(2)

STUDY PROJECT

ARMY CONSTRUCTION POLICY: AN HISTORICAL ANALYSIS

BY

LIEUTENANT COLONEL WALTER J. CUNNINGHAM, JR.
United States Army

USAWC CLASS OF 1991

U.S. ARMY WAR COLLEGE, CARLISLE BARRACKS, PA 17013-5050

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED	1b. RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION/AVAILABILITY OF REPORT Cleared for public release. Distribution unlimited.
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S)	5. MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION U.S. Army War College 6b. OFFICE SYMBOL (If applicable)	7a. NAME OF MONITORING ORGANIZATION
6c. ADDRESS (City, State, and ZIP Code) Carlisle Barracks, PA 17013-5050	7b. ADDRESS (City, State, and ZIP Code)
8a. NAME OF FUNDING/SPONSORING ORGANIZATION 8b. OFFICE SYMBOL (If applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
8c. ADDRESS (City, State, and ZIP Code)	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO. / PROJECT NO. / TASK NO. / WORK UNIT ACCESSION NO.

11. TITLE (Include Security Classification)
Army Construction Policy: An Historical Analysis

12. PERSONAL AUTHOR(S)
COL Walter J. Cunningham, Jr.

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Year, Month, Day)	15. PAGE COUNT
Military Studies Program	FROM 8 Aug 90 TO 5 Apr 91	91/04/05	44

16. SUPPLEMENTARY NOTATION

17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	Engineer civil works, military construction policy, DOD bureaucracy, turf fights, MCA, history of the Corps of Engineers, flood control, hydro power,

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

The Department of the Army is responsible for two large construction programs: the Corps of Engineers Civil Works Program and the Military Construction, Army Program. The policies governing these programs are formulated in the offices of two different Assistant Secretaries of the Army. Dividing policy responsibilities generates additional overhead and creates artificial organizational boundaries that inhibit taking full advantage of the mutually supporting nature of the two programs. The approach used in this study is an historical analysis of the two construction programs and the associated policy apparatus. Based upon historical analysis, the author determines that policy responsibilities for the two construction programs can and should be combined under one Assistant Secretary of the Army.

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT	21. ABSTRACT SECURITY CLASSIFICATION
☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS	UNCLASSIFIED
22a. NAME OF RESPONSIBLE INDIVIDUAL COL David E. Shaver	22b TELEPHONE (Include Area Code) (717) 245-3275 / 22c. OFFICE SYMBOL AWCI

DD Form 1473, JUN 86 *Previous editions are obsolete.*

18. Subject Terms (Continued)

fortifications, rivers and harbors, Weitzel Lock, Quartermaster General, Cantonment Division, mobilization, logistics.

USAWC MILITARY STUDIES PROGRAM PAPER

ARMY CONSTRUCTION POLICY: AN HISTORICAL ANALYSIS

AN INDIVIDUAL STUDIES PROJECT

by

Lieutenant Colonel Walter J. Cunningham, Jr.
United States Army

Colonel David E. Shaver
Project Adviser

U.S. Army War College
Carlisle Barracks, Pennsylvania 17013

ABSTRACT

AUTHOR: Walter J. Cunningham, Jr., LTC EN

TITLE: Army Construction Policy: An Historical Analysis

FORMAT: Individual Study Project

DATE: 13 March 1991 Pages: 44 Classification: Unclassified

The Department of the Army is responsible for two large construction programs: the Corps of Engineers Civil Works Program and the Military Construction, Army Program. The policies governing these programs are formulated in the offices of two different Assistant Secretaries of the Army. Dividing policy responsibilities generates additional overhead and creates artificial organizational boundaries that inhibit taking full advantage of the mutually supporting nature of the two programs. The approach used in this study is an historical analysis of the two construction programs and the associated policy apparatus. Based upon historical analysis, the author determines that policy responsibilities for the two construction programs can and should be combined under one Assistant Secretary of the Army.

INTRODUCTION

The Department of the Army is responsible for two essentially civilian construction programs. The first is the Corps of Engineers Civil Works Program; the other is the Army's military construction program. Both are administered by the Army Corps of Engineers, but the policies governing these programs are formulated in two different offices. The Assistant Secretary of the Army for Civil Works is responsible for the former; the Assistant Secretary of the Army for Installations, Logistics, and Environment is responsible for the latter. This study project is about the simple notion that policy formulation for Army controlled and executed construction should reside in one place.

Combining the policy responsibilities under one assistant secretary will remove artificial organizational boundaries. Removing these organizational boundaries makes it easier to eliminate much of the bureaucratic overhead that formed to support the two policy making establishments. In addition, it becomes easier to cross-level technical resources between the two programs to take full advantage of the rare, truly synergistic relationship that exists between the civil works and military construction programs.

Because the programs are so vast and diverse, no attempt will be made to determine exactly where cuts can be made or how much can be saved. These are sensitive, complicated decisions that are best done at the lowest level possible. Instead, this study concentrates on creating the necessary conditions at the top that will enable leaders at lower levels to reduce their organizations

without retaining needless bureaucracy. The approach used is to outline an organizational design method that applies to government organizations. This methodology relies heavily on a detailed historical analysis that determines why Army construction is managed as it is and may reveal the best course for the future.

ORGANIZATIONAL DESIGN

Although this study is concerned with one narrow aspect of only one of the myriad functions of the Department of Defense, to fully understand the approach used in this Military Studies Project, it is necessary to review the overall makeup of the defense bureaucracy. The organization of the Department of Defense (DOD) was not designed in any real sense. It evolved. It is a living organism that has reached its present form through an immensely complicated interaction of personalities, politics, self-interest, culture, myth, tradition, managerial theory, expediency, and in some cases, what works. The result of this interaction is a series of offices with functions, roles, and missions delineated more as a by-product of bureaucratic struggle than any conscious effort to design the most efficient organization.

The defense establishment has had ten major reorganizations since 1947.[1] All this attention underscores the importance of the organization of the defense bureaucracy to the overall efficiency and productivity of DOD. The more efficient the organization of the bureaucracy, the more effective and

affordable it should be. The continued tinkering with the organization of DOD also implies that much of the previous tinkering did not work.

The normal goal of the reorganization studies is to attempt, as much as possible, to optimize the function being studied. Because of the size and complexity of defense activities, reorganization studies concentrate on individual segments rather than the whole organization. The measure of success is how much money can be saved. The data used by the study group is supplied by the organizations being studied. As a general rule, the study group recommends some level of consolidation, reduction of intermediate staffs, and elimination of a portion of the working end of the organization.[2] Occasionally, this approach works; all too often, it does not.

The goal to optimize the overall organization is the correct goal, but after that, the process tends to miss the mark. First, optimizing the parts does not necessarily optimize the whole; thus, before a given function can be adequately studied, all the activities that affect that function must be ascertained and analyzed together. In an organization as intricate as the Pentagon, this simple concept is difficult to accomplish; so it is often ignored, with the result that a piecemeal approach is taken to the analysis. This usually causes other problems that lead inevitably to the endless cycle of study and reorganization that is a permanent part of Pentagon life.

Second, money saved is invariably the worst possible indicator of success when attempting to design an optimally

efficient organization. Private for profit corporations are really about optimizing profits; so measuring the success of the organization by using dollars as the management indicator makes perfect sense. Translating this approach to analyzing government organizations is a mistake. Government organizations exist to provide specified functions; none of these functions is expected to turn a profit. Then, to optimize a government organization, the function for which it is responsible must be optimized. The management indicators selected to determine success or failure must be measures of the productivity in performing the function, not merely dollars saved. Simple cost comparisons are terribly misleading because they treat all cuts as the same. Thus, cuts in the operational activities, "muscle", are treated the same as cuts in overhead, "fat". Tremendous saving can be claimed when in fact the functions that are the organization's reason for being are reduced or eliminated, and the overhead per unit of output is increased. On the other hand, if the optimization processes are done properly, the cost will be reduced, but these savings result from an overall more efficient organization.

Finally, organizations must be optimized from the top down. Essentially, this means ensuring that the roles, missions, and functions of the organization are clear and do not encroach on other organizations, and that the policies governing the roles, missions, or functions are made in one place. Because of the complex interaction of political, personal, and historical forces during the evolution of the defense establishment, the authority for determining the policies that control some functions is

fragmented. This fragmentation inevitability causes the creation of needless overhead to respond to each policy maker that influences the organization or function. Also, additional coordination is required to ensure that each policy apparatus with an interest in the function is informed of actions affecting the function. This fragmentation is also a prime cause of time-wasting turf fights. Not surprisingly, the status and power of the policy makers discourage the average reorganization study from looking systematically at how, why, and by whom policy is made, but, unless this is done, truly efficient organizations can not be created.

The key to the design of efficient governmental organizations is the delineation of where and how policy for the various functions is made. The most reliable way to unravel the complex interaction of personalities, politics, self-interest, culture, myth, tradition, managerial theory, expediency and actual effectiveness that has evolved into the current policy structure is to conduct a detailed historical study of the organizations involved and all related functions. The historical study should concentrate on determining why the current structure was selected, what worked in both peace and war, and what conditions have changed that impact on the function. A product of the historical study is a clear understanding of the natural boundaries of the organization. These boundaries, coupled with a single policy apparatus for related functions, are an essential condition before an organization can be optimized or designed in its most efficient form.

CIVIL WORKS

Surrounded as we are in the United States by the peaceful works of engineering construction, it is difficult to appreciate the warlike traditions associated with engineers and their works. Until recently "engineer" meant what today is termed a military engineer. The first distinction between engineers occurred in the mid eighteenth century when the Englishman, John Smeaton, began calling himself a "civil engineer" to simply indicate that he was not a military engineer.[3] Specialization in engineering only began in the last 250 years or so; before that time engineers were expected to be proficient in all aspects of the profession. "The first engineers were irrigators, architects, and military engineers."[4] Curiously, either consciously or not, the Army's engineers are still organized around these ancient engineering disciplines--irrigation evolved into hydraulic engineering which is the essence of the civil works program; architectural construction equates to much of the work in the MCA program, and military engineering is still military engineering.

On June 16, 1775, the Continental Congress authorized a separate department with a "Chief Engineer and two assistants".[5] For twenty years after the Revolution, no permanent engineer structure was maintained.[6] The current Corps of Engineers was established by an act dated March 16, 1802.[7] The United States Military Academy was created by the same act. The legislation envisioned that the officers of the Corps of Engineers would be the faculty for the new Academy.[8] West Point became the only engineering school in the nation until the founding of Rensselaer

Polytechnic Institute (RPI) in 1824; RPI did not produce graduates until 1835.[9] As late as 1867 there were only three nonmilitary technical colleges in the country.[10] Thus during the critical formative years of the U.S. Government and its institutions, Army trained engineers were the only engineers available.

Whether the national government should or should not be involved in internal improvements was a major political issue in the early years of the new national government and was decisive in several presidential elections.[11] However, from the first year of the national government and into the first decade of the nineteenth century, the government authorized internal improvements. "How much of this early work was done by the Engineer Department is problematical, but there is plenty of evidence to show that it did participate."[12]

The British, by invading the country and burning the Capitol in the War of 1812, marvelously focused the strategic vision of the day. Based on studies after the war, Secretary of War, John C. Calhoun, recommended using the Corps of Engineers to improve the nation's rivers so troops and supplies could be moved efficiently during emergencies. These improvements were also expected to assist the public.[13] Congress accepted these recommendations and on April 30, 1824, passed the General Survey Act authorizing the President to use Army engineers to survey road and canal routes that may be of both commercial or military benefit. On May 24, 1824, Congress appropriated funds to improve navigation on the Ohio and Mississippi Rivers and authorized the

President to use the engineers.[14] These acts form the basis for the Corps' current civil works program. The end result was a uniquely American military organization, built in part to support an expansionist frontier tradition and to enhance both military and economic interest. Thus, the task of advancing the nation's technical potential in civil as well as military engineering was inherited by Army Engineers.[15] No other significant body of military engineers is so constituted; in a very real sense, the Corps of Engineers became "engineers of the state".[16]

To implement the 1824 legislation authorizing the President to use the Corps of Engineers on internal improvements, a board composed of two senior officers and an experienced civilian engineer was formed.[17] As far back as 1819, Secretary of War Calhoun proposed that a series of fortresses be constructed by private contractors under the supervision of the Corps; the Army's engineers were to be responsible for the final product and an accounting of the funds expended.[18] Thus at the very inception of the organization, the Corps of Engineers' character as a military, civilian organization, which accomplished its tasks through private contractors, was fixed.

Between 1824 and the Civil War, the civil works program expanded rapidly at first, then levelled off, and began to decline, but the nature of the work remained the same.[19] The Engineers were involved with river and harbor improvements; surveys and mapping; railroad, fortification, lighthouse and road construction; and a variety of construction activities in the District of Columbia.[20] This work, along with the Mexican War,

constituted a major portion of the professional experience of an abnormally large number of the senior commanders in the coming Civil War. Because the Corps of Engineers had responsibility for the Military Academy until after the War, all West Point cadets, regardless of branch, were trained as civil engineers.[21] These engineer-trained officers' approach to large scale military operations was almost certainly colored by their backgrounds.

How much the engineering education and public works experience affected the wartime performance of the Corps' officers is problematic. Although some experience is directly translatable, particularly in the important areas of training, organization, and logistics, nothing fully prepares one for actual combat. George McClellan was a superb organizer and trainer; his engineering background probably was very helpful, but when it came to using the army he created, he was mediocre at best. George Meade's experience building lighthouses in the Florida Keys[22] most likely was not much help when he was stalking Lee toward Pennsylvania. His opposite number's experience removing snags on the Mississippi River also was not of much help. On the other hand, G.K. Warren's background as a topographer mapping the West[23] was almost certainly useful when he realized the tactical value of Little Round Top and started moving men to secure it.[24] Montgomery Cunningham Meig's extensive experience with large, complex construction projects made him a superb choice to be the Quartermaster General.[25] Meig's appointment started a trend--engineers with extensive civil works backgrounds became the senior logisticians in both

world wars--George Goethals in World War I and Brehon B. Somervell in World War II. Regardless of the achievements and failures of individuals, the heavy involvement of engineers in positions of authority in a conflict that invented modern war and defined the American way of war, had a profound effect on the U.S. military.

Immediately following the Civil War, the civil works program received a larger appropriation and had more work than in any previous year. The program would remain several times larger than during the Antebellum period.[26] This expansion made necessary a permanent, countrywide field structure. In 1888, the Chief of Engineers reorganized the Engineer Department by adding five districts to adequately control the work. Eventually this would expand with additional divisions and districts.[27] In the future this decentralization of execution would prove to be a characteristic of the Corps of Engineers and a great strength allowing for exceptional (by government standards) organizational flexibility.

In the first half of the nineteenth century, military engineers filled a vacuum, but as civilian engineering became more developed, the technical influence of military engineers waned.[28] Whereas in 1840 the only engineering schools in country were West Point and Rensselaer; by 1870 there were over seventy.[29] The rapid economic expansion after the Civil War created the finest construction industry in the world. Since most of the Corps' construction was done by contractors,[30] ready access to this first class industrial base was a major strength

of the Corps' program. With the development of a capable civilian engineering profession, military involvement in river and harbor improvements came into question. Essentially, the civilians challenged the military's technical capability; the efficiency of taking top quality officers from their purely military duties; and just the general idea of military involvement in what they felt to be purely civilian undertakings.[31] Since the 1880's the idea of transferring the civil program from the Corps of Engineers has surfaced periodically[32] and will again.

While the technical ability of Engineer Officers was being questioned, the French were attempting one of the great technical achievements of all time--a canal across Panama. The French would fail; the Army Engineers, in large measure because of their experiences improving U.S. waterways, would succeed in building that canal.

The Panama Canal was not built by the Corps of Engineers, but by a commission composed mostly of military officers headed by Colonel Goethals.[33] Army Engineers inherited the missions much as they had inherited the rivers and harbors work in the first place. President Theodore Roosevelt wanted the Army in charge because they would not, nor could not, quit.[34] In effect, he wanted a military chain of command. By assigning the job to the Army the President got an added benefit: Colonel Goethals "and the other engineering officers who were to serve in Panama considered themselves part of an honored tradition; and this, it should be emphasized, gave to their whole mode of operation a

very different tone from that of the previous regime. It was not that they were necessarily superior technicians to the railroad people who had preceded them, but that their entire training and experience had been directed toward large construction works in the national interest."[35]

The American proponents of a lock system instead of a sea level channel for the canal based their theory on the effectiveness and applicability of the Weitzel Lock on the passage between Lake Huron and Lake Superior.[36] This project, also dubbed the Soo Project, was a state of the art effort administered by the Corps of Engineers.[37] Lieutenant Colonel Harry F. Hodges, who was head of design for the Panama Canal Locks, had worked on the Weitzel Lock. Major William Sibert, who was in charge of the Canal's Atlantic Division, also worked on the Soo Project. In addition, he had extensive experience at the Pittsburgh District on lock and dam construction. The civilian engineer, Sydney B. Williamson, who headed the Pacific Division, had been an assistant to Colonel Goethals when Goethals supervised construction of a high lift lock at Muscle Shoals on the Tennessee.[38]

The Panama Canal was powered and controlled by an all electrical system. The Canal in many ways was a pioneer in the large scale use of electrical power. This was the General Electric Company's first large government contract. "In the broader context, the arrangement was also an historic forerunner: a large, novel, technological objective was to be obtained in abnormally little time and according to the most stringent

standards through the combined efforts of the federal government and a specialized industry. (It is, to be sure, a very long way from the electrical installations at Panama to the Manhattan Project, but the lineage is plain.)"[39]

In World War I, the engineers performed their traditional roles of mobility, countermobility, and survivability for the combat units. Engineer officers, often with considerable civil works experience, performed in a variety of command and staff positions, as they had in the Civil War. Major General Goethals, for example, eventually became the Army's senior logistician.[40] The infrastructure and logistics requirements for mobilization and combat were becoming more and more complicated. The allies requested the deployment of engineer troops as the top priority. The first U.S. casualties were engineers. Engineers were involved in extensive theater construction and combat support.[41] How much the civil experience of regular officers facilitated accomplishing these missions is unknown. The country did not have time to fully mobilize for World War I. It would not be until the total mobilization of World War II that the real value of the Corps of Engineers' unique civil, military blend would be realized.

The period following the first great war saw the Corps of Engineers mature into its current organization. Actually the process had its beginnings in the later stages of the nineteenth century but was firmly set in the twenties and thirties of this century. The Corps' missions were steadily expanded when the Congress added flood control, hydro-power development, and

regulatory responsibilities.[42] These were tied to the Corps' original rivers and harbors work. The difference with the new missions acquired in the twenties and thirties was that now the Corps was no longer "the only game in town"; there were plenty of opportunities for the Government to use someone else or form a new department. There are probably several reasons this did not happen. Nothing is ever simple in Washington, but one thing must be inferred from the expansion of missions--the Corps of Engineers got the job done at least as efficiently as the remainder of government could, and probably a little better, given the level of interest in removing civil works from the Corps of Engineers and the War Department.[43]

At this point, the institutional character the Corps of Engineers had been molded and set by its history. Basically, the Army Corps of Engineers was a civil, military institution with a stable, technically sophisticated, civilian workforce, directed by a small military chain of command. The operating elements were dispersed throughout the country, and decision authority was remarkably decentralized. The whole structure had easy access to and detailed knowledge of the U.S. industrial base because its work was normally accomplished under contract to private firms. This is a tremendously powerful and useful combination of characteristics. It also formed the center of gravity of U.S. military engineering and still does.

MILITARY CONSTRUCTION

As World War II approached, the War Department had under its control a first rate engineering organization. "Embracing fortifications, river and harbor improvements, flood control projects, roads, railroads, dams and canals, the Corps' experience in heavy construction was unequaled by that of any other engineering outfit in the world."[44] Oddly, the War Department's own construction was not accomplished by the Engineers; it was done by the Quartermasters.

When the position of Quartermaster General was established in 1775, the American Continentals used the British Army as a model. During the Revolution the responsibilities were quite different from those of today. The Quartermaster General had operational as well as logistical duties. He was expected among other things to assist in planning marches, opening and repairing routes of march, and siting bridges and fords. He laid out camps, assigned quarters, and provided materials for huts.[45] At that time, sheltering the troops often involved quartering them in civilian homes. If construction was necessary to provide shelter, it was done by the soldiers themselves; the quartermasters were responsible for materials and tools, a supply action. Thus, from the beginning, construction was viewed as a supply function, not an engineering function, but almost from the beginning, the situation would change. We Americans so resented the British habit of quartering troops in civilian homes that we prohibited the action in our Bill of Rights. Amendment III states: "No Soldier shall, in time of peace be quartered in any house,

without the consent of the Owner, nor in time of war, but in a manner to be prescribed by law."[46]

As the permanent United States military establishment was forming in the early 1800's, the Army decided to continue the traditional practice of assigning fortification and combat construction to the Engineer Department and of assigning installation and road construction to the Quartermaster Bureau.[47] The Engineers had the responsibility for building the coastal forts. The Quartermasters were responsible for the barracks, storehouses and quarters. Construction of the inland forts and the associated roads were the job of the Quartermasters.[48]

This division of responsibility worked reasonably well throughout the nineteenth century. The Quartermaster Bureau generally had little trouble accomplishing its construction mission with only a small organization.[49] Actually, until the near total mobilizations of the twentieth century, providing construction support to the military was not a particularly difficult problem.[50] Under the circumstances, practically any arrangement would have worked. Unfortunately, several factors were rendering the arrangement for construction in the U.S. military hopelessly obsolete. Engineering and construction were becoming more complex and more necessary to support the military. "With only a small amount of work to do, oriented toward supply rather than construction, composed largely of detailed officers, few of whom had any technical background and forced to rely more and more on private builders, architects and engineers, the Quartermaster Corps was unable to develop anything approaching

the construction capability of the Corps of Engineers."[51] Also, the primary mission of the Quartermaster Corps, logistics sustainment, was becoming infinitely more difficult.

A faint precursor to the eventual problem could be detected in 1836 when the acting Quartermaster General requested relief from some construction duties, so the Department could more fully support operations against the Seminoles in Florida.[52] The experience of the Civil War appeared to mask the eventual problem. In that war, large cantonments were not needed because the troops were raised in the states and immediately deployed south[53] where the Third Amendment did not apply. The industrial construction for the first "gross national product" war seems to have been adequately accomplished by private industry. Roughly the same thing, on a smaller scale, took place in the Spanish-American War, but by that time the general inability of the traditional bureau structure of the War Department to cope with a changing world was becoming apparent. The Quartermaster Department's performance in the Spanish-American War was a particular embarrassment and was a stimulus for the Root Reforms (The Root Reforms established a Chief of Staff and the General Staff and reduced the power of the Bureaus.) that began this century.[54]

About the same time, the idea of making military construction a responsibility of the Corps of Engineers surfaced. General Leonard Wood, Chief of Staff from 1910-1914, favored this change. Transferring the responsibility for military construction from the Quartermaster Corps to the Corps of Engineers was vigorously

opposed by Major General James B. Aleshire, the Quartermaster General. In addition, there was opposition both in and out of the Army to anything that would add to the strength and prestige of the Corps of Engineers. The idea was shelved and nothing changed.[55]

Nothing may have changed in the War Department's bureaucracy, but the technology of war had undergone a revolution. Much is made in military theory about ensuring that tactics keep pace with technology The same point should be made about ensuring that organizations keep pace with technology. "The days of taking the flint lock off the wall and going off to fight were beyond recall. A new day had dawned, a day of large scale mobilization, systemic training and technological warfare. Camps to house whole divisions; plants to mass-produce weapons and ammunition; warehouses, depots, and terminals to handle huge quantities of materiel; and myriad other facilities had become sinews of war. In a country which had no sizable standing army, no munitions industry to speak of and few facilities to support a mighty military effort, construction had become the key to preparedness."[56]

In reality military construction was now an engineering task, not a quartermaster supply function. At the outset of the First World War, the Construction and Repair Division, Office of the Quartermaster General was responsible for military construction. It was immediately overwhelmed by the volume of construction needed to mobilize.[57]

A month after the start of the World War I the prewar Construction and Repair Division was completely reorganized into the Cantonment Division. The Cantonment Division was established as a virtually separate bureau with its chief reporting directly to the Secretary of War. The new division was staffed by experienced engineers from the top engineering and construction companies in the nation.[58] This organization bore little resemblance to its predecessor. It was, in effect, a second engineer department. The Cantonment Division was an aggressive, innovative organization that managed to complete the difficult camp construction program almost on schedule.[59] After the war, however, its methods and efficiency were severely criticized in Congress. There was great concern about the profits made on wartime contracts by firms which had senior employees doing wartime service in the Cantonment Division.[60]

Despite the obvious importance of military construction to mobilization, and the inability of the Quartermaster Corps' prewar organization to cope with the mission, shortly after the Armistice, the Quartermaster Corps sought to reclaim all their old turf.[61] The fact that their organization had failed utterly did not seem to matter. The Cantonment Division was attempting to become a separate branch. The Engineers wanted to erase the Cantonment Division and take over the military construction mission. When it became apparent that they could not get the military construction mission, the Engineers supported the Quartermasters' attempt to regain control of military construction. This happened, and in 1920 the Cantonment Division

was disbanded.[62] This country, having just fought a war, almost immediately thereafter discarded all the lessons learned and returned the War Department Bureaus to the status quo antebellum. It should not be surprising that bureaucracies are living organisms that often act in their own self interest, with little regard for the total organization they serve.

DUAL MISSION

When the United States began thinking about mobilization for World War II, the problems about how to accomplish military construction, which were swept under the rug after World War I, reappeared almost immediately. The construction necessary to support mobilization was massive. "Directly or indirectly, military construction affected the life of every American."[63] As Lieutenant General Leslie R. Groves said, "Mobilization was decisive and construction generally controlled mobilization."[64] As World War I had already demonstrated, an engineering organization needs to control the construction. Overly centralized and under resourced, the Quartermaster Construction Service, like its World War I predecessor, would be overwhelmed. As it struggled to accomplish its mission, it became, in fact if not in name, another engineer department controlled by engineer officers such as Brehon B. Somerville[65] and Leslie P. Groves. This also paralleled the experience of the First World War.

In the latter part of 1939, the War Department's leadership became increasingly concerned about the pace of construction.[66] There was wide spread public criticism and allegations of

mismanagement in the construction program.[67] While the military construction program was being rapidly increased, the Corps of Engineers civil works program was being reduced; so resources were available to support the mobilization effort.[68] It made sense then, instead of creating another military construction organization, to just transfer the mission to the Corps of Engineers. The first transfer occurred in November, 1940, when the Corps was given responsibility for the critical Air Corps construction program. At the time, the airfield program was in serious trouble, but the Corps' field organization was able to quickly shift from civil functions.[69] Within four months of receiving this mission, the Corps had eighty-one Air Corps projects under contract.[70] The Engineers' performance would settle the long, often bitter debate, and in December, 1941, the Corps of Engineers became responsible for military construction and in the process absorbed the Quartermaster's Construction Service.[71] The Corps of Engineers was now a dual mission construction organization. The present day Army Corps of Engineers was in place.

The Corps of Engineers was able to absorb the military construction program and continue the high pace of construction largely because of the inherent strength of the organization, not because of any particular expertise in the types of construction being undertaken.[72] Certainly, the Corps was technically qualified, but then so were the Constructing Quartermasters and any number of potential civilian controlled proposals. The Corps' strength lay in its organization which combined a small,

disciplined military chain of command with a large, technically sophisticated, experienced civilian workforce that was arrayed throughout the country in a flexible, decentralized structure. Significant authority was delegated to the Divisions and Districts.[73] In 1939 the Engineer Department had eleven Divisions and forty-six Districts with 225 officers and 49,000 civilian employees.[74] This structure would expand greatly during the war, but the basic organizational philosophy would remain the old decentralized approach of the civil works program.[75]

The Corps' performance in World War II validated the organizational concept. The Manhattan District alone secured its reputation, but this was only one of a number of remarkable achievements. The officers served at all levels in command and staff positions in and out of combat. A General Staff study completed in 1949 concluded that the in theater combat and construction engineering provided during the war was "second to none".[76] It was better than that. It was the best any nation has ever had.

Unfortunately, even a superb organizational concept does not automatically guarantee efficient, economical operations. It may be a necessary condition, but it is not a sufficient condition. The basic organizational design of the Corps that had evolved from the Revolution to World War II, actually offered a situation in which the whole could be greater than the sum of the parts, a situation almost unheard of in governmental affairs. The three major mission areas of the Army's engineers, civil works, military construction, and theater of operations combat and

construction engineering, can and should be beneficial to the Army, the Defense Establishment, and the U.S. Government. If these three interrelated engineering functions are efficiently and economically managed, there should be corresponding peacetime savings in the cost of civil works and military construction, plus more rapid and effective engineering support to mobilization or combat operations.

The wartime benefits flow from two characteristics of the Corps:

> First is its status as a military engineering organization in-being which can be quickly brought to bear in an emergency to provide needed services in the United States or in theater.
>
> Second is the technical training and experience gained by military officers while on duty with the Corps of Engineers. This experience translates into better combat and construction support in a theater of operations.[77]

In peacetime the challenge is to provide civil works and military construction as efficiently and economically as possible. No matter how good the organizational concept of the Corps of Engineers is, if the services it delivers are too costly, the organization will be dissolved or drastically cut.

After World War II instead of organizing functionally and treating each mission the same, regardless of funding source, the Corps maintained separate, virtually self-contained civil works and military construction organizations. This essentially artificial barrier increased the overhead and tended to inhibit the ability to shift between programs. The dual structure probably was inevitable, given the bitter, bureaucratic struggle

that preceded transferring the military construction mission to the Corps in the first place. The Corps has almost certainly combined these programs as much as the current external environment will allow. A study of the Corps of Engineers during the McNamara reorganizations noted that "The civil works organization is intimately interwoven with the military construction activities of the Chief of Engineers to a great extent except in Washington at the Headquarters."[78] Obviously, the differences between the two programs are not technical or functional. Experience during World War II leads to the same conclusion. Then, the distinction that requires two separate headquarters structures must be administrative and driven by policy considerations.

CONSTRUCTION POLICY

Policy formulation for the Army administered construction programs evolved along two separate paths, military construction and civil works. This separateness of policy formulation resulted from the traditional view, inherited from the British and instituted during the Revolution, that military construction was a logistics function, not an engineering function. Thus military construction policy has remained to this day within the sphere of the logisticians--Quartermasters, G-4s, and Assistant Secretaries with logistics responsibilities. Civil works was always considered an engineering activity.

From the beginning civil works policy was the responsibility of the Secretary of War. As a practical matter, through World

War II, the various Secretaries tended to let the Chief of Engineers administer the program with little War Department oversight.[79] However, also from the beginning, Congress was heavily involved. Because of the civil works program, the Corps of Engineers developed a very "special relationship" with Congress.[80] Even today the civil works side of the Corps of Engineers is treated as virtually a separate agency of government.

Initially, military construction policy was a subset of the Quartermaster's responsibilities. When World War I started, the size and importance of the construction effort caused the creation of a separate military construction agency, whose head reported directly to the Secretary of War.[81] A new player appeared in November, 1917, when an effective Assistant Secretary of War was appointed.[82] The position had been authorized in 1882 but was rescinded in 1884 because the job was never filled. On March 5, 1890, the position was reauthorized,[83] but it was little used until World War I.[84] Starting with that conflict, the Assistant Secretary of War became heavily involved in policy regarding military construction.[85]

When the Quartermaster Corps regained responsibility for military construction after the First World War, policy for military construction reverted to the process used before the war. The National Defense Act of 1920 authorized the Assistant Secretary of War to plan for industrial mobilization and current procurement; planning for wartime military construction was included in his responsibilities.[86] During the interwar years

the Assistant Secretaries were involved in construction planning for mobilization.[87] As mobilization commenced for the Second World War, the head of the Quartermaster's Construction Division received policy direction from the Chief of Staff, the Assistant Secretary of War, the Quartermaster General, and the Administration. Each had different perspectives and priorities.[88] In late May, 1940, the Chief of Staff, General Marshall, directed that the G-4 would oversee construction matters.[89]

When the military construction mission was transferred to the Corps of Engineers, the logistics bureaucracy managed to retain responsibility for policy direction. This arrangement worked during the war because the G-4 by late 1941 was an experienced engineer, General Brehan B. Somervell.[90] When General Marshall reorganized the Army in March 1942, General Somervell became the commander of the Army Services of Supply, redesignated Army Service Forces.[91] The Chief of Engineers, as head of a technical service, reported to General Somervell.[92] In effect, World War II military construction was carried out through an engineer chain of command.

After the war the Corps of Engineers administered both the civil works and military construction programs. (The Corps also executes the Air Force military construction program, but policy for this program resides within the Department of the Air Force and is not included in this analysis.) The policy formulation for the two programs, civil and military, was not consolidated even though wartime experience amply demonstrated that there were

no technical barriers associated with combining the actual construction. Essentially, the bureaucracies administering the two programs continued to form policies governing construction along prewar lines. The major difference was the inclusion of an expanding Secretariat with more oversight capability.

Through the early 1950s, the Chief of Engineers had direct access to the Secretary of the Army on civil works issues. For military construction matters, the Chief of Engineers reported through the Deputy Chief of Staff for Logistics (DCSLOG), initially Assistant Chief of Staff for Logistics, to the Assistant Secretary of the Army (ASA) for Logistics, initially ASA for Materiel, then ASA for Logistics and Research and Development.[93] In 1957 the policy responsibilities for civil works and the bulk of the military construction program were consolidated into the Office of the Assistant Secretary of the Army for Civil-Military Affairs (ASA-CM). The ASA-CM was responsible for:

> All civil functions, including the civil works program, assigned to the Department of the Army;
> military construction except industrial construction;
> real property except for industrial facilities;
> and housing and public quarters.[94]

The Assistant Secretary for Logistics was responsible for construction and real property at logistics installations and industrial facilities.[95] In July 1959 the Secretariat was reorganized into an Under Secretary of the Army and three Assistant Secretaries, not four as before. The ASA-CM was eliminated. The Assistant Secretary for Manpower, Personnel and

Reserve Forces inherited the ASA-CM's construction responsibilities. The responsibilities of the ASA for Logistics did not change.[96]

With the start of the McNamara reorganizations in May 1961, policy formulation for military construction and civil works was again divided. The Assistant Secretary of the Army for Installations and Logistics (ASA-IL) became responsible for military construction; the Assistant Secretary of the Army for Financial Management (ASA-FM) became responsible for functional supervision of the Chief of Engineers when the civil works program was involved.[97] As with the other technical services , the Chief of Engineers still reported to the DCSLOG. [98] About this time a detailed analysis of the entire Department of Defense was undertaken. The Department of the Army's portion of this analysis was contained in the Hoelscher Study. The civil works functions were originally to be reviewed as part of the Hoelscher Study,[99] but the civil works analysis was delayed and finally completed in 1966 in a separate analysis for the Secretary of the Army.This report was eventually adopted by the U.S. Senate's Committee on Public Works.[100]

As the McNamara reorganizations gained momentum, the construction responsibilities remained stable until April, 1963. At that time, ASA-FM's responsibilities for the Army's civil functions were rescinded, and, as an additional duty, the Army General Counsel became "Special Assistant to the Secretary of the Army for Civil Functions and is assigned responsibility for the civil functions of the Department of the Army".[101] The Chief of

Engineers was to execute the civil works program "under the direction and supervision of the Secretary of the Army".[102] In 1964 the responsibilities among the various policy makers with construction related functions were clarified, but the actual responsibilities remained roughly the same as before. The ASA-IL had responsibilities for installation planning and programming, facilities and real property management, construction, and housing and public quarters.[103] The DCSLOG exercised general staff supervision over the Chief of Engineers, but the DCSLOG's authority specifically did not extend to civil works.[104] The Army General Counsel remained Special Assistant for Civil Functions with a notation that the Civil Works Program was included.[105]

In 1965-1966 a task force commissioned by the Secretary of the Army reviewed the rationale for continuing to administer the civil works program. The task force concluded that there were advantages to both the civil works activities and the Department of Defense in keeping the mission within the Corps of Engineers.[106] In addition, the task force recommended that:

> The Secretary of the Army should seek to establish an office of an Assistant Secretary of the Army with responsibility primarily for the civil works mission and, incidental thereto, to maintain general cognizance of interrelated aspects of the civil works and military missions of the Chief of Engineers.[107]

The recommendations were adopted but not implemented for almost ten years. The division of responsibilities regarding construction remained the same through the end of the 1960s.[108]

The Under Secretary of the Army assumed policy responsibilities for civil works in 1972; the General Counsel reverted to strictly legal functions. The ASA-IL's military construction duties stayed the same.[109] The Chief of Engineers was placed directly under the Chief of Staff; for civil functions the Chief of Engineers reported directly to the Secretary of the Army. Practically every General Staff agency had some control over engineer activities that affected their functional areas of responsibility.[110] In 1974 the construction responsibilities remained the same as previously; however, for the first time environmental programs and policies were included. The Under Secretary and the DCSLOG had environmental responsibilities.[111]

The Assistant Secretary of the Army for Civil Works (ASA-CW) was formally organized in 1975. The ASA-CW's responsibilities included the traditional civil works program, environmental program and policies, Panama Canal affairs, and other longstanding civil functions such as the National Cemetery Program. The ASA-IL's responsibilities were unchanged.[112] Now the Chief of Engineers was "under the direction and supervision" of the ASA-CW for civil works functions. The Engineers also assumed General Staff responsibility from the DCSLOG for environmental planning and coordination.[113]

This division of functions remained roughly the same during the Carter years. The ASA-IL and ASA-FM were combined; however, the military construction responsibilities did not change and stayed in the new ASA-IL&FM's office. The ASA-CW's oversight covered the same areas as in 1975 including the Army's

environmental program.[114] The Chief of Engineers "serves as the Army's Environmentalist."[115] On January 1, 1981, just before the Carter Administration departed, the ASA-CW assumed responsibility for "oversight for construction support to foreign nations except for construction in support of U.S. Forces, but dropped its functions regarding Army environmental policy. The ASA-CW retained the full scope of the civil works program with its attendant environmental responsibilities.[116] The Army's internal environmental program became part of the ASA-IL&FM's Installation and Housing Management program.[117] The Chief of Engineers' responsibilities were not changed, but now the Engineers are to advise and coordinate with the Deputy Chief of Staff and were not under the direction and supervision of those agencies. For civil works matters, the Chief of Engineers stayed under the supervision and direction of the ASA-CW. In addition, the Chief of Engineers commands the major command, the U.S. Army Corps of Engineers.[118]

Except for the designation little changed when the Corps of Engineers became a major command in 1979;[119] however, it is important to note that the Corps of Engineers had survived as the last of the old bureaus. To be sure, the Chief of Engineers did not possess all the traditional responsibilities of the old bureau chiefs, but by combining both staff and command responsibilities for a functional area, the Chief of Engineers operated in an organizational environment that was remarkably similar to the old bureau structure.

Through the 80's, the policy making apparatus has been practically constant. In 1984 the ASA-FM was reestablished.[120] The reorganized ASA-IL continued to exercise policy for military construction and the Army's environmental program.[121] In late 1989 the ASA-IL was redesignated the Assistant Secretary of the Army for Installations, Logistics, and Environment (ASA-IL&E). The ASA-CW's role did not change. The current draft General Order dated 11 October 1990 assigning duties within the Office, Secretary of the Army indicates no changes.[122]

The Goldwater-Nichols Department of Defense Reorganization Act of 1986 made the biggest impact on policy formulation in the 1980s.[123] Congress intended "to strengthen civilian control and focus the attention of military headquarters on policy concerns and not day to day operational details."[124] The Act states "The Secretary of the Army may assign such of his functions, powers, and duties as he considers appropriate to the Under Secretary of the Army and to the Assistant Secretaries of the Army."[125] Among the Secretary's functions, which he shares with the other service secretaries, are "[t]he construction, maintenance, and repair of buildings, structures, and utilities and the acquisition of real property and interests in real property necessary to carry out the responsibilities specified in this section."[126] The legislation sanctions five Assistant Secretaries of the Army, who will "....perform such duties and exercise such powers as the Secretary of the Army may prescribe. One of the Assistant Secretaries shall be the Assistant Secretary for Manpower and Reserve Affairs. ....One of the Assistant Secretaries shall be

the Assistant Secretary of the Army for Civil Works. He shall have as his principal duty the overall supervision of the functions of the Department of the Army relating to programs for conservation and development of the national water resources, including flood control, navigation, shore protection and related purposes."[127]

Essentially, the Goldwater-Nichols Act gives the Secretary of the Army wide latitude in delegating policy responsibilities within the Secretariat for his military construction functions. civil works policy responsibilities are another matter; the legislation mandates an ASA-CW with responsibility for the civil works program.

We are at the end of 216 years of organizational evolution. The starting point was a British model adopted during the Revolutionary War; that model separated various construction responsibilities between the Quartermasters and the Engineers. What was to become military construction was viewed as a logistics responsibility, not an engineering responsibility. As military construction became more necessary and more complicated, the Quartermaster organization simply could not cope with the mission. On the other hand the Corps of Engineers, largely because of its civil works program, evolved into one of the premier construction agencies in the world.

At the outbreak of World War II the responsibility for military construction, which had resided with the Quartermasters for 166 years, was transferred to the Engineers, but policy responsibilities and oversight remained associated with the

logisticians. Today, after 216 years the Assistant Secretary of the Army with logistics responsibilities still has responsibility for military construction. Since the mid 1970s policy formulation for the civil works program has resided with the Assistant Secretary of the Army for Civil Works. For fifty years the Corps of Engineers has been ably executing both construction programs.

CONCLUSIONS

1. From the Revolution to World War II, military construction was considered a logistics responsibility not an engineering function. As far back as the Seminole War in 1836, this organizational concept proved unworkable when placed under stress. The Army Corps of Engineers became responsible for military construction at the outbreak of World War II, but the logistics structure retained responsibility for policy formulation.

2. Military construction and civil works are compatible activities and have been accomplished in the same field organizations for fifty years.

3. The separation of policy formulation for the two Army administered construction programs creates artificial organizational boundaries that inevitably reduce efficiency.

4. Policy formulation for the Civil Works and Military Construction, Army programs should be combined under one Assistant Secretary of the Army.

5. Because the Goldwater-Nichols Defense Reorganization Act mandates an Assistant Secretary of the Army for Civil Works with responsibilities for the civil works programs, it is easier to consolidate the two programs under that assistant secretary.

6. Finally, the historical analysis reveals that the center of gravity of all Army engineering actually resides with the construction activities of the Corps of Engineers' civil works program.

RECOMMENDATION

Recommend transferring the military construction responsibilities of the Assistant Secretary of the Army for Installations, Logistics, and Environment to the Assistant Secretary of the Army for Civil Works.

ENDNOTES

1. U.S. Department of the Army Manual, p. 2-24 (hereafter referred to as DA Manual).

2. Walter J, Cunningham, personal opinion based on the author's understanding of the Army Management Review, the Hoeschler Report, The Civil Works Study, and the Defense Management Review on Single Construction Agent.

3. L. Sprague De Camp, The Ancient Engineers, p. 370.

4. Ibid., p. 20.

5. W. Stull Holt, The Office of the Chief of Engineers of the Army, Its Non-Military History, Activities, and Organization, p. 1.

6. Ibid., p. 2.

7. Ibid.

8. Ibid., p. 3.

9. Russell F. Weigley, History of the United States Army, p. 164.

10. Raymond H. Merritt, Engineering in American Society 1850-1875, p. 29.

11. Holt, . 4.

12. Ibid.

13. U.S. Army Corps of Engineers, The History of the U.S. Army Corps of Engineers, p. 37 (hereafter referred to as History of the COE).

14. Ibid., pp. 37-38.

15. Forest G. Hill, Roads, Rails and Waterways, The Army Engineers and Early Transportation, p. 205.

16. David McCullough, The Path Between the Seas: The Creation of the Panama Canal, 1870-1914, p. 541.

17. Holt, p. 6.

18. Weigley, p. 164.

19. Holt, pp. 5-10.

20. History of the COE, pp. 29-52 and 61-67.

21. Holt, p. 3.

22. History of COE, p. 35.

23. Frank N. Schubert, Vanguard of Expansion--Army Engineers in the Trans-Missippi West 1819-1879, pp. 115-130.

24. History of the COE, p. 71.

25. Erna Risch, Quartermaster Support of the Army, History of the Corps 1775-1939, pp. 336-339.

26. Holt, p. 11.

27. Lenore Fine and Jesse A. Remington, United States Army in World War II, The Technical Services, The Corps of Engineers: Construction in the United States, p. 6.

28. Merritt,p. 4.

29. Ibid., pp. 29-30.

30. Holt, p. 13.

31. Merritt, pp. 125-128.

32. Office of the Chief of Engineers, Corps of Engineers Function and the National Interest, Volume I, pp. 45-49 (hereafter referred to as Corps Functions and the National Interest).

33. McCullough, p. 571.

34. Ibid.

35. Ibid., p. 541.

36. Ibid., pp. 482-484.

37. History of the Corps, p. 44.

38. McCullough, pp. 540-542.

39. Ibid., pp. 599-601.

40. Risch, p. 633.

41. History of the Corps, pp. 79-81.

42. Ibid., pp. 47-59.

43. Corps Functions and the National Interest, pp. 45-49.

44. Fine, p. 440.

45. Risch, p. 1-2.

46. "Constitution of the United States".

47. Fine, p. 4.

48. Risch, p. 210.

49. Fine, p. 4.

50. Ibid., p. 3.

51. Ibid., p. 5.

52. Risch, p. 218.

53. Fine, p. 3.

54. James E. Hewes, Jr., From Root to McNamara: Army Organization and Administration, 1900-1963, pp. 6-8.

55. Fine, pp. 6-7.

56. Ibid., p. 7.

57. Ibid.

58. Ibid., p. 9.

59. Weigley, p. 365-366.

60. Fine, pp. 26-32.

61. Hewes, pp. 25-50.

62. Fine, p. 40

63. Ibid., p. 372.

64. History of the COE, p. 101.

65. Fine, p. 463.

66. Ibid., pp. 239-240.

67. Ibid., p. 241.

68. Ibid., p. 244.

69. Ibid., pp. 440-443.

70. Ibid., p. 267.

71. Ibid., p. 476.

72. Ibid., p. 440.

73. Ibid., p. 268.

74. Ibid., p. 241.

75. Ibid., p. 499.

76. Corps Functions and the National Interest, pp. 101-103.

77. U.S. Congress, Senate, Committee on Public Works, Civil Works Program of the Corps of Engineers, p. 5 (hereafter referred to as "The Civil Works Study").

78. Ibid., p. 55.

79. Ibid., p. 63

80. Weigley, p. 166.

81. Fine, p. 9.

82. Risch, p. 599.

83. George B. Davis, Military Laws of the United States, p. 26.

84. Risch, p. 599.

85. Fine, p. 19.

86. Hewes, pp. 51-54.

87. Fine, pp. 69-72.

88. Ibid., p. 157.

89. Ibid., p. 165.

90. Hewes, pp. 90-91.

91. Ibid., p. 165.

92. Ibid., p. 97.

93. U.S. Department of the Army, Special Regulation 10-5-1 with changes 1 through 9.

94. U.S. Department of the Army, Army Regulation 10-5: Organizations and Functions, 22 May 1957, p. 4-5 (hereafter referred to as AR 10-5 with change number and date of version).

95. Ibid., p. 5-6.

96. AR 10-5, Change 4, 10 July 1959, pp. 1-3.

97. AR 10-5, 5 May 1961, pp. 5-6.

98. Ibid., pp. 16-17.

99. Blumenson, Reorganization of the Army, 1962, pp. 5-14.

100. The Civil Works Study.

101. AR 10-5, Change 2, 19 April 1963, p. 1.

102. Ibid., p. 4.

103. AR 10-5, 10 August 1964, p. 4.

104. Ibid., p. 12.

105. Ibid., p. 5.

106. The Civil Works Study, p. 5.

107. Ibid., p. 18.

108. AR 10-5, 23 May 1969, pp. 2-3.

109. AR 10-5, 6 June 1972, pp. 2-2 to 2-3.

110. Ibid., p. 3-2.

111. AR 10-5, 28 January 1974, pp. 2-2 and 2-11.

112. AR 10-5, 1 April 1975, pp. 2-2 to 2-3

113. Ibid., pp. 2-29 to 2-30.

114. AR 10-5, 1 November 1978, p. 2-3.

115. Ibid., p. 2-36.

116. AR 10-5, 1 January 1981, p. 2-2.

117. Ibid., p. 2-3.

118. Ibid., 2-31 to 2-32.

119. DA Manual, p. 5-39.

120. Ibid., p. 5-40.

121. U.S. Department of the Army, General Order 15, pp. 4 to 5.

122. U.S. Department of the Army, General Order Final Draft dtd 11 October 1990, pp. 1 to 5.

123. U.S. Laws, Statutes, etc., Public Law 99-433, preamble, (hereafter referred to as "P.L. 99-433").

124. DA Manual, p. 5-43.

125. P.L. 99-433, Title V, Part A, Sec. 501, p. 3013.

126. Ibid.

127. Ibid., Title V, Part A., Sec. 501, p. 3016.

BIBLIOGRAPHY

Blumenson, Martin. Reorganization of the Army, 1962. Washington: U.S. Department of the Army, Office of the Chief of Military History, 1962.

Davis, George P. Military Laws of the United States. Washington: Government Printing Office, 1897.

De Camp, L. Sprague. The Ancient Engineers. Cambridge: MIT Press, 1970.

Fine, Lenore and Remington, Jesse A. The United States Army in World War II, The Technical Services, The Corps of Engineers: Construction in the United States. Washington: Office of the Chief of Military History, United States Army, 1972.

Hewes,James E. Jr. From Root to McNamara: Army Organization and Administration, 1900-1963. Washington: Center for Military History, United States Army, 1975.

Hill, Forest G. Roads, Rails, and Waterways: the Army Engineers and Early Transportation. Norman: University of Oklahoma Press, 1957.

Holt, W. Stull. The Office of the Chief of Engineers of the Army Its Non-Military History, Activities, and Organization. Baltimore: The Johns Hopkins Press, Institute for Government Research, 1923.

McCullough, David. The Path Between the Seas: The Creation of the Panama Canal, 1870-1914. New York: Simon and Schuster, 1977.

Merritt, Ramond H. Engineering in American Society 1850-1975. Lexington: University Press of Kentucky, 1969.

Office of the Chief of Engineers. Corps of Engineers Functions and the National Interest Volume I. Washington: 1953.

Risch, Erna. Quartermaster Support of the Army, History of the Corps 1775-1939. Washington: Quartermaster Historian, Office of the Quartermaster General, 1962.

Schubert, Frank N. Vanguard of Expansion, Army Engineers in the Trans-Mississippi West, 1819-1879. Washington: Office of the Chief of Engineers, Historical Division, Office of Administrative Services, 1980.

U.S. Army Corps of Engineers. The History of the Corps of Engineers. Washington: 1986.

U.S. Congress. Senate. Committee on Public Works. Civil Works Program of the Corps of Engineers. A Report to the Secretary of the Army by the Civil Works Study Board. February, 1966, 89th Cong., 2d Sess. Washington : Government Printing Office, 1966.

U.S. Department of the Army. Army Regulation 10-5: Organization and Functions. Washington : dates vary.

U.S. Department of the Army. General Order 15: Assignment of Duties and Responsibilities within the Office of the Secretary of the Army. Washington: 12 June 1985.

U.S. Department of the Army. General Order : Assignment of Functions, Responsibilities, and Duties Within the Office, Secretary of the Army--Final Draft. WAshington: 11 October 1990.

U.S. Department of the Army. Manual. Washington: October 1989.

U.S. Department of the Army. Special Regulation 10-5-1: Organization and Functions. Washington: 11 April 1950.

U.S. Laws, Statutes, etc. Public Law 99-433, 99th Cong., 1 October 1986. "Goldwater-Nichols Department of Defense Reorganization Act of 1986."

Weigley, Russell F. History of the United States Army. Bloomington: Indiana University press, 1984.