German Gamma swimmers were similar in purpose to U.S. Navy Frogmen of the era.

[52]Nicholas, 12. The total list of skills taught at the school: construction of the Bailey Bridge, Seamule operation, construction and operation of rafts and ferries, LCVP/LCP loading and unloading, outboard motor operation, construction of treadway bridge, boom installation.

[53]Ibid., 11.

[54]Nicholas,12. The 332nd General Service Regiment and to the 1056th Engineer Port Construction and Repair Group, were executing heavy bridge construction projects at the time.

[55]Ibid.

[56]Ibid.

[57]Ibid., 7.

[58]Nicholas, 11. In several sources, terms indicating an “artificial moon” were used while working at night to illuminate the work area. After comparing several sources, this artificial moon was accomplished by spotlights normally utilized to look for enemy aircraft being reflected off of overhead clouds. It provided light similar to a full moon and reduced the signature that would be provided by direct beams on the work area.

[59]Ibid., 11.

[60]Ibid., 19.

[61]Ibid., 14-15.

[62]Ibid., 15.

[63]Ibid., 19.

[64]Ibid.

[65]Ibid., 30.

[66]Ibid., 32.

[67]Nicholas, 15-42. It was determined that bridges that had been blown by the Germans were registered by their artillery. Several of the bridges that were constructed near these demolished bridges were relocated.

[68]Ibid., 39.

[69]Charles B. MacDonald, *United States Army in World War II, The European Theater of Operations, The Last Offensive* (Washington, DC: Center of Military History, 1993), 319-320.

[70]Ibid., 459.

[71]Ibid., 474-475.

[72]Historical Section, Technical Information Branch, Office of the Chief of Engineers, The Training of Engineer Officer Candidates, 1 July 1945-31 December 1945, The Engineer School, Fort Belvoir, VA, Unpublished Manuscript, 1946, Combined Arms Research Library, 1.

[73]Ibid., 1.

[74]Historical Section, Technical Information Branch, Office, Corps of Engineers, The Training of Replacements and Fillers in the Corps of Engineers, 1 July 1945-31 December 1945, The Engineer School, Fort Belvoir, VA, Unpublished Manuscript, 1946, Combined Arms Research Library, 23.

[75]Ibid., 14.

[76]Historical Section, Technical Information Branch, Office of the Chief of Engineers, The Training of Engineer Officer Candidates, 1 July 1945-31 December 1945, 2.

[77]Historical Section, Technical Information Branch, Corps of Engineers, The Training of Replacements and Fillers in the Corps of Engineers, 1 July 1945-31 December 1945, The Engineer School, Fort Belvoir, VA, Unpublished Manuscript, 1946, Combined Arms Research Library, 14.

[78]Ibid., 2.

[79]Historical Section, Technical Information Branch, Office of the Chief of Engineers, The Training of Engineer Officer Candidates, 1 July 1945-31 December 1945, 5-7.

[80]Historical Section, Technical Information Branch, Office of the Chief of Engineers, The Training of Replacements and Fillers in the Corps of Engineers, 1 July 1945-31 December 1945, 17-18.

[81]ASF Circular No. 393, 19 October 1945 and Headquarters, Fort Belvoir, Virginia, Letter to the Commandant, The Engineer School, "Hazardous Training," available as Exhibit IV in Historical Section, Technical Information Branch, Office of the Chief of Engineers, The Training of Engineer Officer Candidates, 1 July 1945-31 December 1945, 5.

[82]Historical Section, Technical Information Branch, Office, Corps of Engineers, The Training of Replacements and Fillers in the Corps of Engineers, 1 July 1945-31 December 1945, 17.

[83]Ibid., 2 and 37.

CHAPTER 6

CONCLUSION

The engineer training system of World War II was not able to prepare adequately the rapidly-formed combat engineer units for their primary role as specialized technicians, and even less so for their secondary role as combat troops, due to the isolationist strategy implemented following the Great War, the inability to field trained engineers to meet the combat requirements in three major theaters, and the lack of combat experienced leadership within the Corps of Engineers. The engineer training system of World War II was never able to replicate the quality of engineer developed during the interwar period, but improved leadership, tactical and operational experience, and more efficient utilization throughout the conflict resulted in highly capable engineer units by the war's end. Lessons in mobilization, training, and leadership can be drawn from this research to ensure that future formations are better prepared to meet combat requirements.

In September 1939, the 786 officers and 5,790 enlisted members of the United States Army Engineer Corps could not support the rapid expansion required of engineer forces and provided little opportunity to successfully execute War Plan Orange as part of the Protective Mobilization Plan.[1] The incremental approach of the United States' Government to implement a military expansion following Hitler's denouncement of the Treaty of Versailles in 1935 and continued slow response following Germany's invasion of Poland in 1939, prevented combat engineers from being properly trained in sufficient quantities to meet the demands of the rapidly formed military. Initial estimates by the War Department required 18 months following the attack on Pearl Harbor to be "mobilized, trained, and equipped."[2] The minimal engineer force of the interwar period was unable to mobilize fully due to the surprise attack at Pearl Harbor and subsequent declaration of war, which prevented the United States from fielding a properly trained and equipped force at the onset of hostilities. The Corps of Engineers may have been better prepared had more emphatic preparations been implemented as a result of either of Hitler's belligerent actions.

The resultant expansion required to address the global war exposed the degradation of the engineer training infrastructure. Facilities were inadequate and in many cases had to be constructed to support the training requirements of mobilizing forces. The limited quantity of experienced engineers prevented the simultaneous manning of units and service as instructors. The combination of a lack of facilities and instructors prevented an increase in output of trained engineers to the force. The immediate demand for engineers, in the absence of training opportunities, resulted in fillers being sent to the force without training in basic military or engineer tasks. The few engineers that completed the now abridged training were retained as instructors to meet the increased output requirement of the training institutions. This resulted in engineers being trained by men who had only the experience gained while completing their entry-level coursework. It is critical that training institutions are maintained and that a sufficient number of engineers are retained to both train and field units during rapid mobilization.

The failures of engineers in the early battles of World War II were directly attributed to ineffective training for combat, minimal equipment available with which to train, and engineers who had no prior engineer experience before entering the military.

The shortfalls in basic engineer tasks were overcome, in many cases, after engineers conducted hands on training in combat. As a result, combat engineers endured heavy casualties early in the war due to the unpreparedness of the force. In the Philippines, during the first combat operations of the war, engineer units were incapable of basic tasks such as preparing defensive positions and utilizing demolitions. In North Africa, at Kasserine Pass, the 19th Engineer Combat Regiment amassed 127 casualties in a three day holding action. The losses by the 19th were attributed to the lack of "hard, realistic training" prior to combat. Each of these training deficiencies could have been prevented with increased military readiness during the interwar period.[3]

War is dynamic and the exact location of the next battle is difficult to predict. The engineers of World War II utilized in-theater training to capitalize on recent lessons learned and to educate the force on unique aspects of the environment faced. Following the victory in North Africa, the Corps of Engineers began to reap the benefits of recent combat experience. Tactics, techniques, and procedures were provided from combat veterans to the training facilities. Integration of live munitions, night missions, and additional bridging exercises added complexity to combat focused training. The full mobilization planned by the War Department also improved the availability of resources. Shortages of equipment, which plagued the training facilities, were now fulfilled allowing new engineers to handle the rifles and operate the machinery they would utilize in their theater of operation. Determined to prevent the shortcomings in previous training, engineer units arriving in Europe prior to the Normandy invasion were given proficiency tests. These evaluations allowed the Chief Engineer to address any deficiencies, before going into combat, with innovative means such as mobile training teams and training centers that had been built to replicate future objectives. The selection of units for specific missions, based upon their performance during the assessments, ensured trained units would accomplish critical tasks during the historic operation. Following hostilities in Europe, as engineers transitioned to the Pacific Theater, a theater training school was established to ensure the reconstituted engineer units had the skills required to perform successfully in the jungles of the Pacific, while conducting the island hopping campaign. In-theater training, which was beneficial in the 1940s, could be augmented with support from the Center for Army Lessons Learned to further educate units prior to arriving in-theater. Upon arrival in-theater, relationships develop through bilateral exercises, state partnership programs, and regional alignment, which increases familiarity with the operating environment.

Another immeasurable effect on the efficiency of engineers operations in combat was the value of experienced engineer leadership. Throughout the war exceptional leaders bridged the gap created by the lack of training and equipment. The value of combat-experienced leadership was evident in the earliest engineer operations of the war during the defense of Bataan. General Hugh Casey, the Chief Engineer, provided direct guidance and leadership to his inexperienced formations. Casey's forethought on multiple occasions demonstrated the ingenuity of a trained engineer leader. The War Department formally recognized the value of leadership experience in combat following operations in North Africa. Prior success as commanders in a combat theater was identified as criteria for the selection of division leadership. This combat experience resulted in critical operations such as the Rhine River crossing being executed following a proper build-up and preparation that addressed shortfalls experienced in previous major operations. In several critical missions, the value of experienced leadership reflected positively on the planning, training, and execution of engineer operations. As a result leadership development following the war was emphasized. Additional measures to evaluate leadership traits were implemented into the engineer officer's course. Any officer found to possess "borderline" or "unsatisfactory" leadership traits was sent to a three week troop leadership course. After successful completion, they were allowed to reenter training.[4]

The engineers of World War II overcame the challenges of rapid mobilization to field units that executed highly technical operations in combat. The shortened training, rapid deployment, and limited experience within the corps were overcome with dedicated leadership and by capitalizing on lessons learned during recent combat. Research of other branches during this period of rapid mobilization could provide similar lessons, to better prepare current forces for rapid growth. In addition to lessons from specific branches, the rapid reduction of the military following the Great War and World War II was replicated following Korea, Vietnam, and the Gulf War. Each reduction resulted in a military that experienced difficulties while mobilizing for the following conflict. Leaders within the military will benefit from research which identifies common practices which were successful, but not initially utilized during each build-up. Another opportunity, during this period of regional alignment and diversification of military leaders, would be to research the training facilities that were established to support operations in the diverse battlefields of World War II. The unique aspects of each could be captured and utilized to improve current training as the Army attempts to improve skill sets that have atrophied during the wars in Iraq and Afghanistan (jungle warfare, amphibious assaults, artic operations).

The United States military is technically more complex than that of 1941, but the experience of the combat engineers in World War II is of great relevance to the Army of today and the future. United States policy makers should be wary of the true cost of the swift reduction of military forces following extended operations. The initial requirement to grow a professional force, due to a rapid drawdown, cedes the tenet of current unified land operations requiring the Army to "seize, retain, and exploit the initiative" on a strategic level.[5] The value of a trained, ready force, to rapidly end a conflict can be less expensive monetarily and reduce the casualties experienced during a protracted war. Concerns related to a smaller and less capable military, created as a result of current budgetary constraints, are voiced in the Chairman's assessment of the 2014 *Quadrennial Defense Review* and appear eerily similar to those faced by the nation preparing for war in early 1941.[6]

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[1]Coll, Keith, and Rosenthal, 109.

[2]Watson, 340-341. In a typed note to General Marshall, dated 2 June 1941, General Maloney made the following estimate, "July 1, 1943 as the earliest date when the US armed forces can be mobilized, trained, and equipped for extensive operations."

[3]Beck et al., 98.

[4]Officer Candidates late '45, 5-7.

[5]Headquarters, Department of the Army, Army Doctrine Reference Publication (ADRP) 3-0, *Unified Land Operations* (Washington, DC: The Government Printing Office, 2012), 2-1.

[6]General Martin Dempsey's Assessment of the March 2014 Quadrennial Defense Review, specifically pages 62-64.

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