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# Engineering Victory: The Ingenuity, Proficiency, and Versatility of Union Citizen Soldiers in Determining the Outcome of the Civil War

Thomas F. Army Jr  
*University of Massachusetts - Amherst*

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**Engineering Victory: The Ingenuity, Proficiency, and Versatility of Union Citizen Soldiers in  
Determining the Outcome of the Civil War**

A Dissertation Presented

by

THOMAS F. ARMY, JR.

Submitted to the Graduate School of the  
University of Massachusetts Amherst in partial fulfillment  
of the requirements for the degree of

DOCTOR OF PHILOSOPHY

May 2014

Department of History

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**Engineering Victory: The Ingenuity, Proficiency, and Versatility of Union Citizen Soldiers in  
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A Dissertation Presented

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THOMAS F. ARMY, JR.

Approved as to style and content by:

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Heather Cox Richardson, Chair

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Jennifer Fronc, Member

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Leonard L. Richards, Member

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Merritt Roe Smith, Member

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Marla R. Miller, Graduate Program Director  
Department of History

## **DEDICATION**

For Virginia because without your love and support none of this  
would have been possible.

## **ACKNOWLEDGMENTS**

When I first came up with the idea for writing something about Civil War engineering, I was in the middle of my tenure as headmaster of a New England boarding school. Life often takes us on unexpected twists and turns, and so eventually I found myself applying to graduate schools to pursue my lifelong dream of earning a Ph.D. in American history. I was pleased to be admitted to the University of Massachusetts, Amherst, where I began to turn my dreams into reality. This also meant taking my ideas about Civil War engineering and developing a more cohesive argument so the topic would become the framework for my dissertation. Throughout this process I have received the generous and unwavering support of so many people, and I owe a debt of gratitude to each of them.

Back in 2002 as I started to think seriously about Civil War engineering, my friend Phil Cole, a Licensed Battlefield Guide at Gettysburg National Military Park had just embarked on a project of his own, and so we spent a fair amount of time standing atop Little Round Top discussing ideas and theories about our respective topics. Phil offered to help me in any way possible, suggesting where to find archival information, and he encouraged me to follow my passion. His practical advice, wisdom, and guidance helped jump-start my journey into the world of Civil War bridge builders, and for this I am truly thankful.

Arriving at UMass, I also had the great fortune of meeting Professor Heather Cox Richardson and was honored when she agreed to be my dissertation committee chair. She is an excellent teacher and our work together has been rigorous and fulfilling. She has sharpened my thinking and writing and inspired my learning. She has patiently read chapter drafts, provided access to databases, and helped structure my writing. I am deeply thankful for her mentoring

and her friendship, and I am grateful to her for the faith she has demonstrated in me as a scholar.

My three other committee members also provided me with suggestions, essential insight, constructive feedback, and encouragement during the past twenty months as the writing process unfolded. Professor Jennifer A. Fronc of UMass helped me steer through several political and academic subtleties. Professor Leonard L. Richards frequently offered cheerful and smart advice about the structure of my dissertation, championed my topic enthusiastically, and encouraged my storytelling. I am also deeply indebted to Professor Merritt Roe Smith of the Massachusetts Institute of Technology for agreeing to serve on my committee. His knowledge of the development of nineteenth century American technology and its intersection with the Civil War is remarkable, and he was most generous in sharing his vast knowledge, expertise, and time with me. I have been deeply touched by Professor Smith's confidence and faith in my scholarship. This has meant a great deal to me.

I travelled extensively during summer vacations, visiting archives and Civil War battlefields. I am thankful to the many people who generously offered their time and knowledge. Park Rangers and historians at the Vicksburg, Chickamauga, Chattanooga, and Perryville battlefields were enormously helpful in pointing out important landscape features, especially those that required the attention of Union engineers and Confederate engineers. In particular, I want to thank the people at the Flowerdew Hundred Plantation for giving my daughter Priscilla and me a personal tour of the spot where Grant's army crossed the James River in June 1864. We had quite an adventure finding Flowerdew headquarters and our discovery of the place is now part of Army family legend. Visiting the sites where the engineers plied their craft is difficult. They are often hard to find or access because most are not within National Park Service properties. Consequently, to discover them requires map reading, luck,

and some spirit and daring. To find the spot where Lee's army crossed the Potomac River after the Battle of Gettysburg, my friend Bob Carter and I had to ask a number of questions to the locals, and then stealthily walk over two miles of private property to eventually find the crossing spot marked by a park service sign. Finding the remains of Grant's Canal at Vicksburg was also an escapade, and the memory of all these journeys brings a smile to my face.

I would not have been able to visit archives without financial assistance and so I am grateful to the UMass history department for the Bauer-Gordon Award in 2012. With this funding I was able to research at the National Archives in Washington, DC, the Virginia and New York State libraries, the Museum of the Confederacy in Richmond, the Connecticut Historical Society in Hartford, and the Civil War Museum in Atlanta.

A number of my closest friends and family members including Vicki Martin, Art Mulligan, Bill Army, Tim Army, Mary Beth Army, Amy and Dave Sluyter, Weezie Huyck, Richard and Claire Griffith, Danny, Cinnie, Sam and Charissa Slack, Lesley Schumann, and Roger Franklin encouraged and supported me throughout this long process. I could not have made the journey without their assistance, offered in a variety of ways. My wonderful in-laws, Paul and Priscilla Gray have always offered lively conversations, good food, and constant support to go with their warm hearts and loving spirits. They believed I could and would do this. I also want to thank the community of St. John's Episcopal Church in Vernon, Connecticut, whose members on any given Sunday, would offer me kind words of encouragement and demonstrate genuine interest in my work. This was especially true of Alicia DiLeo who took time away from her busy schedule to read and edit my manuscript with a professional eye.

There are three people who deserve special mention. First I want to thank Margaret Mullen for all her assistance in helping me to organize my tables electronically so I could import



the data into my dissertation. She worked with grace and efficiency, and she was eminently patient with me as I made changes to the data and added more information.

Next, I want to offer a debt of gratitude to Dr. Richard Griffith, one of the most kind, wise, capable, and gentle souls I have had the privilege to know. Richard and I spent many an evening together enjoying a meal and discussing a range of topics including our shared interest in the Civil War. A relative of Robert E. Lee, an anesthesiologist, and a Ph.D. in engineering, Richard found my ideas about Civil War engineering exciting and fresh and his enthusiasm meant a great deal to me. In his spare time, Richard is also a part time videographer, and he graciously offered to assist me in the reproduction of the maps I used for this dissertation. He took my hand drawn maps with penciled in text and he turned them into masterpieces. I know he is related to General Lee, but I really believe that he has the skills, talent, and spirit of the great Confederate mapmaker, Jedediah Hotchkiss, alive within him.

The final person of this triumvirate I would like to offer special thanks to is my amazing brother-in-law Dave Sluyter. Without Dave's assistance, I would still be sitting at my laptop trying to format my dissertation. He is a computer ninja and also a wizard. His computer skills are brilliant and unparalleled, and I could not have finished this project without his expertise, patience and extraordinary gift of time. Inserting tables, illustrations, and maps into my final document was no easy task, and yet he was able to manipulate the pages so everything fit perfectly. It really was magic to behold. He also read every page of the manuscript, offering constructive comments, fine proofreading, and exceptional encouragement and confidence.

Finally, I must express my most sincere and abiding thanks to my parents and my own family. My love of history comes in large part because of my parents Tom and Betty Army. When I was nine years old my parents bought me the *American Heritage Golden Book of the Civil War*—it was the first history book I owned. Over summer vacations we travelled to Civil War

battlefields, and they always encouraged my interest. I was surrounded by history growing up. My grandfather, George Army, played minor league baseball in the 1920s, and I was filled with stories of old ballplayers and teams, and I learned to appreciate my own connections to the past. I also want to offer special thanks to my Dad for the hand drawn illustrations that appear in the dissertation. My parents are my biggest champions and I love them very much.

My five daughters, Hannah, Rachel, Priscilla, Elizabeth, and Catherine have, beyond measure, brought joy and fulfillment into my life. Each one of them has grown into a strong, resilient, intelligent, and independent woman. Each one of them made contributions to my dissertation even when it was not apparent to them that they were making them. Sitting around the dining room table during holidays, I would carry on about my project and the girls would roll their eyes and tell me if I did not stop there would be no dessert. Our family actually owns a Chauncey Jerome clock (featured in chapter 2), and each time I started to tell a guest the story of Mr. Jerome and his clock manufacturing, the girls in unison would moan and tell me to stop. Surprise phone calls came when I was discouraged. They proffered help with computer problems (there were many), teased me about my slow, four finger typing, and sent me on the occasional guilt trip because their mom and I had not visited them in awhile. All these words and acts and countless other deeds, large and small, helped to keep in perspective the things that really mattered. I am a very fortunate man.

My deepest obligation and thanks go to my remarkable wife, Virginia. It is difficult to describe the emotions I feel as I write this because, from the very beginning of this journey she has been at my side, encouraging me, supporting me, believing in me. She pushed me to apply to graduate school, made sacrifices to see me pursue my dream, graciously understood all the time, including family vacations, I spent wed to my computer, and never wavered in her support and love. She is my companion and soulmate. This dissertation is the result of her faith and love.

For all of this and countless other reasons, known only to the two of us, I dedicate this dissertation to her.

## **ABSTRACT**

### **ENGINEERING VICTORY: THE INGENUITY, VERSATILITY, AND PROFICIENCY OF UNION CITIZEN SOLDIERS IN DETERMINING THE OUTCOME OF THE CIVIL WAR**

**MAY 2014**

**THOMAS F. ARMY, JR., B. A., WESLEYAN UNIVERSITY**

**M. A. L. S., WESLEYAN UNIVERSITY**

**Ph.D., UNIVERSITY OF MASSACHUSETTS AMHERST**

**Directed by: Professor Heather Cox Richardson**

My dissertation explores the critical advantage the Union held over the Confederacy in military engineering. The skills Union soldiers displayed during the war at bridge building, railroad repair, and road making demonstrated mechanical ability and often revealed ingenuity and imagination. These skills were developed during the antebellum period when northerners invested in educational systems that served an industrializing economy. In the decades before the war, northern states' attempt at implementing basic educational reforms, the spread of informal educational practices directed at mechanics and artisans, and the exponential growth in manufacturing all generated a different work related ethos than that of the South. The northern labor system rewarded mechanical ability, invention, and creativity. The labor system in the South failed to do this. Plantation slavery generated fabulous wealth for a tiny percent of the southern white population. It fostered a particular style of agriculture and scientific farming that limited land use. It curtailed manufacturing opportunities, and it stifled educational opportunities for the middle and lower classes because those in political power feared that an educated yeomanry would be filled with radical ideas such as women's equality, temperance, and, worst of all, abolition.

These differences in the North and South produced unique skill sets in both armies, and consequently, resulted in more successful and resourceful Union engineering operations during the war. Moreover, without the unique and astonishing engineering operations conducted by common laborers, machinists, shipbuilders, and both common school educated and West Point trained engineers, it was unlikely the North would have won the war. The outcome of the Civil War depended on the Union Army's ability to improvise and take the war to the South. Northern armies operated on unfamiliar terrain, which included mountain ranges, swamps and wetlands, alluvial plains, forests, and rugged hills, all of which were difficult to access because of dismal road systems and poorly mapped landscapes. Union generals were forced to execute a strategy that demanded the control of 750,000 square miles of territory and the defeat of enemy armies, partisan raiders and cavalry constantly threatening long and tenuous supply lines. Between 1861 and 1865 the North engineered victory.

## TABLE OF CONTENTS

|  | Page |
|--|------|
| ACKNOWLEDGMENTS.....   | v    |
| ABSTRACT .....   | xii  |
| LIST OF TABLES.....  | xv   |
| LIST OF MAPS .....   | xvi  |
| <br>CHAPTER  |      |
| 1. THE MISSISSIPPI DELTA .....   | 1    |
| 2. EDUCATION IN ANTEBELLUM AMERICA: COMMON SCHOOLS AND MECHANICS<br>INSTITUTES.....                            | 40   |
| 3. MANUFACTURING, AGRICULTURE, SCIENCE, AND TECHNOLOGY .....   | 76   |
| 4. PROFESSIONALS AND VOLUNTEERS .....  | 128  |
| 5. TRIAL AND ERROR .....   | 177  |
| 6. ENGINEERS, PIONEERS, AND RAILROAD MEN .....   | 227  |
| 7. VICKSBURG.....  | 276  |
| 8. GETTYSBURG AND CHATTANOOGA .....  | 330  |
| 9. RED RIVER, PETERSBURG AND ATLANTA.....  | 379  |
| 10. A SIGNIFICANT AMOUNT OF BRIDGING .....   | 429  |
| 11. “THE BRIDGE SHOULD HAVE BEEN FINISHED LONG AGO.” .....   | 450  |
| TABLES .....   | 475  |
| MAPS .....   | 488  |
| <br>APPENDICES   |      |
| A. UNION ARMY ENGINEERING ASSETS DURING THE CIVIL WAR .....  | 502  |
| B. CONFEDERATE ENGINEERING ASSETS DURING THE CIVIL WAR .....   | 507  |
| C. GENERAL OUTLINE OF DANIEL C. McCALLUM’S ORGANIZATIONAL CHART FOR<br>THE NEW YORK & ERIE RAILROAD, 1854..... | 510  |

|    |   |     |
|----|---|-----|
| D. | A SHORT HISTORY OF THE UNITED STATES ARMY’S CORPS OF ENGINEERS AND<br>CORPS OF ENGINEERS AND CORPS OF TOPOGRAPHICAL ENGINEERS ..... | 511 |
| E. | ILLUSTRATIONS .....   | 525 |
|    | BIBLIOGRAPHY .....  | 532 |

## LIST OF TABLES

| Table  | Page |
|--|------|
| 1. West Point Graduates who Served as Engineers, 1802-1860, United States .....                                  | 475  |
| 2. West Point Graduates who Served as Engineers, 1802-1860, Confederate States .....                             | 477  |
| 3. Statistics from the 6 <sup>th</sup> Census of the United States Regarding Manufacturing<br>Totals 1840.....   | 479  |
| 4. Statistics from the 8 <sup>th</sup> Census of the United States Regarding Employment<br>Statistics 1860 ..... | 480  |
| 5. Colleges in the United States in 1860.....  | 482  |
| 6. School Attendance in the United States in 1860, Confederate States .....                                      | 484  |
| 7. School Attendance in the United States in 1860, Border States .....   | 485  |
| 8. School Attendance in the United States in 1860, Union States.....   | 486  |



## LIST OF MAPS

| Map  | Page |
|--|------|
| 1. A.S. Johnston's Western Defensive Corridor, January 1862 .....                  | 488  |
| 2. Operations around Island No. 10 .....   | 489  |
| 3. Bissell, Tweeddale, Mahon, and Engineers By-Pass Island No. 10.....             | 490  |
| 4. Union Bridging during the Peninsula Campaign, 1862 .....                        | 491  |
| 5. Vicksburg Operational Area, Spring 1863.....                                    | 492  |
| 6. Yazoo Pass, Steele's Bayou, and Lake Providence Operations .....                | 493  |
| 7. Grant Crosses the Mississippi and Engineers Open a Supply Line .....            | 494  |
| 8. Engineers, Pioneers, and Infantry Build Four Bridges over Big Black River ..... | 495  |
| 9. Union, Confederate Troop Movement for Chickamauga, Chattanooga Campaigns....    | 496  |
| 10. Cracker Line at Chattanooga .....  | 497  |
| 11. Bailey and Pearsall's Dams on the Red River .....                              | 498  |
| 12. Crossing the James River, June 1864.....                                       | 499  |
| 13. Sherman's Supply Line During the Atlanta Campaign .....                        | 500  |
| 14. Battle of River's Bridge .....   | 501  |

## CHAPTER 1

### THE MISSISSIPPI DELTA

**“When I learned that Sherman’s army was marching through the Salk swamps, making its own corduroy roads at the rate of a dozen miles a day and more, I made up my mind that there had been no such army in existence since the days of Julius Caesar.”**

**Confederate General P. T. G. Beauregard, 1865**

**“That engine was made in our shop; I guess I can fit her up and run her.”**

**Private Charles Homans, Company E, Eighth Massachusetts Infantry, 1861**

Only the landscape’s semi-tropical climate, dismal swamps, numerous alligators, countless mosquitoes and mayflies, cottonmouth water moccasins, and occasional quicksand matched the enormity of the task before Union officers and their sweat-soaked dirty men. Operating on the western side of the Mississippi River, Colonel James Keigwin of the 49<sup>th</sup> Indiana Volunteer Infantry was ordered to “reconnoiter the region between Somerset and the Louisiana shore opposite the mouth of Bayou Pierre, and see if there were a practicable road through Tensas Parish to facilitate the Union army’s march to Hard Times and beyond.”<sup>1</sup> The orders Keigwin received were part of General Ulysses S. Grant’s attempt to besiege the city of Vicksburg. Grant’s army was in its fifth month of operations in April 1863. On seven occasions Grant had attempted to reach dry ground east of the city, and seven times he failed.<sup>2</sup>

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<sup>1</sup> Edwin Cole Bearss, *The Campaign for Vicksburg*, vol. 1, *Grant Strikes a Fatal Blow*, (Dayton, Ohio: Morningside House, Inc., 1986), xiii and 285.

<sup>2</sup> In December 1862 the Union Army, under Grant’s command, attempted to breakthrough Vicksburg’s outer defenses striking at Chickasaw Bayou. This action failed to bring the desired result. Union forces did succeed in capturing Arkansas Post on January 11, 1863, which prevented Confederate cavalry from operating against Grant’s supply line north of Vicksburg. Again, between January and April 1863, Grant attempted five more initiatives, this time to get naval transports and 22,000 men, 9,000 horses, and 300 pieces of artillery past the Confederate guns guarding the river. Once out of danger from fire atop the bluffs protecting Vicksburg, Grant would move far enough south of the city to cross the river and operate from the dry ground on

On April 25, before Keigwin's patrol left the semi-dry ground of their camp to begin their reconnaissance, Grant's army had performed yeoman's work in cutting a road forty miles long from Milliken's Bend to New Carthage. The spongy and bleak terrain required a two hundred foot bridge constructed from barn timbers over Roundway Bayou, a corduroy road, twenty feet wide from Milliken's Bend to Richmond, Louisiana, a drain to draw water away from the vital road network, and a dam built by the 1<sup>st</sup> Missouri Engineers and 127<sup>th</sup> Illinois Infantry, to retain water in Roundway Bayou.<sup>3</sup>

When Grant arrived at New Carthage, however, he discovered the flooding there from the soaking rains of the past three weeks made the position untenable as a jumping off point for his three army corps to cross to the east bank of the Mississippi. The Kentucky Company of Engineers (100 strong), Company I 35<sup>th</sup> Missouri Infantry (the army's pontoon company), and the 34<sup>th</sup> Indiana Infantry built four more bridges, and two miles of connecting roads that required, in some places, layers of planking to create sufficient buoyancy over quicksand to Perkin's Plantation.

It was with the Missouri engineers attending to the bridges and roadway from Milliken's Bend to New Carthage, and the Kentucky engineers opening a passage to Perkin's Plantation, that Grant decided to extend his line of march to Hard Times and perhaps beyond. The commanding general now needed more engineering troops so Grant turned to the infantry. He had used infantry regiments before, with great success, when confronted with a shortage of engineering forces, so Colonel Keigwin's 49<sup>th</sup> Indiana, 114<sup>th</sup> Ohio, a detachment of the 2<sup>nd</sup> Illinois Cavalry, and a section of guns manned by the 7th Michigan battery set out to find a passable

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the eastern shore. The five operations included Grant's Canal, the Lake Providence Expedition, the Yazoo Pass Expedition, the Steele's Bayou Expedition, and finally the Duckport Canal.

<sup>3</sup> Civil War Talk, "Milliken's Bend to the Big Black," <http://civilwartalk.com/threads/millikens-bend-to-the-big-black...>

route to Hard Times. Cypressess, cottonwoods, Spanish moss, several bayous, and 500 Confederate cavalymen with guns stood in the way of Keigwin's detachment. Lieutenant Francis Tunica of the Corps of Engineers accompanied Keigwin on the march.<sup>4</sup>

In four days the patrol built four bridges totaling a distance of 450 feet. They secured lumber for the bridges by tearing down buildings on nearby plantations, and foraging parties found tools and rope. Three of the bridges were particularly complicated to build because the bayous were wide, the currents strong, and the quicksand abundant. In these cases infantry officers (Lieutenant Colonel John W. Beekman, Captain William H. Peckinpaugh, and Lieutenant James Fullyard) supervised the construction because Tunica was recalled to headquarters. In addition, Keigwin received frequent harassment from Major Harrison's Confederate cavalry.<sup>5</sup>

On April 29<sup>th</sup> Keigwin reported to army headquarters that a practical road from Somerset (just north of Perkin's Plantation) to Hard Times was open for traffic. Yet, the story was not over. Grant decided to move his Mississippi River staging area fifteen miles further south to Deshroon's Landing. Four more bridges were built and three required "excavation to level the exit and entry points."<sup>6</sup> When the Union army finally crossed the river on April 30<sup>th</sup> they had extended their major supply line through terrain the Confederates deemed impassable. Starting at Milliken's Bend and ending at Deshroon Landing, through rain, mud, and swamps in thirty days Grant's soldiers travelled 70 miles and built 2,000 feet of "floating roads" and bridges. Furthermore, since Grant had only about 100 engineer troops, and none of them

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<sup>4</sup> *The War of the Rebellion: A Compilation of the Official Records of the Union and Confederate Armies*, (hereafter cited as O. R) Ser. I, Vol. XXIV, pt. I, 187, 571-572. Colonel Keigwin and Lieutenant Tunica filed separate reports and they were different from each other, especially regarding the role Lieutenant Tunica played in the operation.

<sup>5</sup> *O. R.*, Ser. I, Vol. XXIV, pt. I, 571-573.

<sup>6</sup> *O. R.* ser. 1, vol. XXIV, pt. 1, 571-573.

commanded by West Point trained officers, some of the building was undertaken and completed by men from infantry regiments.

Grant's reputation as stubborn and determined, "I can't spare this man, he fights," as Lincoln was apocryphally known to say, was proven again and again throughout the war. From this we can be certain that once he determined to find a staging area for his 40,000 men on the west bank of the Mississippi, he pressed his commanders to do so regardless of the obstacles. Three times he observed for himself potential staging areas at New Carthage, Perkin's Plantation, and Hard Times, and three times he ordered further reconnaissance south. It was clear that Grant believed the men in his army possessed the skill, regardless of difficulty, to deliver him to the desired strategic point. This symbiotic relationship between the commander's strategic and tactical objectives, and his men's ability to deliver the army to those points, gave Grant a significant advantage over his enemy.

British Field Marshall Archibald Percival Wavell, a veteran of the Boer War, World War I, and World War II, wrote about this critical relationship between a commander's plan and the reality of its execution. "The more I see of war, the more I realize how it all depends on administration and transportation....It takes little skill or imagination to see where you would like your army to be and when; it takes much knowledge and hard work to know where you can place your forces and whether you can maintain them there."<sup>7</sup> Grant understood this long before Sir Archibald, yet a careful reading of Grant's memoirs reveals that the general took this idea for granted. In his recollection of the Vicksburg Campaign and the march from Milliken's Bend to Perkins's Plantation he wrote, "Four bridges had to be built across bayous....The river falling made the current in these bayous very rapid, increasing the difficulty of building and

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<sup>7</sup> Martin Van Creveld, *Supplying War: Logistics from Wallenstein to Patton* (Cambridge: Cambridge University Press, 1977), 231-232.

permanently fastening these bridges; but the ingenuity of the “Yankee soldier” was equal to any emergency.”<sup>8</sup> This comment and several others throughout his post war musings gave credit to his citizen-soldiers’ abilities and skills to deliver his army to where he wanted it, and to sustain the supply lines necessary to allow his men to operate against his opponents in favorable positions.

Grant, however, was not the only one who seldom mentioned the Union Army’s engineering efforts, and the remarkable skills displayed by his soldiers. The participants on both sides, and the writers, journalists, and historians who followed them, produced an infinite number of carefully argued reasons why the North won the American Civil War. In this historiographical corpus, reasons for Union victory ranged from overwhelming resources, better civilian and political leadership, failed economic planning by the Confederacy, a stronger Union navy, and according to Robert E. Lee, God’s will.

This dissertation serves as a corrective. The critical advantage the Union held over the Confederacy was its ability to engineer victory. The North won, in part, because in the decades before the war Northerners invested in educational systems that served an industrializing economy. Furthermore, the labor system in the North rewarded mechanical ability, ingenuity, and imagination. The labor system in the South failed to do this. Plantation slavery generated fabulous wealth for a tiny percent of the southern white population. It fostered a particular style of agriculture and scientific farming that limiting land use. It curtailed manufacturing opportunities, and it stifled educational opportunities for the middle and lower classes because those in political power feared that an educated yeomanry would be filled with radical ideas such as women’s equality, temperance, and, worst of all, abolition.

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<sup>8</sup> Ulysses S. Grant, *Personal Memoirs of U. S. Grant* (New York: Penguin Books, 1999), 254.

In the North, each state's attempt at implementing basic educational reform, the introduction of the natural sciences into university curricula, the spread of informal educational practices directed at mechanics and artisans, and the exponential growth in manufacturing all generated a different work related ethos than that of the South. Ironically, southern politicians such as South Carolina's James Henry Hammond and Edmund Ruffin viewed the northern industrial economy as a chimera. They argued that workingmen's associations, immigration, and rampant unemployment destabilized the North, and it was only a matter of time before the North would explode in a class war creating chaos, collapse, and future uncertainty. It was for this unstated reason, Southern fire-eaters continued, that Northern politicians, especially Whigs and Republicans, demanded free territory in the west. This was the place, according to Hammond, where northerners sent immigrants and the unemployed to free eastern cities of social unrest. The North would come to see that Southern slavery provided a stable social structure, and that Southern agriculture was not susceptible to the ebb and flow experienced by Northern manufacturers. In the end, indeed, "Cotton is King."<sup>9</sup>

The slaveocracy missed the larger picture not because they were uneducated, but because their system was structured around the brutality of slavery—it was what they knew. As a result of this complete commitment to their "peculiar institution," when the Civil War broke out, few Southern officers were either trained or inclined to solve the massive logistical operations necessary to win the war. Even fewer common soldiers were interested in or skilled enough to maintain roads, build bridges, repair railroads, or dig fortifications—this was work for slaves.

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<sup>9</sup> Expression made famous by Senator James H. Hammond of South Carolina as part of a speech he delivered to the United States Senate on March 4, 1858. James H. Hammond, *Selections from the Letters and Speeches of the Honorable James H. Hammond of South Carolina* (New York: John F. Trow & Co., 1866), 311-322.

It is possible to argue, however, that since most of the war was fought in the South, Confederate armies in the field did not need extensive logistical support. Southern generals knew the geography better than their Northern counterparts, they understood the road systems, could count on accurate intelligence from their fellow Southern citizens who wanted to rid their territory of the hated, invading Yankees, and Confederate generals often would determine the place of battle.

Some historians argued that having few mechanics, civil engineers, and artisans within the ranks of the Confederate Army made little difference in the South's ability to win the war. This cannot be said for the North. Without the unique, novel, and remarkable engineering operations conducted by common laborers, machinists, gun makers, and both common school educated and West Point trained engineers, it seems unlikely the North would have won the war. In a letter dated October 10, 1861, Confederate Secretary of War George W. Randolph wrote, "They may overrun our frontier states and plunder our coast, but as for conquering us, the thing is an impossibility. There is no instance in history of a people as numerous as we are inhabiting a country so extensive as ours being subjected if true to themselves."<sup>10</sup> Union generals were forced to execute a strategy that demanded the control of 750,000 square miles of territory and the defeat of enemy armies, partisan raiders and cavalry constantly threatening long and tenuous supply lines. Between 1861 and 1865 the North engineered victory.

This dissertation examines how differences of emphasis in cultural values shaped the formation of the Union and Confederate armies. During the antebellum period the nation enjoyed shared values: manifest destiny, hard work, a social hierarchy, racism and gender bias, capitalism, and individual freedom and liberty. Yet the growing emphasis in the North on

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<sup>10</sup> Margaret E. Wagner, Gary W. Gallagher, and Paul Finkelman, eds., *The Library of Congress Civil War Desk Reference* (New York: Simon & Schuster, 2002), 333.



manufacturing and universal education was a stark contrast to the South's emphasis on strict social controls and slavery. These differences in the North and South produced unique skill sets in both armies, and as such, resulted in more effective and efficient Union engineering operations during the war. The outcome of the Civil War depended on the Union Army's ability to improvise and take the war to the South. Northern armies operated on unfamiliar terrain, which included mountain ranges, swamps and wetlands, alluvial plains, forests, rugged hills, all of which were difficult to access because of dismal road systems and poorly mapped landscapes. Union generals, therefore, came to expect engineers and their men to adapt to what Prussian military theorist Carl von Clausewitz described as the "fog of war."<sup>11</sup>

Union engineers and often Union infantry-turned-engineers, succeeded at responding to multiple problems in the field, which allowed the army to maintain the initiative. Colonel Keigwin, the 49<sup>th</sup> Indiana, and the 114<sup>th</sup> Ohio infantries provided an example of these Northern mechanical and building skills. This dissertation will argue that like the North, cultural, economic, and social influences before the war in the South were reflected in Confederate engineering operations during the war. Unlike the North, however, these elements in the South produced a limited number of men (especially among the infantry's rank and file) with mechanical ability or engineering skills. This vacuum resulted in critical strategic and tactical

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<sup>11</sup> Clausewitz wrote: "Finally, the general unreliability of all information presents a special problem in war: all action takes place, so to speak, in a kind of twilight, which, like fog or moonlight, often tends to make things seem grotesque and larger than they really are. Whatever is hidden from full view in this feeble light has to be guessed at by talent, or simply left to chance. So once again for lack of objective knowledge one has to trust to talent or to luck." See Carl von Clausewitz, *On War*, eds. and trans. Michael Howard and Peter Paret (Princeton: Princeton University Press, 1976), 140. General Ulysses S. Grant echoes Clausewitz's sentiments in a letter to Mr. John Russell Young: "If the Vicksburg campaign meant anything, in a military point of view, it was that there are no fixed laws of war which are not subject to the conditions of the country, the climate, and the habits of the people....I don't underrate the value of military knowledge, but if men make war in slavish observances of rules, they will fail." In David Donald, ed., *Why the North Won the Civil War* (Baton Rouge: Louisiana State University Press, 1960), v-vi.

blows to the Confederacy. For example, Fort Donelson was so poorly constructed that during the “ordinary rise of the Tennessee River, the lower river battery would be under nine feet of water.” In addition, “It was only after the fall of Fort Donelson that Confederate General Albert Sydney Johnston learned that his engineers had failed to construct a second line of defenses at Nashville.”<sup>12</sup>

This dissertation contributes to the rich historiography about why the North won, and the South lost, the American Civil War. Yet, this dissertation’s argument might have detractors. Many professional historians believe that the Civil War has been covered *ad nauseum*, and that military history serves limited purposes better suited, perhaps, to soldiers and statesmen, rather than serious history students who investigate and explore cultural, social, economic, transnational, and gender formations and occasionally political and diplomatic history.

Many Civil War topics have, indeed, been covered *ad nauseum*. Historian Edward Tabor Linenthal explained about Gettysburg: “Fixation on the battlefield itself played out in the extreme in battlefield reenactments, celebrated American martial courage and ignored the more profound legacy of the battle and war.” Works by David W. Blight and Drew Gilpin Faust have addressed both the remarkable and awful legacies of the war. Yet, as Linenthal wrote, academics were contemptuous of the “Which regiment took the Peach Orchard?” approach to history.<sup>13</sup>

Furthermore, since the Reagan Administration and the rise of neo-conservative ideology, academic historians have feared the growth of conservative popular culture and the

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<sup>12</sup> Thomas Lawrence Connelly and Archer Jones, *The Politics of Command: Factions and Ideas in Confederate Strategy* (Baton Rouge: Louisiana State University Press, 1973), 95-96.

<sup>13</sup> Kenneth W. Noe, George C. Rable, and Carol Reardon, “Battle Histories: Reflections on Civil War Military Studies,” *Civil War History* Vol. 53 No. 3 (2007): 229. See also, David W. Blight, *Beyond the Battlefield: Race, Memory, and the American Civil War* (Amherst: University of Massachusetts Press, 2002) and Drew Gilpin Faust, *This Republic of Suffering: Death and the American Civil War* (New York: Alfred A. Knopf, 2008).

direction this might take us in the future. This fear, based on the entrenchment of partisanship in Washington, the racist treatment, by some, of our first African-American president, new attacks on women's rights, conduct by the general public (like chanting U. S. A. / U. S. A. in front of the White House after Osama Bin Laden was killed), and the vitriol spewed by right-wing political commentators, is real. Scholars perceived reenactments, motion pictures, and computer games as the public's fascination with war, and as historian Andrew J. Bacevich pointed out, the development of the new American militarism.<sup>14</sup>

This new American militarism is dangerous. "It subordinates concern for the common good to the paramount value of military effectiveness."<sup>15</sup> It takes the American people away from President Abraham Lincoln's vision of becoming the nation that represents the "last, best hope on earth," and instead, drives us to imperialistic policies that continue to isolate us from a global world. James Madison wrote: "Of all the enemies of public liberty, war is perhaps the most to be dreaded, because it comprises and develops the germ of every other. War is the parent of armies. From these proceed debts and taxes. And armies, debts and taxes are the known instruments for bringing the many under the domination of the few....No nation could preserve its freedom in the midst of continual warfare."<sup>16</sup>

It is precisely because the new American militarism is so dangerous that we need to study military history. Unfortunately, it remains the elephant in the room. Whether we like it or not, war remains a condition of the human race, and it is imperative that academic historians pay heed to the subject. If we choose to ignore it then radio and television commentators,

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<sup>14</sup> Andrew J. Bacevich, *The New American Militarism: How Americans are Seduced by War* (Oxford: Oxford University Press, 2005).

<sup>15</sup> Bacevich, 7.

<sup>16</sup> Bacevich, 7. See also James Madison, "Political Observations," April 20, 1795, in Philip R. Fendall, ed., *Letters and other Writings of James Madison*, vol. 4 (Philadelphia, 1865), 491.

politicians, reenactors, popular writers, and filmmakers will interpret war's lessons and legacies, and shape our understanding of what happened and why it matters.<sup>17</sup>

This dissertation addresses the general topic of "Why the North Won the Civil War," and specifically why Union soldiers were better than Confederate soldiers at engineering that victory. My goal in this study is to explain why and how Northern and Southern engineering differed, and why the difference mattered.

To introduce my idea into the larger conversation historians continue to have about the reasons for Union victory requires a review of the historiography. It is difficult to believe that among the books, articles, monographs, and dissertations written about the American Civil War, none draw comparisons between Union and Confederate engineering. A number of works highlight the North's industrial growth in the antebellum period including works by Paul W. Gates, George Taylor, and David Walker Howe.<sup>18</sup> Each of these scholars discussed the rising capacity of Northern manufacturing and production before the Civil War and supported the notion of the North's overwhelming resources during the war.

The North did possess overwhelming material and manpower resources. General Robert E. Lee recognized this fact. His soldiers were never outfought, nor did they ever display a lack of personal courage or manly skill. After Lee surrendered his tattered and torn Army of Northern Virginia to Union forces at Appomattox Court House he wrote to his men: "After four years of

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<sup>17</sup> Noe, 229.

<sup>18</sup> Paul W. Gates, *The Farmer's Age: Agriculture, 1815-1860* (New York: Harper & Row, 1960). George Rogers Taylor, *The Transportation Revolution, 1815-1860* (New York: Harper & Row, 1951). David Walker Howe, *What Hath God Wrought: The Transformation of America, 1815-1848* (New York: Oxford University Press, 2007).

arduous service marked by unsurpassed courage and fortitude, the Army of Northern Virginia has been compelled to yield to overwhelming numbers and resources.”<sup>19</sup>

In 1960, historian Richard N. Current re-enforced the general’s assessment of why Lee’s army surrendered. Current, a revisionist historian influenced by World War II and the Korean War, witnessed first hand how the industrial might of the United States defeated the Germans and Japanese. He argued that it was improbable that the agrarian South could have defeated their industrial enemy. The North’s overwhelming resources included sixty-one percent of the white population, sixty-six percent of railroad mileage, and eighty-one percent of the factories. According to Current these numbers made it only more remarkable that the Confederacy lasted so long. It would have taken a miracle for the South to win. (Interestingly enough, he canonized Robert E. Lee anyway.) Current wrote that, “as usual, God was on the side of the heaviest battalions.”<sup>20</sup>

After the Vietnam War, historian James McPherson pointed out that, “God was not always on the side of the heaviest battalions.” With American withdrawal from Southeast Asia historians and strategists began the investigation as to what went wrong. Our economic power prolonged the conflict, but it did not bring Ho Chi Minh to his knees. As in our own American Revolution, an undersupplied, underfed, undercapitalized people defeated wealthier nations. Thus, Civil War historians like McPherson determined that Current’s thesis did not adequately answer the question; why did the North win the Civil War? Many turned elsewhere for possible answers.

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<sup>19</sup> Shelby Foote, *The Civil War, A Narrative: Red River to Appomattox*, vol 3., (New York: Random House, 1974), 955.

<sup>20</sup> Richard N. Current, “God and the Strongest Battalions,” in *Why the North Won the Civil War* (Baton Rouge: Louisiana State University, 1960), 21-22. See also James McPherson, “American Victory, American Defeat,” in *Why the Confederacy Lost*, ed. Gabor S. Boritt (Oxford: Oxford University Press, 1992), 20. James M. McPherson, *Drawn With the Sword: Reflections on the American Civil War* (New York: Oxford University Press, 1996), 133.

Before a new generation of historians in the 1970s investigated fresh ways of better understanding the reasons for Union victory and Confederate defeat, they had several theories, besides Current's, to consider. Besides President Abraham Lincoln's belief that "the Almighty has His own purposes," General Lee's belief that the Union had endless resources, and Richmond editor Edward Pollard's belief that it was all Jefferson Davis's fault, it was not until the 1920s that a group of Southern historians determined it was time to defend Southern honor. This included placing the blame for the war "at the doorstep of abolitionists."<sup>21</sup> These scholars became southern apologists and generated considerable treacle, describing the South in a moonlight and magnolia way, which laid the foundation for novelist Margaret Mitchell's, *Gone with the Wind*.

So it was that Frank Owsley wrote *States Rights in the Confederacy* (1925). He maintained, using governors Zebulon Vance of North Carolina and Joseph Brown of Georgia as examples, that Southern adherence to the states' rights principles of the founding fathers, handicapped the central government in Richmond from mobilizing men and supplies for war.

The issue of supplies for war raised serious concerns about the Confederacy's economy and how it was managed. Influenced by the social upheaval of the 1960s, a new group of historians designated the New Left, looked at the relationship between "corporate" interests

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<sup>21</sup> Francis G. Couvares, Martha Saxton, Gerald N. Grob, and George Athan Billias, eds., *Interpretations of American History: Patterns and Perspectives*, vol. 1, *Through Reconstruction* (Boston: Bedford/St. Martin's, 2009), 237. McPherson, "American Victory, American Defeat," 17. *Abraham Lincoln: Speeches, Letters, and Miscellaneous Writings, Presidential Messages and Proclamation, 1859-1865*, ed. Don E. Fehrenbacher (New York: The Library of America, 1989), 686-687. In response to a letter from Thurlow Weed complimenting the President on his Second Inaugural Address, Lincoln wrote: "Men are not flattered by being shown that there has been a difference of purpose between the Almighty and them. To deny it, however, in this case, is to deny that there is a God governing the world." Lincoln to Weed, March 15, 1865, Fehrenbacher, ed., 689.

and “populist” interests.<sup>22</sup> The New Left argued that both were liberal and reform minded, but over time had come to turn away from their bedrock principles and instead focused on abject “consumerism.”<sup>23</sup> David M. Potter was one such historian and argued that the southern Confederacy established economic policies during the war that centered on this consumer culture and consequently, the government was shortsighted in their economic planning. This lack of economic imagination cost the Confederacy the resources to conduct a prolonged war. Potter argued that Confederate policies in reference to taxation, cotton, impressments of supplies, and the use of slave labor damaged the South’s efforts to win independence. More creative and innovative policies might have made a crucial difference in the war’s outcome. Potter suggested, however, “the long years of defending slavery and building protective legalistic safeguards for the South as a minority section within the Union may have impaired the capacity for affirmative and imaginative action on the part of Southern leaders generally.”<sup>24</sup>

Further understanding of the Confederacy’s economy prompted economic historians, with an arsenal of computerized data at their disposal, to investigate the relationship between fiscal and monetary policy and Confederate defeat. Stephen R. Wise’s *Lifeline of the Confederacy* (1988) suggested that the South lost the war for some reason or combination of reasons, but it was not as a result of the Union blockade.<sup>25</sup> Using a quantitative approach to the subject, Wise demonstrated that the Union navy was not capable of preventing blockade-runners from

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<sup>22</sup> Francis G. Couvares, Martha Saxton, Gerald N. Grob, and George Athan Billias, *Interpretations of American History*, vol. 2, *From Reconstruction* (Boston: Bedford/St. Martin’s, 2009), 371.

<sup>23</sup> Couvares et al, vol.2, 371.

<sup>24</sup> David M. Potter, “Jefferson Davis and the Political Factors in Confederate Defeat,” in *Why the North Won the Civil War*, ed. David Herbert Donald (Baton Rouge: Louisiana State University Press, 1960, 1960), 113.

<sup>25</sup> Stephen R. Wise, *Lifeline of the Confederacy: Blockade Running during the Civil War* (Columbia: University of South Carolina Press, 1988). James L. Roark, “Behind the Lines: Confederate Economy and Society,” in *Writing the Civil War: The Quest to Understand*, ed. James M. McPherson and William J. Cooper, Jr. (Columbia: University of South Carolina Press, 1998), 213.

delivering the necessary supplies to sustain the war effort. This, coupled with the success of the South's makeshift industrial revolution, "negated whatever impact the blockade had."<sup>26</sup>

The same year Wise's book came out, James M. McPherson published his epic *Battle Cry of Freedom*, in which, he challenged Wise's thesis. He wrote, "While it is true that five out of six runners got through, that is not the crucial statistic. Rather, one must ask how many ships carrying how much freight *would have* entered southern ports if there had been no blockade." The effectiveness of the blockade, McPherson argued, was that it reduced Southern "seaborne trade to less than a third of normal."<sup>27</sup>

Expanding upon David Potter's New Left interpretation of Confederate economic failure, Stanley Lebergott challenged the view that southern planters abandoned the cotton crop during the war, and instead he argued, grew vast amounts of their "premier cash crop" at the expense of perhaps growing crops to feed armies in the field and starving civilians. Lebergott concluded that, "an army of slaves grew cotton for private profit instead of serving the needs of Confederate independence."<sup>28</sup> Also building upon Potter, Douglas B. Ball's *Financial Failure and Confederate Defeat* (1991), did not mince words when analyzing failed Confederate fiscal policies. According to Ball, the Confederate government, especially Secretary of the Treasury Christopher Memminger and President Jefferson Davis made disastrous decisions regarding the cotton embargo, "the failed control of the banks' limited supply of specie, missed opportunities

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<sup>26</sup> Roark, 213. For the Confederacy's industrial success see Frank E. Vandiver, *Ploughshares into Swords: Josiah Gorgas and Confederate Ordnance* (Austin: University of Texas Press, 1952). William N. Still, Jr. *Confederate Shipbuilding* (Athens: University of Georgia Press, 1969). Mary A. DeCredico, *Patriotism for Profit: Georgia's Urban Entrepreneurs and the Confederate War Effort* (Chapel Hill: University of North Carolina Press, 1990). Charles B. Dew, *Bond of Iron: Master and Slave at Buffalo Forge* (New York: W. W. Norton, 1994).

<sup>27</sup> James M. McPherson, *Battle Cry of Freedom: The Civil War Era* (New York: Oxford University Press, 1988), 381-382. McPherson was well aware of Wise's argument. Wise originally proposed it in his 1983 Ph.D. dissertation.

<sup>28</sup> Roark, 207. Stanley Lebergott, "Why the South Lost: Commercial Purpose in the Confederacy, 1861-1865," *Journal of American History* 70 (June 1983): 67-68.



to float bonds in Europe and buy local cotton,” and the failure to coordinate the purchase of supplies overseas.<sup>29</sup> Ball wrote, “A bankrupt treasury played a significant role in Confederate defeat.”<sup>30</sup>

If Lebbergott and Ball focused on failed economic leadership and imagination, John Solomon Otto added to Confederate criticism by directing his sights on Richmond’s “botched agricultural mobilization.”<sup>31</sup> The government not only generated poor fiscal policies, but it also failed both to invest in a deteriorating infrastructure and to focus on feeding its people. By 1864 “Confederate soldiers possessed first-class ordnance but had second class accouterments and ate third class rations.”<sup>32</sup>

The problem with economic analyses as a way to explain Confederate defeat, however, is just the other side of Professor Richard N. Current’s coin. For Current, Union economic might and sound fiscal and monetary policies delivered the victory. For Potter poor fiscal and monetary policies led to defeat. Both sides of these economic deterministic arguments failed to address the human equation. It is true that if the economies of the North and South had been reversed it would have been almost impossible for the North to conquer the South. As it was the South came close to winning its independence. So how did this happen? To come closer to answering this question a different line of inquiry must be pursued. How badly did Southerners want independence, and how long would they fight for it? How long would Northerners fight to maintain the Union? What if Union blunders on the battlefield led to Confederate victory? What motivated the rank and file to stand and fight? What motivated the societies standing behind

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<sup>29</sup> Roark, 212.

<sup>30</sup> Douglas B. Ball, *Financial Failure and Confederate Defeat* (Urbana: University of Illinois Press, 1991).

<sup>31</sup> Roark, 206

<sup>32</sup> John Solomon Otto, *Southern Agriculture during the Civil War Era, 1860-1880* (Westport, CT: Greenwood Press, 1994).

the soldiers to continue to support the war effort? These questions appear more important in answering why the Union won or the Confederacy lost, the Civil War.

In the past twenty years, gender studies of the North and South during the war years have offered both engaging and compelling theories as to why the war turned out the way it did. Drew Gilpin Faust argued in 1990 that Southern women had more to do with Confederate defeat than any Southern economic blunder, Northern resource, battle, general, or politician between 1861 and 1865. She wrote that as the war raged on and entered the crucial years of 1863 and 1864, Southern women had come to realize they “had embraced the attendant ideology of sacrifice as part of a larger scheme of paternalistic assumptions,” but that white Southern males failed to provide “the services and support understood as requisite to their dominance.” Faust continued, “The way in which their interests in the war were publicly defined...gave women little reason to sustain the commitment modern war required. It may well have been because of its women that the South lost the Civil War.”<sup>33</sup>

Faust expanded her thesis in her 1996 book *Mothers of Invention: Women of the Slaveholding South in the American Civil War*. She challenged traditional notions of Confederate defeat by exploring the relationship between women of the planter class and their husbands away at war. As these women undertook new roles as heads of the households, and their responsibilities expanded dramatically to include the management of money and slaves, a dissonance developed between their memory of idealized prewar years and the realities of their wartime lives. Faust argued that women came to resent a war that turned life upside down, and

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<sup>33</sup> Drew Gilpin Faust, “Altars of Sacrifice: Confederate Women and the Narratives of the War,” in *The Journal of American History* 76, no.4 (1990): 1200-1228. Catherine Clinton and Nina Silber, eds. *Divided Houses: Gender and the Civil War* (New York: Oxford University Press, 1992), 197-199.

consequently wrote to their men to come home. As farmers broke down and slaves fled plantations, many men did walk away from the battlefield.

In 2001 historians George Rable and Jean V. Berlin joined the discussion regarding the role home front morale played in bringing about the collapse of the Confederacy. Rable opined that Southern morale was a complex issue and “to say that Confederate morale collapsed in the spring of 1865 is at best a partial truth.” Perhaps, some women maintained hopes beyond despair, but these were sustained at a growing physical cost. As Yankees struck closer to home, and sometimes home itself, war weariness snuffed out any chance of active resistance.<sup>34</sup>

Jean Berlin took direct aim at Professor Faust and challenged the notion that Confederate women, disgruntled by the role they were forced to lead as a result of the war, contributed directly to Southern defeat. Questioning whether Southern defeat on the battlefield, or women’s demands that their men return home, precipitated Confederate collapse, she argued that women neither “hastened or postponed defeat.”<sup>35</sup> Instead she determined that like Confederate men on the front, white female experiences were a complexity of emotions tied to their spirituality, the availability of food for their families, and the news from the killing fields.

That Southern women, demoralized by the news from the battlefield, and the hunger and deprivation felt at home, encouraged or demanded their men return was real. Yet it is impossible to know for certain if men deserted because of this beckoning, or soldiers threw down their guns because the constant stench of death, disease, and decay compelled them to

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<sup>34</sup> George C. Rable, “Despair, Hope, and Delusion: The Collapse of Confederate Morale Reexamined,” in *The Collapse of the Confederacy*, eds. Mark Grimsley and Brooks D. Simpson (Lincoln: University of Nebraska Press, 2001).

<sup>35</sup> Jean V. Berlin, “Did Confederate Women Lose the War? Deprivation, Destruction, and Despair on the Home Front,” in *The Collapse of the Confederacy*, eds. Mark Grimsley and Brooks D. Simpson (Lincoln: University of Nebraska Press, 2001).

do so. Nonetheless, for as many who walked away from the war, more remained to fight. Similarly, for as many women who became dispirited, more continued to fight. The reality that Southern women carried on the struggle with undaunted courage and unwavering determination, was argued skillfully by Jacqueline Glass Campbell in *When Sherman Marched North From the Sea: Resistance on the Confederate Home Front* (2003). Women saw themselves “as both mothers and warriors,” and invading Northern soldiers were both astonished and enraged by the fierceness women defended their homes.<sup>36</sup> Using diaries and letters, Campbell, demonstrated that like men on the front, women were determined to defend hearth and home. As a result, instead of displaying a submissive persona, women displayed blind hatred for the Yankees. Harriott Middleton wrote to her cousin “that it would be better to “form an army of women” with which they defended themselves, “rather than live under Yankee rule.”<sup>37</sup> Facing the enemy reinvigorated loyalty to the Confederacy.<sup>38</sup>

When women’s loyalty waned, starvation was often the cause. The work force designated to grow the crops, dig the fortifications, and work in the factories started an exodus. By the thousands, African American slaves left their farms, plantations, and workplaces to begin their journey to Union lines and freedom. How they were actually treated by their hosts is another story, yet the abandonment of their owners was a devastating blow to the South and a blessing to the North. In the last twenty years some scholars have argued that African Americans took freedom in their own hands and caused the defeat of the Southern Confederacy.

Dudley Taylor Cornish was one of the first African American historians to argue that black soldiers made a direct contribution to Union victory. His book published in 1956 at the

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<sup>36</sup> Jacqueline Glass Campbell, *When Sherman Marched North From the Sea: Resistance on the Confederate Front* (Chapel Hill: University of North Carolina Press, 2003), 4.

<sup>37</sup> Campbell, 71.

<sup>38</sup> Campbell, 106.

conclusion of the Montgomery Bus Boycott, gave agency to black Union soldiers. Cornish took aim at the normative description of whites, who with grand benevolence and moral certitude, sacrificed and “died to make men free.” Instead, Cornish pointed out, black soldiers made their own sacrifices and won their own freedom.<sup>39</sup>

For Joseph T. Glatthaar African American success in bringing about the end of the Civil War went beyond the battlefield. It was true that 180,000 blacks joined the Union Army and served as skilled soldiers on the frontlines and behind the lines. Yet, it did not end there. As slaves walked away from plantations this resulted in a significant labor shortage connected to Confederate military operations. For example, by 1863 the superintendent of the Virginia Central Railroad, a major supply artery for Robert E. Lee’s Army of Northern Virginia, reported to Jefferson Davis that repairs to tracks and railroad ties “were impossible because laborers [slaves] were unavailable.”<sup>40</sup>

Slaves who remained behind on plantations also operated as a fifth column against their Confederate masters. Slaves hid escaped Union prisoners of war, “sabotaged farm and labor equipment...and promoted widespread insecurity among whites at home” including the fear of servile insurrection. As Glatthaar demonstrated, by 1864 Confederate Major General Patrick Cleburne and many of his officers insisted, “slavery has become a military weakness.”<sup>41</sup>

Immediately after the war Major Martin Delany told a black crowd, “Do you know that if it was not for the black men this war never would have been brought to a close with success to the Union, and the liberty of your race if it had not been for the Negro?”<sup>42</sup> This question about

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<sup>39</sup> Dudley Taylor Cornish, *The Sable Arm: Negro Troops in the Union Army, 1861-1865* (New York: Longmans, Green and Company, 1956). See also Couvares, 322.

<sup>40</sup> Joseph T. Glatthaar, “Black Glory: The African-American Role in Union Victory,” in *Why the Confederacy Lost*, ed. Gabor S. Boritt (New York: Oxford University Press, 1992), 144.

<sup>41</sup> Glatthaar, 145 and 159.

<sup>42</sup> Glatthaar, 162.

the role African Americans played in bringing about Confederate defeat took on the tones of a public debate when historian Barbara Fields introduced the theory of black “self-liberation.” Fields argued that only by walking away from plantations by the tens of thousands, and into Union lines, did the Lincoln administration confront the moral question of the day. According to Fields, Lincoln was finally pushed by thousands of escaping slaves to issue the Emancipation Proclamation. His commitment to emancipation was weak; black commitment to emancipation was strong and determined.<sup>43</sup> It was not the government but the slaves themselves who deserved the credit, for “by the time Lincoln issued his Emancipation Proclamation, no human being alive could have held back the tide that swept toward freedom.”<sup>44</sup>

In response to Fields, James McPherson, an advocate of black agency, wrote that Fields’s argument pushed too far off the mark. She failed to recognize Lincoln’s moral aversion to slavery clearly stated in numerous prewar speeches including his House Divided Speech, the remarks he made during his debates with Stephen Douglas in 1858, and his Cooper Union address. For McPherson “slaves did not emancipate themselves; they were liberated by the Union army.” Since Lincoln’s line-in-the-sand position regarding the free territories placed Northern armies in motion, and since it was Lincoln who issued the Emancipation Proclamation, and since it was Lincoln who stood firm against the onslaught of criticism even to the point of death, then it was Abraham Lincoln who “freed the slaves.”<sup>45</sup>

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<sup>43</sup> Couvares, 322.

<sup>44</sup> Peter Kolchin, “Slavery and Freedom in the Civil War South,” in *Writing the Civil War: The Quest to Understand*, eds. James M. McPherson and William J. Cooper, Jr. (Columbia: University of South Carolina Press, 1998), 248. See also Barbara J. Fields, “Who Freed the Slaves?” in Geoffrey C. Ward, *The Civil War: An Illustrated History* (New York: Alfred A. Knopf, 1990), 178-181. Ira Berlin, Barbara J. Fields, et al., *Slaves No More: Three Essays on Emancipation and The Civil War* (Cambridge: Cambridge University Press, 1992), 5-6.

<sup>45</sup> Kolchin, 248. See also James M. McPherson, *Drawn With the Sword: Reflections on the American Civil War* (New York: Oxford University Press, 1996), 192-207.

In Gary W. Gallagher's important work, *The Confederate War* (1997), the author argued that Confederate nationalism "transcended class lines," and despite Southern defeats on the battlefield, politicians' blunders in congress, and civilian hardships at home, morale remained high until Lee surrendered at Appomattox.<sup>46</sup> Social historian Armstead L. Robinson soon challenged Gallagher's interpretation. A graduate student under Eugene Genovese, Robinson's work had a significant impact on Civil War scholarship and African American history. Robinson believed that social history could provide fresh insights into political and military history, and he argued that Southern political leaders could neither identify nor reconcile "simmering tensions between nonslaveholders and small yeoman farmers, on the one hand, and wealthy slaveholding planters, on the other."<sup>47</sup> For Robinson, "the major Confederate defeats in the western theater during 1863—Vicksburg and Missionary Ridge—were directly attributable to the growing disenchantment and the internal class conflict that underlay it."<sup>48</sup>

Class conflicts, the threat of servile insurrection, southern women's rage directed at Northerners or at the circumstances that placed them in charge of plantations without the support of their patriarchal politicians, and bondsmen turned freedmen who added 180,000 men to the cause of freedom, all deftly assisted in our understanding of the collapse of the Confederacy. Yet, these inquiries, whether we like it or not, still leave questions about why the North won or the South lost the Civil War. Would class conflict have been assuaged by Southern battlefield victories at Vicksburg and Missionary Ridge? Regardless of suffering morale, shortages in food and labor, and losses to Union armies, would the election of McClellan instead of Lincoln in 1864 have led to Southern independence? If there was no Antietam would there be

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<sup>46</sup> Armstead L. Robinson, *Bitter Fruits of Bondage: The Demise of Slavery and the Collapse of the Confederacy, 1861-1865* (Charlottesville: University of Virginia Press, 2005), ix.

<sup>47</sup> Robinson, vii.

<sup>48</sup> Robinson, x.

an Emancipation Proclamation? Did having more soldiers guarantee Northern victory, especially in a war where the tactical defense trumped the full-scale frontal assault? What accounts for the Union armies ability to access Southern armies hidden, protected, and operating in 750,000 square miles of territory with bayous, river systems, mountain ranges, and coastal wetlands?

For many scholars, exploring military causes to the question of why the Southern Confederacy collapsed is trivial and unimportant. For them, achieving battlefield success is as formulaic as the study of military history is itself. The skill of commanders, the courage of soldiers, and the solution to ubiquitous logistical problems has little to do with the great question of victory and defeat that live outside the killing zone. Yet, to understand, as James McPherson brilliantly proposes, the role of contingency in Civil War history, or to fail to understand military answers to why the Confederacy lost a war is a failure indeed. So now we must turn to those historians who have suggested military reasons why the North won the Civil War.

In *Why the South Lost the Civil War* (1986) the authors introduced their topic quoting from an article written by Henry Steele Commager in the *New York Times Magazine* in 1963. Questioning the doctrine of inevitability, Commager posits, "...how can we explain the widespread assumption in Europe—and even in parts of the North—that the South would make good her bid for independence?"<sup>49</sup> The authors continued that the "how indeed" was investigated by writers and historians since John Russell Bartlett published his book in 1866, and interpretations advanced are too multiple to calculate.<sup>50</sup> Yet there is a body of work that has survived the test of time and has offered military explanations for the war's outcome.

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<sup>49</sup> Richard E. Beringer, Herman Hattaway, Archer Jones, and William N. Still, Jr., *Why the South Lost the Civil War* (Athens: The University of Georgia Press, 1986), ix.

<sup>50</sup> Beringer, et al., ix.



One book that offered a most compelling discourse regarding the question about why the North won or the South lost the Civil War is George Edgar Turner's *Victory Rode the Rails* (1953), an investigation into both side's railroad operations during the war. For Turner when the war ended, "the railroad system in the North was stronger than it was when the war began. Except for the lines taken over by the Federal army and rehabilitated for its military use, practically all the railroads of the South were a pitiable mass of wreckage."<sup>51</sup> Turner pointed out that the South's ability to repair track and trains paled in comparison to the Union's efforts conducted by qualified engineers and construction crews. In addition, the North found in the person of Herman Haupt, a skilled engineer and equally skilled organizer and leader, the backbone of all Union railroad operations. The South, Turner concluded, found no Haupt.<sup>52</sup> Yet, Turner's focus was on the war itself and so he did not attempt to answer the ancillary, and perhaps more important question, why did the North produce such a skilled engineer as Haupt, and the South did not?

Just three years after Turner's book was published, Frank E. Vandiver looked at command and logistics from a Southern perspective in *Rebel Brass* (1956). Unlike Turner, however, Vandiver considered the accomplishments and effectiveness of the Confederate command system remarkable. He argued that even with the gravitational pull of state-rights governors such as Zebulon Vance and Joseph Brown demanding decentralized government, "the Confederacy was able to organize and direct a massive war effort for four years." This effort was thanks to Confederate logisticians.<sup>53</sup> Yet Vandiver's analysis of engineers and engineering operations was limited to one sentence, and his assessment of Southern railroad use and

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<sup>51</sup> George Edgar Turner, *Victory Rode the Rails: The Strategic Place of the Railroads in the Civil War*, 3<sup>rd</sup> ed. (Lincoln: University of Nebraska Press, 1992), 376.

<sup>52</sup> Turner, 6.

<sup>53</sup> Frank E. Vandiver, *Rebel Brass: The Confederate Command System* (Baton Rouge: Louisiana State University Press, 1956) 124.

maintenance was summed up with conclusion that “this new dimension in rapid transit was not used to the best advantage.”<sup>54</sup>

A comparative study of command systems led Herman Hattaway and Archer Jones to conclude that the North won the war because of the superiority of its logistical operations and traced the origins of its success to Secretary of War Edwin Stanton’s War Board. Edward Hagerman’s *The American Civil War and the Origins of Modern Warfare* argued that both armies adapted the new industrial technology to the particular ideological, social, and geographical realities of the mid-nineteenth century America, Hagerman also described how the Union Army’s regular Corps of Engineers could not meet the demand for engineer units, but “citizen soldiers” were able to perform such technical military duties, and therefore, displaced the Corps of Engineers. He was silent on Southern engineering.<sup>55</sup>

Writing at the same time as Turner and Vandiver, T. Harry Williams published *Lincoln and His Generals* (1952) and pointed to President Lincoln’s military genius as the reason for Union victory. “He [Lincoln] was in actuality as well as in title the commander in chief who, by his larger strategy, did more than Grant or any other general to win the war for the Union.”<sup>56</sup> Williams acknowledged Grant, however, as the muscle behind the President’s ideas. Lincoln told his generals, especially McClellan, to make the enemy’s armies the objective not Richmond. Grant agreed with and employed Lincoln’s strategy, and beginning with operations in southern Alabama, Georgia, and Virginia in 1864, the general “broke the back of the Confederacy.”<sup>57</sup>

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<sup>54</sup> Vandiver, 103.

<sup>55</sup> Herman Hattaway and Archer Jones, *How the North Won: A Military History of the Civil War* (Urbana: University of Illinois Press, 1983).

<sup>56</sup> McPherson and Cooper, 18.

<sup>57</sup> T. Harry Williams, “The Military Leadership of North and South,” in *Why the North Won the Civil War*, ed. David Donald (Baton Rouge: Louisiana State University Press, 1960), 46-47.

Gary W. Gallagher took up the question of military leadership in his essay ““Upon their Success Hang Momentous Interests””: Generals” (1992) and first paid his respects to historians who explored the “complex and interrelated factors” away from the battlefield that caused reasons for Confederate defeat. Then Gallagher continued, “...no shift in civilian morale North or South—and really none of the non-military factors—can be fully understood outside of the context of the military ebb and flow.”<sup>58</sup> Gallagher agreed with James McPherson “that defeat caused demoralization,” and thus major military events during the course of the conflict altered the direction of the struggle. For McPherson this was the role of contingency, the moments when “victory or defeat hung in the balance, and the issue might easily have been resolved either way.”<sup>59</sup> The four “turning points” were McClellan’s failure to capture Richmond, the failure of the Confederate’s offensives at Antietam and Perryville, Union victories at Gettysburg, Vicksburg, and Chattanooga, and Sheridan’s campaign in the Shenandoah Valley and Sherman’s capture of Atlanta ensuring Lincoln’s election.<sup>60</sup> Thus, for Gallagher, he proceeded to “the assumption that generals made a very great difference in determining the outcome of the war.”<sup>61</sup> Following closely upon this logic he concluded the two generals who needed the most careful scrutiny were Grant and Lee.

Herman Hattaway, Archer Jones, T. Harry Williams, and Brooks D. Simpson took up the cause of General Grant. A man who was on the brink of destitution before the war, Grant emerged as an unlikely leader among the West Pointers available to command Lincoln’s armies. Grant, himself a West Point graduate, did not look back upon his years at the academy with

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<sup>58</sup> Gary W. Gallagher, ““Upon their Success Hang Momentous Interests””: Generals,” in *Why the Confederacy Lost*, ed. Gabor S. Boritt (New York: Oxford University Press, 1992), 84.

<sup>59</sup> Gallagher, 84. See also Emory M. Thomas, “Rebellion and Conventional Warfare: Confederate Strategy and Military Policy,” in *Writing the Civil War: The Quest to Understand*, eds. James M. McPherson and William J. Cooper, Jr. (Columbia: University of South Carolina Press, 1998), 54.

<sup>60</sup> Thomas, 54.

<sup>61</sup> Gallagher, 85.

even a tinge of sentimentality and pride, and instead remembered his time there as a period of drudgery and unhappiness. On the battlefield he did not cut a dashing figure. His frock coat could be distinguished from that of a private only by the two, then three stars he wore on his shoulders. Shelby Foote, the Southern oracle for the Civil War period, described Grant as “a dust covered man on a dust covered horse.”

Revisionist interpretations of why the North won the Civil War, however, developed around the thesis that it was Grant, unencumbered by the theories of Antoine Henri Jomini, the French intellectual of the early nineteenth century who first established the principles of modern warfare, who was responsible for the Union’s victory. Jomini analyzed the campaigns of Napoleon pointing out why the emperor’s campaigns needed to be studied and emulated. Grant later admitted that he never paid much attention to these lectures on Jomini in his West Point classrooms. Grant’s strategy of annihilation, historian Russell Weigley argued, was more like the warfare of the future rather than the warfare of the past. Brooks Simpson, in his 2001 essay “Facilitating Defeat: The Union High Command and the Collapse of the Confederacy,” not only credited Grant with creating and then implementing a strategy of annihilation, but in addition, credited Grant with winning the peace, which helped to avoid a Southern guerrilla war in the years following Appomattox. “In the end, of course,” Simpson wrote, “it was Grant and Lincoln who succeeded in devising a way to remove Virginians from the Confederate army. The general believed that the Appomattox terms, embodying Lincoln’s notion of a lenient peace, would facilitate the end of the war.”<sup>62</sup>

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<sup>62</sup> Brooks D. Simpson, “Facilitating Defeat: The Union High Command and the Collapse of the Confederacy,” in *The Collapse of the Confederacy*, eds. Mark Grimsley and Brooks D. Simpson (Lincoln: University of Nebraska Press, 2001), 98. For an excellent introduction to Jomini and his principles see Crane Brinton, Gordon A. Craig, and Felix Gilbert, “Jomini,” in *Makers of Modern Strategy: Military Thought from Machiavelli to Hitler*, ed. Edward Mead Earle (Princeton: Princeton University Press, 1971), 77-92. For a comparison of Grant’s annihilation strategy and

Historians have challenged the notion, however, that Grant was the most intrepid and skilled general the war produced. Just recently Albert Castel wrote that Robert E. Lee was the war's most brilliant general.<sup>63</sup> Not surprisingly, Castel was in good company. Beginning immediately after the war, former Confederate generals started looking for answers as to why they lost the war. (Lee never commented on this.) Several scapegoats emerged from the ashes of past battlefields and an aura grew around the stately, honorable, courageous, and stoic Robert E. Lee. Lee became the son to the father George Washington. For five score years Lee was sacrosanct.

One of the principle scapegoats was Jefferson Davis. It was argued that his micro-management, arrogance, and timid decisions, unlike Lincoln's boldness, cost the South the war. Yet, in a provocative reappraisal of the Confederacy's strategic decision-making, Thomas Lawrence Connelly and Archer Jones argued that Lee's central concern about the Virginia theater of operations influenced Davis's judgment concerning the crucial western theater. Western generals such as Joseph E. Johnston, Braxton Bragg, and P. G. T. Beauregard, according to the authors, formed a "western bloc" that challenged the strategic ideas of Lee. Davis was left to decide between the two factions and he chose Lee's suggestions. Lee's tunnel vision strategy of the war then led to the loss of western battles, territory and ultimately the war itself. "R. E. Lee, as Davis' adviser, was a major obstacle to the realization of more frequent national applications of Jominian-Napoleonic concepts...." <sup>64</sup>

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Lee's Napoleonic strategy see Russell F. Weigley, *The American Way of War: A History of United States Military Strategy and Policy* (Bloomington: Indiana University Press, 1977) 92-152.

<sup>63</sup> Albert E. Castel, *Victors in Blue: How Union Generals Fought the Confederates, Battled Each Other, and Won the Civil War* (Lawrence: University Press of Kansas, 2011).

<sup>64</sup> Thomas Lawrence Connelly and Archer Jones, *The Politics of Command: Factions and Ideas in Confederate Strategy* (Baton Rouge: Louisiana State University Press, 1973), 193.

Following Connelly and Archer's book, other historians continued to challenge the Lee myth. *Attack and Die* (1982) by Grady McWhiney and Perry D. Jamieson argued that Confederates, especially Lee as commander of such disastrous frontal assaults as Malvern Hill and Gettysburg, lost the war "because they were too Celtic..."<sup>65</sup> Their bloodlines flowed with the need to attack, to race forward with vengeful eyes, enflamed hearts, and rebel yells. "As their enemies were quick to point out, Celts shared certain warlike characteristics. They glorified war, seemed genuinely fond of combat, and usually fought with reckless bravery."<sup>66</sup> This reckless bravery, nonetheless, cost the Confederacy too many men, and hence they were unable to sustain the effort needed to defeat the invading enemy.

Alan T. Nolan also believed that General Lee cost the Confederacy its independence. He argued that Lee "squandered Confederate blood and resources in campaigns and battles that did not resolve anything and, worse, precluded victory."<sup>67</sup> Yet, whether Nolan accused Lee of losing the war, or other historians such as Emory M. Thomas, Charles P. Roland, or Albert Castel credit the general with sustaining the Southern war effort against terrible odds, was it possible for any one man to win or lose the Civil War? Did the fighting men on both sides, the dirty, hungry, terrified foot soldiers help determine the outcome of the war? This was a fair question to ask, and Reid Mitchell attempted to address this in his essay "The Perseverance of Soldiers."

Mitchell, unlike Drew Gilpin Faust, focused on the morale in both armies and wondered aloud not only why Southern soldiers lost the will to fight, but why Northern soldiers, in the face

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<sup>65</sup> Grady McWhiney and Perry D. Jamieson, *Attack and Die: Civil War Tactics and Southern Heritage* (Tuscaloosa: University of Alabama Press, 1984), 180.

<sup>66</sup> McWhiney and Jamieson, 184.

<sup>67</sup> Alan T. Nolan, *Lee Considered: General Robert E. Lee and Civil War History* (Chapel Hill: University of North Carolina Press, 1991). See also Emory M. Thomas, "Rebellion and Conventional Warfare: Confederate Strategy and Military Policy," in *Writing the Civil War: The Quest to Understand*, eds. James M. McPherson and William J. Cooper, Jr. (Columbia: The University of South Carolina Press, 1998), 55.

of a prolonged struggle and the slaughter of men in the Wilderness and at Cold Harbor, continued to fight. He concluded it was “the soldiers’ ideology [that] continued to motivate them through the hellish second half of the war.”<sup>68</sup> Yet Southern soldiers, Mitchell continued, withstood the killing and maiming throughout 1864 with the same courage, bravery, and determination as the Yankees. So what changed in 1865? Nothing changed, but the war continued to take a devastating toll on the battlefield and at home. Confederate soldiers deserted because rations were too low in the army and because they assumed their families faced malnutrition and starvation at home. One soldier wrote, “my little boy was sick and Eliza was give out wek with the rumitiz.”<sup>69</sup>

For Mitchell, however, the “ideological weakness and principal structural weakness was the fact that the Confederacy was created as a means to defend racial slavery.”<sup>70</sup> The Confederacy went to war as a divided nation, those who controlled the government to protect slavery, and those who had no stake in the “peculiar institution,” but fought to protect their homes from the Northern invaders. Southern soldiers went home because slavery “undermined the loyalties of its soldiers in the field.”<sup>71</sup> Also, Mitchell said his divided nation thesis explained why the Confederacy chose to fight a conventional war not an insurgency, or, after April 1865, a

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<sup>68</sup> Reid Mitchell, “The Perseverance of the Soldiers,” in *Why the Confederacy Lost*, ed. Gabor S. Boritt (New York: Oxford University Press, 1992), 120-121.

<sup>69</sup> Mitchell, 126.

<sup>70</sup> Mitchell, 124.

<sup>71</sup> Mitchell, 125. During the debates over Southern secession, fire-eaters made it clear that slavery was the central issue. Yet most Southern leaders believed that slavery did not divide their own white people. This delusion continued well after the war. In an article, which appeared in the New Orleans *Picayune* on January 6, 1889, the author interviewed the Honorable Thomas J. Semmes, a former member of the Confederate Congress. Semmes reminisced about the debate surrounding the Great Seal and Latin motto adopted by the Confederacy, *Deo Vindice* (God Will Vindicate). George Washington was centered on the seal *princeps majorum* (after the manner of our [slaveholding] ancestors, and Semmes said, “I discard[ed] all reference to the cavalier of old, because it implies a division of society into two orders, an area inconsistent with confederate institutions.” See [www.civilwarhome.com/confederateseal.htm](http://www.civilwarhome.com/confederateseal.htm).

guerrilla war. “Many Southern whites proved willing to adopt guerrilla warfare....The Confederacy did not....[T]he Confederacy did not choose to fight a guerrilla war—because, in large part, it did not seem possible to fight a guerrilla war and keep slavery intact.”<sup>72</sup>

The question of why the South did not fight a guerrilla war remains fertile ground for historians. In the Fortenbaugh Memorial Lecture at Gettysburg College, George M. Fredrickson compared Southerners to Afrikaners in the Boer War. He wrote that, “The most significant and salient difference was not in the probable extent of racial fear or anxiety but rather in the degree of class stratification and potential class conflict among the whites in the two societies.” An insurgency would “turn the social order on its head by making coarse and uncivilized back country whites the leading actors in the drama.”<sup>73</sup>

Fredrickson, Mitchell, and Faust have added immeasurably to our understanding of why the Confederacy collapsed. They have demanded we look at issues beyond the battlefield and to consider class conflict, slavery, and gender as important factors in both the formation of the Southern Confederacy and its demise. Yet, as patriarchal as the South was, as internally divided as it was between the yeomanry and planter class, and as insidious and barbaric as the institution of slavery was, still the South almost won the Civil War. To all the actors in this drama it was never inevitable. As the war continued through the spring and summer of 1864, and Grant was stopped at Petersburg and Sherman frustrated in Georgia, the Northern home front grew tired of the bloodshed. Citizens North and South were well aware that if Lincoln were re-elected in November he would continue to prosecute the war. They also knew that if the President’s Democratic opponent, General George McClellan was elected he might continue the

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<sup>72</sup> Mitchell, 124-125.

<sup>73</sup> Thomas, 53. See also George M. Fredrickson, “Why the Confederacy Did Not Fight a Guerrilla War after the Fall of Richmond: A Comparative View” (Gettysburg: Gettysburg College, 1996) 27 and 29.



struggle or he might negotiate a peace for an independent Confederacy, or more likely, a negotiated peace with slavery intact in a re-United States, meeting all the demands of the South. We can only speculate what McClellan would have done as president, but in July 1864 hopes sprung eternal in the hearts and minds of Southerners.

Therefore, new interpretations about why the South lost or the North won the Civil War continue to interest historians. In 2011 William C. Harris published his masterful book *Lincoln and the Border States* suggesting that it was Lincoln's deft political skill that kept the Border States in the Union and, as a result, brought about the emancipation of slaves and the downfall of the Confederacy. So crucial were the President's efforts that, "The failure of Lincoln's border states policies would have ensured the independence of the Southern slave republic, dealt a serious blow to the Republican Party in the North, and greatly complicated emancipation, even to the extent of postponing indefinitely the death of slavery."<sup>74</sup>

Most recently, the role of the United States Navy in bringing about Union victory has drawn popular attention. James McPherson's *War on the Water* (2012) builds upon Gary D. Joiner's 2007 book *Mr. Lincoln's Brown Water Navy*, and argued that the navy deserves as much credit for Northern victory as the army has received. The navy's efforts as early as 1861 in destroying Confederate forts guarding Hatteras Inlet in North Carolina, the capture of New Orleans in 1862, the part played by the Mississippi squadron in 1863, and the victory at Mobile Bay in 1864 have for too long gone unrecognized.<sup>75</sup> McPherson was quick to point out, however, that the navy's role did not supersede that of the army's, and he remained firm in his

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<sup>74</sup> William C. Harris, *Lincoln and the Border States: Preserving the Union* (Lawrence: University Press of Kansas, 2011), 8.

<sup>75</sup> James M. McPherson, *War on the Water: The Union and Confederate Navies, 1861-1865* (Chapel Hill: University of North Carolina Press, 2012), 11. See also Gary D. Joiner, *Mr. Lincoln's Brown Water Navy: The Mississippi Squadron* (New York: Rowman & Littlefield Publishers, Inc., 2007). Craig L. Symonds, *Lincoln and His Admirals* (Oxford: Oxford University Press, 2008).

belief that a different result of just one battle, specifically Antietam, Gettysburg, Vicksburg, Chattanooga, or Atlanta, would have changed the outcome of the war.

Why did McPherson believe this? Because with a Confederate victory at Antietam or Gettysburg, peace democrats in the North would apply unrelenting pressure on the Lincoln administration to negotiate a settlement with the Davis government. A successful invasion of the North would have had a damaging impact on Northern public opinion. Furthermore, in the case of Antietam, the preliminary emancipation proclamation would not have been issued and those political voices in the North, and in the Union Army itself, that subscribed to the notion that the war should not be about slavery, would have gotten louder than they already were.

Yet, even with victories at Antietam and Gettysburg, the South's geographic advantage loomed large, and the strategic theory that the North could conquer the South remained remote. In addition, political problems remained for the Lincoln government. The border states would stay on tentative ground, the idea of placing weapons in the hands of Northern blacks would be experimental at best, and the Northern public would not tolerate and support a long war. Union Army operations against specific geographic points and the Southern armies who guarded them were the key elements in destroying the Confederacy. Control of the Mississippi River, extending supply lines and operations into the Confederate heartland, the destruction of the South's army defending Virginia, and the avoidance of Union military disasters defined the Union's strategic goals.

Therefore a study of the campaigns, which broke the back of the Confederacy, led to the demoralization on the Southern home front, and broke the will of Southern citizens to continue to fight, must be reconsidered. The campaigns of momentous consequence, Vicksburg, Chattanooga, Atlanta, Petersburg, and the Carolina Campaign, maintained the Union's strategic initiative, improved Northern morale, and weakened the South's strategic defenses. All of these

have one thing in common; complex engineering operations were essential to their success. Seldom highlighted in Civil War literature, Northern engineers over enormous geographic space with limited time, kept supply lines open, built roads to move tens of thousands of men through impassable terrain, repaired roadways, bridges, tunnels, and railroad lines almost as quickly as enemy soldiers and partisan raiders destroyed them, and thus emerged as a critical resource. Engineering was the key to victory.

Several studies by preeminent historians have explored the scientific and technological advantage the North had over the South before the war. *Military Enterprise and Technological Change: Perspectives on the America Experience* edited by Merritt Roe Smith challenged the notion that the rise of nineteenth-century American “industrial capitalism” was solely linked to and influenced by private individuals and firms operating in the marketplace. Instead, the author argued, the military enterprise played a major role in the United States’ rise as an industrial power. Specifically, there were three areas of technological change in the nineteenth century tied to the military: interchangeable manufacturing, machine tools, and railroads.<sup>76</sup>

Dirk J. Struik’s *Yankee Science in the Making: Science and Engineering in New England from Colonial Times to the Civil War* explored how New England engineers began to transform the American landscape, how doctors contributed to advances in medicine, and how communities established educational institutions devoted to the study of science and engineering.<sup>77</sup>

Several Civil War studies described the operations of Northern engineering regiments. These works offered insight into the formation and composition of such units, described how

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<sup>76</sup> Merritt Roe Smith, ed. *Military Enterprise and Technological Change: Perspectives on the American Experience* (Cambridge: MIT Press, 1985).

<sup>77</sup> Dirk J. Struik, *Yankee Science in the Making: Science and Engineering in New England from Colonial Times to the Civil War* (New York: Dover Publications, Inc., 1991).

bridges were built, canals dug, road systems created, and how engineers provided vital support for battlefield operations and campaigns. The two best books on Northern engineering during the war are Phillip Thienel's *Mr. Lincoln's Bridge Builders: The Right Hand of American Genius*, and Mark Hoffman's *"My Brave Mechanic": The First Michigan Engineers and Their Civil War*. These two books make a case for the skills of Union engineers but both are limited. Thienel's focus was limited to bridge building feats and Hoffman's work looked specifically at the role of an engineer regiment serving in the Civil War's western theater. Hoffman emphasized that the First Michigan Engineers were versatile soldiers and that not only did they repair bridges, railroad tracks, and telegraph lines, but also fought in a number of engagements.<sup>78</sup>

There are few books devoted to Confederate engineering. Two studies in the last fifteen years that brush the topic are *Buff Facings and Gilt Buttons: Staff and Headquarters Operations in the Army of Northern Virginia, 1861-1865* by J. Boone Bartholomees, and *Retreat from Gettysburg: Lee, Logistics & the Pennsylvania Campaign* by Kent Masterson Brown. Both works are well done but give little coverage to the engineers. Brown actually and unintentionally, exposed the ineptitude of Lee's engineers. Lee's escape across the swollen Potomac River after the Gettysburg Campaign almost met with disaster because Southern engineers attempted to

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<sup>78</sup> Phillip M. Thienel, *Mr. Lincoln's Bridge Builders: The Right Hand of American Genius* (Shippensburg, PA: White Mane Books, 200). Mark Hoffman, *"My Brave Mechanics": The First Michigan Engineers and Their Civil War* (Detroit: Wayne State University Press, 2007). For works on other engineering regiments or specific actions see the following: David F. Bastian, *Grant's Canal: The Union's Attempt to Bypass Vicksburg* (Shippensburg, PA: White Mane Books, 1995). Philip Katcher, *Building the Victory: The Order Book of the Volunteer Engineer Brigade Army of the Potomac* (Shippensburg, PA: White Mane Books, 1998). Phillip M. Thienel, *Seven Story Mountain: The Union Campaign at Vicksburg* (Jefferson, NC: McFarland & Company, 1998). Philip L. Shiman, "Engineering and Command: The Case of General William S. Rosecrans, 1862-1863," in *The Art of Command*, ed. Steven E. Woodworth (Lincoln: University of Nebraska Press, 1998). Ed Malles, ed. *Bridge Building in Wartime: Colonel Wesley Brainerd's Memoir of the 50<sup>th</sup> New York Volunteer Engineers* (Knoxville: University of Tennessee Press, 1997). Paul Taylor, *Orlando M. Poe: Civil War General and Great Lakes Engineer* (Kent, OH: The Kent State University Press, 2009). Earl J. Hess, *Into the Crater: The Mine Attack at Petersburg* (Columbia: The University of South Carolina Press, 2010).

anchor a pontoon bridge by filling used ammunition crates with rocks. Since the crates could not dig into the mud at the bottom of the river the swiftness of the current broke the bridge apart. It was only after this fiasco that Lee decided to establish an engineer regiment attached to his army.<sup>79</sup>

Some studies by battlefield archaeologists have focused attention on Southern fortifications built around Vicksburg, Atlanta, and Petersburg, and offered insights into the construction of Confederate trench lines protecting these important cities. These works suggested the competency of Southern engineers. A study ten years ago by Robert J. Fryman concluded that Confederate military engineering during the Atlanta Campaign was adequate to meet the onslaught of Union artillery fire, but that the fortifications, as General William T. Sherman remarked, were just field entrenchments “peculiar to America.”<sup>80</sup> There was nothing imaginative or unique about the entrenchments. The preparations of defensive positions, such as “Hardee’s Salient, the Kennesaw Mountain Line, and the Chattahoochee River Defense Line, were all constructed in advance of their occupation by the Confederate Army of Tennessee,” and so required little in the way of imagination because the engineers had ample material and time to correct problems.<sup>81</sup>

Yet, even Southern fortifications and the engineers who built them have come under careful criticism. In two highly detailed and technical books, Earl J. Hess evaluated both Union

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<sup>79</sup> J. Boone Bartholomees, *Buff Facings and Gilt Buttons: Staff and Headquarters Operations in the Army of Northern Virginia, 1861-1865* (Columbia: University of South Carolina Press, 1998). Kent Masterson Brown, *Retreat from Gettysburg: Lee, Logistics & the Pennsylvania Campaign* (Chapel Hill: University of North Carolina Press, 2005). For the rocks in the box see Harry L. Jackson, *First Regiment Engineer Troops P. A. C. S.: Robert E. Lee’s Combat Engineers* (Louisiana: R. A. E. Design and Publishing, 1998). James L. Nichols, *Confederate Centennial Studies Number Five: Confederate Engineering* (Tuscaloosa: Confederate Publishing Company, Inc., 1957).

<sup>80</sup> Robert J. Fryman, “Fortifying the Landscape: An Archaeological Study of Military Engineering and the Atlanta Campaign,” *Archaeological Perspectives on the American Civil War*, eds. Clarence R. Geier and Stephen R. Potter (Gainesville: University Press of Florida, 2000), 46-47.

<sup>81</sup> Fryman, 47.

and Confederate fortifications during the Overland and Petersburg Campaigns and concluded that Southern engineers were unable to adjust to the shifting movements of Grant's army, and especially at Petersburg, forced Lee to evacuate his position much sooner than necessary. Hess wrote, "...there is little doubt that the Federals gained more from their use of fortifications than the Confederates gained from their use of earthworks." Initially, Southerners were able to punish Grant's attacks and prevent him from striking at Lee's flanks. "But Confederate fortifying began to serve Lee less and less well from September onward...and his engineers continued to rely on heavy belts of obstructions in front of the trenches rather than enclosed works to minimize the number of troops holding the line."<sup>82</sup>

The question, however, of why the Confederacy had so little in the way of engineering support, and why the Union had much in the way of engineering support has not been answered. Was there a relationship between labor, manufacturing, agricultural, and educational systems in the North and South before the war and the effectiveness or ineffectiveness of engineering operations during the war? This dissertation looks critically at these relationships and asks three primary questions: 1. How did the economic, social, and educational patterns in the North differ from those of the South before 1860? 2. How were Union and Confederate engineer regiments formed, and how did they differ, if at all, from each other? 3. What role did engineering play in the critical campaigns of the war?

So we are finally back with Colonel James Keigwin of the 49<sup>th</sup> Indiana Infantry, and as the calendar turned the page to May 1, 1863, he and 33,000 soldiers passed to the eastern bank of the Mississippi River. General Grant now began the task of chasing Confederate General John

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<sup>82</sup> Earl J. Hess, *In the Trenches at Petersburg: Field Fortifications & Confederate Defeat* (Chapel Hill: University of North Carolina Press, 2009), 284-285. See also Earl J. Hess, *Trench Warfare under Grant & Lee; Field Fortifications in the Overland Campaign* (Chapel Hill: University of North Carolina Press, 2007) and *Field Armies and Fortifications in the Civil War: The Eastern Campaigns, 1861-1864* (Chapel Hill: University of North Carolina Press, 2005).

Pemberton's army across southwestern Mississippi to move within striking distance of Vicksburg. It took Grant eleven months to get into this position. To invest or besiege the city's earthworks, the army faced a final challenge. On the morning of May 17<sup>th</sup>, the Union offensive against Southern forces stalled. The muddy, sluggish, deep, and football field wide Big Black River stood between the Confederate fortifications surrounding Vicksburg and Grant's army. Retreating Confederate forces had destroyed the existing bridges over the Big Black. Grant wanted to cross the Big Black immediately in order to maintain the initiative and prevent giving the Southerners time to plan an escape across the Mississippi, but the equipment to build floating bridges, known as pontoons, sat fifteen miles from the river. Unfortunately, moving the essential material quickly forward proved herculean. Heavy traffic of men, horses, munitions and quartermaster wagons clogged the roadways between the river and the pontoons. To bring the train forward required time—at least eight to ten hours.

The pontoon train itself, formed by 34 pontoon wagons, 22 chess wagons, 4 tool wagons, 2 forge wagons, and approximately 300 horses and 100 to 500 men, always lumbered to its destination. The pontoon wagons carried multiple small, flat-bottomed boats, very heavy and hard to transport. The chess wagons delivered the boards used to hold the pontoons together, and once soldiers built the roadway, the engineers used remaining boards to build side rails. The tool wagon consisted of shovels and carpenter tools, and the forge wagons contained anchors and horseshoes.

Bridling under the pressure of time, Grant asked his engineers to find solutions to the bridging problem without waiting for the pontoon train. Under considerable pressure and lacking equipment, three different teams of engineers came up with three different solutions to the problem of crossing the Big Black River. Each built a bridge using scant resources and a large dose of Yankee ingenuity. One group, led by Captains Tresilian and Hickenlooper (a non-West

Point artillery officer when the Campaign began) used cotton bales found in an old warehouse. Directed by the officers, men recruited from the closest infantry regiments to the river fastened these 500- pound bales of cotton to frameworks the men built out of salvaged timber. The men built three sections of frames, fastened them together and then tied them to guy lines. Now under cover of darkness, two men, in a makeshift raft, stealthily crossed the river and anchored the guy lines to trees on the opposite bank of the river. Everyone knew that Confederate skirmishers might be nearby, ready to move to the river and fire on the vulnerable bridge building party. This fear added an element of anxiety and haste to the operation. The work on the Union side of the river continued as men used bayonets, sticks, and rocks, (the shovels were in the tool wagon miles away) to cut away the river bank in order to meet the grade of the road. Planks from the warehouse nailed to the top of the cotton bales made a roadway that completed the bridge.

The bridge was finished by 3:00am May 18<sup>th</sup>. In the next nine hours 15,000 men, horses, wagons, and artillery pieces crossed to the west side of the river. Two other bridges built downstream helped the rest of Grant's army to cross and besiege Vicksburg. With no obvious escape route for the 30,000 Confederate soldiers inside the fortifications, Confederate officials surrendered the city forty days later. The Mississippi River was, once again, open to Union river traffic inspiring President Lincoln's ageless statement, "The Father of Waters again goes unvexed to the sea."

Why was it that Grant's engineers and his infantry, turned engineers, were able to solve these unusual problems with unusual solutions? The answer rested in the textile mills, railroad yards, small farms, and plantations of antebellum America.



## CHAPTER 2

### EDUCATION IN ANTEBELLUM AMERICA: COMMON SCHOOLS AND MECHANICS INSTITUTES

**“A Yankee mixes a certain number of wooden nutmegs, which cost him  $\frac{1}{4}$  cent apiece, with a quantity of real nutmegs, worth 4 cents apiece, and sells the whole assortment for \$44; and gains \$3.75 by the fraud. How many wooden nutmegs were there?”**

**Southern algebra textbook by Daniel Harvey Hill, 1857<sup>1</sup>**

As Colonel Keigwin’s men swatted mosquitoes and kept a keen eye out for alligators, perhaps some turned to thoughts of life before the war. Standing in knee high water and feeling the bone-chilling dampness, these soldiers may have dreamed of the warmth of hearth and home and a work environment that did not require dodging Confederate bullets and artillery shells.

The division commander chose the 49<sup>th</sup> Indiana and 114<sup>th</sup> Ohio because many of the men had mechanical ability learned before the war on farms or in machine shops and factories. Their bridge building assignments required the ability to solve problems in unconventional ways with limited raw materials and tools. It was a significant advantage for Union generals over their counterparts to be able to send forward a regiment of soldiers with both the skills to build bridges and the combat experience to fight off Confederate raiding parties and guard the bridges once built.

Why was it that so many of these Union soldiers had some mechanical skill? A look back at the country’s schools, literacy levels, technology, manufacturing, and agriculture before the war provides answers. Furthermore, understanding the prewar background of soldiers North and South explains the subsequent arguments made in this dissertation regarding the different

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<sup>1</sup> Diana Ross McCain, *It Happened in Connecticut* (Guilford, CT: Guilford Press), 137.

approaches and practices of the Union and Confederate armies. An investigation into conventional attitudes in the North, South, and West about, economic development, societal structures, and cultural formations does make clear in large measure the reasons for the disparity in military engineers between the Union and the Confederacy, and explains why, thanks to its engineering prowess, the Union prevailed at places like Vicksburg and Chattanooga and ultimately won the Civil War.

At the beginning of the nineteenth century American schools reflected the national ethos. Wealthy merchants, plantation and business owners, attorneys, ministers, and scholars sent their sons to the small number of regional private schools and then on to the great universities where these young men studied Latin, Greek, classical literature, and philosophy. Knowledge in these areas of study defined what it meant to be a gentleman in American society. Young men were trained to quote Shakespeare, command respect, and fight to defend family and honor. Upper class women were trained to look for these traits in a man.

For the sons and daughters of artisans, craftsmen, yeoman farmers, and storekeepers, to learn republican virtues, the Christian faith, and basic literacy and arithmetic required a rudimentary education. Schools were operated by local communities, if at all, and many children learned their lessons at home because boys spent most of their time assisting on the farm and girls assisted in rearing the younger children and running the household.

The Bible, *The New England Primer*, and Noah Webster's *The American Spelling Book* were the standard texts used in what developed into the common school. Webster's original edition published in 1783 at the close of the American Revolution attempted to establish a new American culture by using language to transform thirteen independent states into one independent nation. In his introduction Webster wrote, "Every state in America and almost every town in each State, has some peculiarities in pronunciation which are equally erroneous

and disagreeable to its neighbors. This [the Webster speller] is designed to introduce uniformity and accuracy of pronunciation into common schools....Such a standard, universally used in schools, would in time, demolish those odious distinctions of provincial dialects, which are the objects of reciprocal ridicule in the United States.”<sup>2</sup>

By the 1830s common schools operated throughout the North. Local communities controlled the funding, maintained the cold and dreary one-room schoolhouses, provided teachers who were often “only a few steps ahead of their pupils,” and did not require attendance.<sup>3</sup> The 1840 Census revealed the dismal state of American common school education. In Massachusetts and New York, of a total population of children between the ages of five and sixteen years old, only twenty-three percent attended some kind of common school.<sup>4</sup> This did not necessarily represent the literacy rate, which was hard if not impossible to determine, but the numbers suggested a failed system.

In the South, the limited number of towns over 2,500 people and unregulated schools made it more difficult for census takers to determine the number of children attending school, but the numbers reported revealed the lack of emphasis Southerners placed on education. The average number of children who attended common schools in Virginia, North Carolina, and South Carolina was three percent of the school age population. Thomas Jefferson had failed

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<sup>2</sup> Noah Webster, *The American Spelling Book* (1783). After memorizing thousands of words, students were presented with sentences such as, “No man may put off the law of God.” “O may I not go in the way of sin.” A 1829 copy of *The New England Primer* used in New England, New York, and Pennsylvania, guided students through their ABCs this way: C is for Christ. “Come unto Christ, all ye that labour, and are heavy laden, and he will give you rest.” F is for Foolishness. “Foolishness is bound up in the heart of a Child, but the rod of correction shall drive it far from him.” L is for Liars. “Liars shall have their part in the fire that burns with fire and brimstone.” See *The New England Primer Improved: Being an Easy Method to Teach Young Children the English Language*, (Lenox, MA: J. G. Stanly, 1829), 3 and 4.

<sup>3</sup> Carl F. Kaestle, *Pillars of the Republic: Common Schools and American Society, 1780-1860*, ed. Eric Foner (New York: Hill and Wang, 1983), 62.

<sup>4</sup> United States Bureau of the Census. 1840.

twice to push the Virginia legislature to pass a “free schools bill.” In 1807 he wrote to Joel Barlow, “There is a snail-paced gait for the advance of new ideas on the general mind, under which we must acquiesce.”<sup>5</sup>

During the first two decades of the nineteenth century when efforts to better organize and run common schools was inconsistent and stagnant, the Northeast began to show signs of a structural change to its economic system. Early educational reformers were concerned that the current system might not provide enough workers with the skills necessary to meet the demands of the new economy. With the rapid growth of textile manufacturing and the parallel development of machine tool industries there occurred a transformation to the work force.<sup>6</sup> Commerce, transportation technology, finance, and innovation highlighted the importance of reading, writing, and arithmetic. Furthermore, an influx of immigrants from western Europe was now competing for jobs with the native born. Also new political parties encouraged an expanded electorate, which placed greater emphasis on reading newspapers and staying informed.

By the third decade of the nineteenth century most Americans worked in the countryside, worshipped in Protestant churches, believed only property owning, white men should vote, and believed their state representatives were more important than their national representatives. Jeffersonian principles of small government and individual self-sufficiency were republican virtues inherited from the patriots of the revolution. Women were cast for particular roles, immigrants—especially Catholic ones—were mistrusted, and free blacks and Native Americans were third-class citizens. African slaves were property, not people.

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<sup>5</sup> Kaestle, “Victory in the Common School Movement,” 2.

<sup>6</sup> Kaestle, 65.

During this decade, however, a rural economic change was in the offing. New roads, canals, and railroads opened access to urban markets, and population growth forced young people to search for occupations other than farming. Christopher Clark in *The Roots of Rural Capitalism: Western Massachusetts, 1780-1860*, argued that “the use of credit, the emergence of cash and negotiable paper instruments, and the charging of interest on debts all contributed to the development of rural capitalism.”<sup>7</sup> Formal education outside the home became important, and reformers in Massachusetts like Horace Mann called attention to the decrepit state of common schools. In 1838 Mann wrote, “It is commonly believed down to the present hour...that in all the world there is nothing to be compared to the common school system of New England....Till dreamings and gloryings as contemptible as these are banished from our firesides and legislative halls, nothing will be accomplished, and our common schools will continue in the process of deterioration.”<sup>8</sup>

Mann’s concerns alone, however, were not enough to launch a widespread educational reform movement throughout New England, Pennsylvania, New York, Ohio, and the Northwest. The expansion of factories, white male suffrage, political parties, new technologies, civic responsibility, urbanization, and Protestant values, all contributed to the transformation of education in general and the common school movement in particular. Men who became leaders in reform did not necessarily agree with each other about why change was essential, but they left a mark by their work that helped to impress upon bankers, merchants, mechanics, farmers, and politicians the value of education for everyone.

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<sup>7</sup> Christopher Clark, *The Roots of Rural Capitalism: Western Massachusetts, 1780-1860* (Ithaca: Cornell University Press, 1990).

<sup>8</sup> Catherine Fennelly, *Town Schooling in Early New England, 1790-1840* (Sturbridge, MA: Old Sturbridge Village, Inc., 1962) 39 and 40.

Yet by the late 1830s there were growing tensions and economic divisions between workers and business owners. The growth of the market economy, increased competition, urban growth, and inexpensive labor comprised of French and Irish immigrants, contributed to these tensions. With varying concerns about cultural assimilation, the negative and destructive influence of the Catholic Church on America's democratic society, and an increase in poverty and crime among the urban unemployed, educational reformers believed the solution to these problems rested in a vastly improved educational system.

As grassroots reformers, the Workingmen's Associations believed that public education overcame "inequalities of birth," and worked to destroy "the unfair advantage that well-to-do citizens derived from [private] academies and colleges...."<sup>9</sup>. Education would develop talented citizens from families of the poor as well as the rich. It would produce informed citizens who in turn could influence party platforms and legislation within the framework of a broadening popular democracy launched in the mid 1820s by the Democratic-Republicans. Education would also provide moral training and discipline, essential skills for Americans unique among the people of the world.

Francis Wright, a New York City radical in 1829 said if citizens should unite around one reform, "this measure will be found in a plan of equal, universal, and republican education...."<sup>10</sup> This comment was followed one year later by a "Report of a Committee of Philadelphia Workingmen," in which the committee advocated for a strengthening of common schools in order to strike at "an aristocracy of talent...in the hands of a privileged few," and for these chances to be orchestrated by the state legislature to ensure that liberty and "equal prosperity and happiness" be attainable for everyone not just the cities or towns committed to educational

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<sup>9</sup> Rush Welter, *Popular Education and Democratic Thought in America* (New York: Columbia University Press, 1962), 51.

<sup>10</sup> Welter, 51.

reform.<sup>11</sup> This request of the Philadelphia Workingmen to have the state government pass legislation to establish and regulate public education was a radical departure from the standard practice of allowing local government to determine the extent of support for their own common school without interference from the state. In 1831 Pennsylvania passed a law making state funds available for schools. It was a first step.

Four years later, legislators drafted a bill to repeal the Public School Act of 1834 because it “removed instruction from religious control, and it forced the whole group to pay for instruction to benefit only those who had children in school.”<sup>12</sup> Does this sound familiar? It took a resolute Thaddeus Stevens to convince his colleagues to pocket their proposed repeal. “In New England free schools plant the seeds and desire of knowledge in every mind, without regard to the wealth of the parent, or the texture of the pupil’s garments,” he insisted.<sup>13</sup>

If state government could regulate transportation, commerce, financing, and banking, then as New York Governor William Seward in 1840 declared, it could then use “the same resources to improve the public morals and increase the general happiness.” Nothing was more important to the achievement of these goals than common schools.<sup>14</sup>

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<sup>11</sup> “Report of a Committee of Philadelphia Workingmen (1830,) in *American Writings on Popular Education: The Nineteenth Century*, ed. Rush Welter (Indianapolis: The Bobbs-Merrill Company Inc., 1971), 39.

<sup>12</sup> Thomas Frederick Woodley, *Great Leveler: The Life of Thaddeus Stevens* (1937; repr., Freeport, NY: Books for Libraries Press, 1969), 110.

<sup>13</sup> Woodley, 111.

<sup>14</sup> Kaestle, 73. For a discussion on government activism and the law see Morton J. Horwitz, *The Transformation of American Law 1780-1860*. Horwitz argued that a choice was made to promote economic growth through the legal system. He wrote, “Between 1780-1860 a transformation of the legal system took place. It enabled emergent entrepreneurial and commercial groups to win a disproportionate share of wealth and power in American society.” In *Palmer v. Mulligan* (New York 1805) the question was did the plaintiff, who owned a downstream mill, have the right to damages for obstruction of water flow by the defendant, who had erected his own upstream dam. The court did not apply the “common law rule” which most colonies and states had followed since after the revolution. The court ruled the plaintiff had no right to collect damages.

In Connecticut, the impetus behind educational reform was the result of urbanization that accompanied industrialization. For example, in mill towns and cities unemployed teenage boys, “transient mill workers and immigrants” who worked on jobs like the Farmington canal project and new railroads, were seen as threats to social stability and as contributors to prostitution, drunkenness, poverty, and crime.<sup>15</sup> Henry Barnard, the first secretary of the Board of Commissioners of Common Schools in Connecticut reported his concerns to the legislature in 1840 arguing that the state could not combat the social problems of recalcitrant, uneducated teenagers running amuck if the government would not commit to increased funding and improved teacher training. “That our schools are not as good as they should be, or as they can be made with or without a school fund, that there are defects, and great defects...is painfully evident.” Furthermore, “the source of much if not all of the inefficiency of common schools everywhere [is] the want of a suitable number of well qualified teachers.”<sup>16</sup>

As a result of Barnard’s passionate persuasion, the state passed legislation in 1841 to revamp the common school system by granting district school societies the power to levy school taxes and “prescribe rules and regulations for the management, studies, books, classification and discipline of the schools in the society.”<sup>17</sup> Each district school organized its own curriculum and all common schools taught reading, arithmetic, spelling, writing, and history. Some schools also began to teach rhetoric, geography, geometry, algebra, chemistry, surveying, and

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<sup>15</sup> Christopher Collier, *Connecticut’s Public Schools: A History, 1650-2000* (Orange, CT: Clearwater Press, 2009), 74.

<sup>16</sup> Henry Barnard, 2<sup>nd</sup>., *Second Annual Report of the Board of Commissioners of Common Schools in Connecticut Together with the Second Annual Report of the Secretary of the Board, May 1840* (Hartford: Case, Tiffany and Burnham, 1840), 42. Barnard reported that in 1839 the average cost to each child attending school was \$3.20. The states’ “school fund” contributed \$1.25 to the cost, the “Town Deposit Fund,” the money from which came as a result of the 1836 Federal surplus, contributed thirty cents, and the rest was raised through a Town Tax, District Tax, and tax on parents of children attending school.

<sup>17</sup> Collier, 80.



bookkeeping.<sup>18</sup> Yet, like other Northern states before the Civil War, the Connecticut system of public schools looked good on paper. In reality, significant problems remained.

The system was haphazard. In 1852, 217 school societies supervised 1,642 districts.<sup>19</sup> Fifty districts had school for 200 days or more. The Fairfield North School District in 1857-1858 was a district that kept school for 200 days, and that year during the winter term, twenty-two students were enrolled. The average daily attendance was eighteen.<sup>20</sup> For the decade of the 1850s, fifty-seven percent of the school age population was enrolled in Connecticut common schools. Yet, as the Fairfield District example pointed out, the number of days a student was actually in school varied by gender and age. When they were in school, however, students were learning to read and spell using the *McGuffey Reader*, younger students were memorizing multiplication tables and doing “mental arithmetic,” and older students solved arithmetic word problems.<sup>21</sup>

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<sup>18</sup> Barnard, 28.

<sup>19</sup> Collier, 103.

<sup>20</sup> Fairfield North School District Journal, 1851-1861. The Connecticut Historical Society, Hartford. The winter term was seventy days long and commenced on December 21, 1857 and closed March 27, 1858. The data collected for the winter term beginning October 8, 1860 and closing January 14, 1861 was more substantial than previous years. During this winter term seventeen students were enrolled, ten boys and seven girls. The oldest girl in the class was thirteen years old and she attended school forty-four days. Five girls between seven and eleven years old attended school on average sixty-one days. The one six-year-old girl attended school fifteen days. The oldest boy was sixteen years old and he was in school thirty-one days. Four boys between fourteen and eleven years old attended school on average thirteen days. The nine and ten year old boys were in school fifty-nine days and the six year old boy sixty-one days. The seven and eight year old boys were present twenty-six days.

<sup>21</sup> Collier, 150. Two boys under fourteen years old, John B. Stow and George Barnett, were reported by an eyewitness to have calculated the following in forty minutes: Multiply 253,412,003,520,155,102,350 by 521,342,125,145,534,142,125. The product is 132,114,352,452,585,239,925,224,746,717,418,821,493,750.

By 1860, learning to read, to calculate, and to keep books, were deemed valuable skills for practical work.<sup>22</sup> Learning was an accepted part of masculine identity in the North, and men who used knowledge to become skilled mechanics, craftsmen, or inventors were admired in cities and rural areas, as well. Teaching in the common schools, however, was becoming more closely associated with women, and what started as the young female teacher, after the Civil War, morphed into the schoolmarm.

Henry Barnard, Noah Porter (a Yale president,) and most men believed women were more effective in the classroom and especially with younger children. “As a class,” Barnard wrote, “schools taught by females, are better governed than males [because of their] gentle manner....”<sup>23</sup> Noah Porter agreed. “Female teachers are cheaper; female teachers are better for this immature age. Their influence is more gentle; it forms the girls to mild dispositions and graceful manners; it infuses a portion of its own sweetness into the harsh and self-willed persevereness [sic] of early boyhood.”<sup>24</sup> Many teenage girls began teaching in the summer, and as it became increasingly acceptable for women to teach, these young women moved into cities or villages to teach year round. The view was that married people “ought not be hired as teachers for fear they might neglect their jobs in deference to their domestic duties.”<sup>25</sup>

Gender bias remained resilient. Male teachers were still preferred before 1860, and females were grossly underpaid. In the decades of the 1840s and 1850s, approximately 2,700 teachers were employed each year in the state of Connecticut. During winter terms, Barnard

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<sup>22</sup> The standard textbook used in bookkeeping instruction was written by Nicholas Harris and published in Hartford in 1841 under the comprehensive title *First Lessons in Book-Keeping: Exhibiting Simple and Approved Methods of Recording Farmers' and Mechanics' Accounts, By Single Entry Accompanied by Valuable Suggestions in Doing Business; Introductory Lessons in Double Entry, Followed by A Series of Mathematical Tables, and Rules for Performing Computations in Business, Designed for Common Schools.*

<sup>23</sup> Collier, 111.

<sup>24</sup> Collier, 111.

<sup>25</sup> Collier, 112.

reported, males taught almost exclusively, and during the summer months females taught in the common schools. Sixteen hundred males taught per year and only 150 taught in the same school the entire year. "Most had no previous acquaintance with the schools [they taught in] and left quickly."<sup>26</sup> Men's average wage in the summer was \$20 a month and \$17.50 in the winter with board. Women made \$6.30 per month in the summer and \$8.69 with board in the winter.<sup>27</sup>

Although most women were silent on the issues affecting female teachers, Catherine Beecher was a voice in the wilderness. She advocated for the training of women as professional educators, for fair pay, and for a shift in the mission of common schools, which she believed would only happen if women taught in the classroom. In several addresses throughout the North, Beecher challenged her listeners to "remedy the evils which now oppress their country," and to help secure proper teacher training so the nation could deal with tens of thousands of neglected children all over America.<sup>28</sup> She argued that educating children was a noble profession worthy of the best minds in the United States. Beecher compared it to the military profession which "custom rendered elegant...the killing of others...viewed as glorious...and the...young and generous and enthusiastic have been drawn into it!"<sup>29</sup> She continued, "If one-half the poetry, fiction, oratory, and taste thus misemployed had been used to embellish and evaluate the employment of training the mind of childhood, in what an altered position should we find this noblest of all professions," and the country itself.<sup>30</sup>

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<sup>26</sup> Barnard, 25.

<sup>27</sup> Barnard, 26.

<sup>28</sup> Catherine E. Beecher, *The Evils Suffered by American Women and American Children: The Causes and the Remedy. Presented in an Address by Miss C. E. (Catherine Esther) to Meetings of Ladies in Cincinnati, Washington, Baltimore, Philadelphia, New York, and Other Cities. Also an Address to the Protestant Clergy of the United States* (New York: Harper & Brothers, 1846), 12.

<sup>29</sup> Beecher, 10.

<sup>30</sup> Beecher, 10.

Beecher's criticism was forged by what she saw in some states including Connecticut, yet she was also quick to praise other states for reform minded systems of common schools. "Wherever education is most prosperous, their women is [sic] employed more than men. In Massachusetts, where education is highest, five out of seven of the teachers are women...."<sup>31</sup> There was no doubt that New England and New York had a significant influence on schools systems and educational reforms in the Midwest. Reformers in Ohio such as Caleb Atwater, Nathan Guilford, and Ephraim Cutler were born in New England. Michigan leaders John Pierce and Isaac Crary were from New England, and the first state superintendent of Indiana, William Larrabee was born in Maine, taught in Connecticut and New York, and then moved to the Midwest.<sup>32</sup> "All but one of Wisconsin's state school chiefs until 1880 were born in New York or New England, as were all of Michigan's superintendents."<sup>33</sup>

More importantly, the mid-western states believed common schools demonstrated a culture committed to individual freedom, an informed citizenry, free enterprise, and self-government.<sup>34</sup> Michigan reformer John Pierce wrote, "Justice, truth, and equity are the glory of a nation, but these attributes of virtue are not to be found among an ignorant and vicious people."<sup>35</sup> Midwestern educators learned valuable lessons about curricula, administration, state support, and teacher training from eastern reformers like Horace Mann, Henry Barnard, and Catherine Beecher, but the state school system that garnered the most attention, and received the highest adulations was that of New York. It was well deserved.

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<sup>31</sup> Beecher, 9. All the New England states required towns to tax for school support except Connecticut. In Massachusetts, the average expense per student was \$3. In Rhode Island it was \$3.40, New Hampshire \$2.23, Maine \$2.49, and Vermont \$2.20. All of these numbers exceeded that of Connecticut. See Collier, 104.

<sup>32</sup> Kaestle, 188.

<sup>33</sup> Kaestle, 188.

<sup>34</sup> Kaestle, 190.

<sup>35</sup> Kaestle, 190.

Perhaps the secret to New York's success, or at least one of them, rested with the creation of the Regents of the University of the State of New York. Established in 1784, the Regents "were a corporation empowered to act as trustees of Columbia College... and of every other college and academy incorporated in the state thereafter."<sup>36</sup> After the state developed a system of common schools in 1812 the responsibilities of the superintendents and Regents overlapped until 1842 when the Superintendent of Common Schools became a member of the Board of Regents. The organizational structure of the New York State school system provided significant advantages over other school systems in the North. The state monitored teacher training, local library development, curriculum development, textbook use, and attendance, in addition to serving as a powerful voice within the halls of the state legislature and governor's office. On January 4, 1831, using data supplied by the Regents, Governor Enos T. Throop, addressed the legislature stating clearly, "There is no one of our public institutions of more importance, or which has better fulfilled public expectations, than that providing for instruction in common schools."<sup>37</sup>

After reporting an increase in the number of children enrolled in school from the previous year, and accounting for state money apportioned among school districts, the governor challenged lawmakers and educators to consider more change: "For mere purpose of reading and arithmetic, selections may be made among various books extant, of such as are perfectly adopted to the purpose. But I feel confident that, under proper regulation, a vast amount of knowledge in the arts and sciences, connected with agriculture and handicraft, which are simple

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<sup>36</sup> Folts, 1.

<sup>37</sup> Charles Z. Lincoln, ed. *State of New York Messages from the Governors Comprising Executive Communications to the Legislature and Other Papers Relating to Legislation from the Organization of the First Colonial Assembly in 1683 to and Including the Year 1906. With Notes, vol. 3, 1823-1842* (Albany: J. B. Lyon Company, 1909). 1831 January 4 Legislature, 54<sup>th</sup> Session, Enos T. Throop, Governor, 336.

in their principles...might be taught to children during those years which are usually spent at common schools.”<sup>38</sup> Thirteen years later, the state encouraged school districts to teach rudimentary farming principles to their pupils, which included a basic understanding of chemistry. In 1856 New York attempted to establish, with limited success, two-acre farms near common schools to be cultivated by the male children, under the supervision of a teacher. “Young ladies” were encouraged to attend to an ornamental garden.<sup>39</sup>

Abstracts of reports submitted to the Superintendent of Public Instruction (the title was changed in 1854) paint an extraordinary canvas. The ratios between the total number of children in each county and the children taught were impressive. Furthermore, counties were required to maintain libraries with some such as Oneida County boasting as many as 54,000 volumes. Of course these varied, and the small Maine County had only 1613 volumes in its library. The state apportioned money for the purchase of new books.<sup>40</sup>

Problems, however, remained. In a letter by E. Powell, School Commissioner for Oswego Tioga County to Superintendent V. M. Rice in 1856, Powell reported, “The obstacles that lie in the way of the progress of our schools in standing; [sic] character are numerous and various; prominent among which are, the change of teachers twice a year, a want of uniformity as

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<sup>38</sup> Throop, 337.

<sup>39</sup> Document of the Senate, *Second Report of the Special Committee for Promoting the Introduction of Agricultural Books in Schools and Libraries*, no.85, 79<sup>th</sup> sess., vol 1 no 1 to 40, 1856. From the 69<sup>th</sup> *Annual Report of the Regents of the University of the State of New York Made to the Legislature January 15, 1856*, 381.

<sup>40</sup> *Abstract of Reports in 1854 from the following Counties: Chemung, Elmira, Kings, Monroe, Odgen, Westchester, Otsego, Albany, Broome, Maine, Erie, Buffalo, Oswego, and Oneida*. Most students attended school for six months and the percent of children who went to school versus the total number of children in each county varied. In Albany County it was forty-four percent, but in Oneida County it was eighty percent. Monroe boasted of seventy percent, Kings County sixty-nine percent, and Oswego County sixty-seven percent. Some counties operated “Colored Schools.” Erie and Buffalo counties had 194 black children in school, Kings County 130 and Albany County 104. Many, however, reported zero, and no one made an account of Native American children.

regards a system of instruction, and of text books, inexperience of teachers and a dire want of interest among the inhabitants....”<sup>41</sup>

For those in the North regardless of their common school experiences and their states’ problems in fixing them, continuing educational opportunities remained. Lyceums, mechanics institutes, country fairs, and agricultural societies were the epicenter of adult learning. The dissemination of knowledge and useful information to a broad audience, rural and urban, contributed to greater farm and manufacturing production, and also opened the way to potential upward mobility for those men interested in inventing new and more efficient tools and machines that contributed to the overall wealth of a region.

The idea for the lyceum as developed first in the North probably began in the United Kingdom. The story goes that Henry Brougham, an English proponent of popular education, often had to repair his own scientific equipment, and consequently, he had to explain the actual steps to the smiths, glassblowers, and carpenters involved in doing the repairs. He, therefore, decided to “deliver a series of lectures upon the *mechanical properties of solid and fluid bodies*, abounding with experiments and conducted with the greatest simplicity of expression and familiarity of illustration, solely for persons engaged in the practical exercise of the mechanic arts.”<sup>42</sup>

Brougham founded the London Mechanic’s Institution in 1824. The concept of this organization crossed the Atlantic and in 1826 a former laboratory assistant to Benjamin Silliman at Yale, Josiah Holbrook, started the Millbury (Massachusetts) Branch Number One of the

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<sup>41</sup> E. Powell to V. M. Rice, December 1, 1856, State of New York Archives, Albany, New York.

<sup>42</sup> Carl Bode, *The American Lyceum: Town Meeting of the Mind* (New York: Oxford University Press, 1956), 4.

American Lyceum.<sup>43</sup> For Holbrook the lyceum was an educational and social institution, and a crusade to diffuse knowledge to thousands who might otherwise develop habits “which will lead to their ruin....”<sup>44</sup> Holbrook believed that the lyceum would extend to everyone in the community, “old and young, the male and female, the learned and illiterate,” that it would bring together ideas regarding the improvements of common schools, and for a young person growing up “under the advantages and influence of an Association well conducted,” the lyceum would provide “more useful, practical information than he would be likely to obtain in a College [sic] course.”<sup>45</sup>

The Millbury Lyceum was the first of many and as the idea spread, so did the breath and depth of the presentations and lectures. In 1836-37 the Salem Lyceum offered lectures by Daniel Webster on “Popular Knowledge as applied to Scientific Improvements,” the “Application of Science to Common Life,” by Elisha Bartlett, and “Electro Magnetism,” by Charles G. Page.<sup>46</sup> Other speakers included Charles Francis Adams, George Bancroft, Ralph Waldo Emerson, Horace Mann, George Catlin, and John Quincy Adams and topics ranged from “Common School Education” to “The Legal Rights of Women” to the “Life and Times of Oliver Cromwell.”<sup>47</sup> The Lincoln, Massachusetts Lyceum recorded that on January 19, 1847 the speaker was Henry David Thoreau, and after his lecture a discussion question was posited: “Are the

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<sup>43</sup> Holbrook entered Yale in 1806 and graduated in 1810. Silliman, as Yale’s first chemistry professor, delivered the first science lectures ever given at Yale in 1804. In 1818 he also founded the *American Journal of Science*.

<sup>44</sup> Josiah Holbrook, “American Lyceum for Science and the Arts,” in *The Massachusetts Lyceum During the American Renaissance: Materials for the Study of the Oral Tradition in American Letters: Emerson, Thoreau, Hawthorne, and Other New England Lectures*, ed. Kenneth Walter Cameron (Hartford: Transcendental Books, 1969), 46.

<sup>45</sup> Holbrook, 46-47.

<sup>46</sup> *Historical Sketch of the Salem Lyceum with a List of the Officers and Lecturers Since its Formation in 1830* in *Massachusetts Lyceum During the American Renaissance* ed. Kenneth Walter Cameron (Hartford: Transcendental Books, 1969), 16.

<sup>47</sup> *Historical Sketch of the Salem Lyceum*, 16-17.



present customs of society in this country calculated to develop the mental and physical powers of its young men?" Two men were appointed to argue in the affirmative and two in the negative. The arguments were not recorded, yet we were told that after hearing the discussion the "house voted in the affirmative."<sup>48</sup>

In the North the common school and lyceum movements provided citizens with an opportunity to expand their knowledge base, collect new ideas, and compete in a growing industrial and mechanical environment. To the contrary, the opportunity for commoners to receive a basic education in the South was so inadequate, for example, that by 1860 only eighteen percent of children between five and nineteen years old attended a common school.<sup>49</sup> This inadequacy was not just because the Southern economic system centered around agriculture and slave labor, but also because men in power with hierarchical notions of how society was controlled, chose to reject educational reform. Furthermore, some Southerners encouraged by Northern industrial success sought to open new manufacturing operations. The dominant planter class who controlled state legislatures often blocked these efforts.

Wealthy planters and middle class professionals could afford to hire private tutors to instruct their children, and they had the additional option of sending their children to the large number of academies, denominational schools, and subscription schools. By 1850 the number of academies in the South as a whole (2,700) surpassed the number of academies in the Middle Atlantic region (2,100) or New England (1,000).<sup>50</sup> Episcopalians, Methodists, Baptists, and Presbyterians, all established academies. Finally, some communities built log cabin schoolhouses in old fallow fields, hired teachers, charged tuition, and provided a basic elementary education for anyone who could pay. These "old-field schools" operated at the

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<sup>48</sup> *Lyceum Records of Lincoln, Massachusetts* in Cameron, 213.

<sup>49</sup> Eighth Census of the United States, 1860.

<sup>50</sup> Kaestle, 193.

whim of the community, and often recruited men who were looking to make some money instead of teach. Governor George Gilmer of Georgia recalled his old-field teachers as a "...loud, violent Irishman, an impoverished Virginia gentleman who drank too much, and a well-qualified, sober Georgian."<sup>51</sup> Benevolent societies, and states such as Virginia that had a small fund for teaching poor children, would also reimburse old-field schools for pupils whose families could not afford the tuition.

The institution of slavery represented the most ubiquitous obstacle to the formation of common schools in the South. It was the *sine qua non* of conservative social thought. Southerners argued against the North's competitive, free-market, wage-labor system. They sounded like Marxists as they said that in the North, "the interests of capitalists and laborers are antagonistic."<sup>52</sup> Henry Hughes said, "Want is not eliminated.... The young, the old, and other inefficients"[sic] are not supported. Under slavery, Edmund Ruffin wrote, "there is no possibility of the occurrence of the sufferings of the laboring classes" that characterize the "class-slavery of labor to capital."<sup>53</sup>

For conservative thinkers, hierarchy, aristocracy, and social control were the fundamental principles of God's divine plan where rich and poor, intelligent and illiterate, leaders and followers could coexist in harmony and happiness. Education could upset the social balance. Public education could be dangerous. Extreme pro-slavery ideologue South Carolina attorney William Harper argued, "Men of no great power of intellect, and of imperfect and superficial knowledge, are the most mischievous of all.... Of all communities, one of the least desirable, would be that in which imperfect, superficial half-education should be universal."<sup>54</sup>

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<sup>51</sup> Kaestle, 194.

<sup>52</sup> Kaestle, 205.

<sup>53</sup> Kaestle, 205.

<sup>54</sup> Welter, 133-134.

The free exchange of ideas and the ability of the entire population to read them could produce revolutionary ideas among slaves, as it did with Frederick Douglas, and radical thinking among some Southerners who might sympathize with Northern abolitionists. An 1852 article in the *Southern Quarterly Review* succinctly stated its case, "Throughout the whole country, from the Hudson to the Bay of Fundy, a settled determination exists to abolish slavery at the South....The diffusion of education in New England is likely to effect a dissolution of the Union."<sup>55</sup>

Large plantation slave owners dominated the halls of state assemblies, controlled local government, and in a paternalistic relationship with yeoman farmers and others in their sphere of influence, commanded loyalty in turn for protection from outside interference. Virginia and North Carolina, however, attempted, with marginal success, to establish common school systems more in keeping with their sister states in the North. Local citizens targeted distinct regional areas where slavery played a small role for educational reform, although there remained significant push back from state legislators whose interests were closely aligned with the plantation aristocracy. In both states, westerners called for "equitable representation and free common schools."<sup>56</sup>

Western Virginia in the three decades before the Civil War clamored for better public education based on a belief that their section of the South had the natural resources in coal and other minerals to forge an industrial center similar to those areas in the North. Business interests in western Virginia were not afraid of Northerners' ideas about slavery, and instead sought Northern advice and guidance regarding manufacturing and commerce. Henry A. Wise, a Whig congressman, challenged his constituency to "*Educate your children, all your children—every one of them!*" After attacking the Southern educational system as one based on charity

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<sup>55</sup> Welter, 134.

<sup>56</sup> Kaestle, 208.

instead of one based on opportunity and the privilege of citizenship, Wise continued, “Does anyone suppose that if education had been diffused universally among our people...that her [Virginia] agriculture and mechanic arts would be in the low state they are now in? That the rich bowels of her inexhaustible mountain mines of iron and coal would be undug [sic] and almost unexplored? That her manufactures would have languished as they do?”<sup>57</sup> Wise reminded men that the axe helve, plow handle, handspike, and ox chain were all “levers of knowledge.”<sup>58</sup> Yet eastern plantation Democrats made it exceedingly difficult to create the common schools and, in 1860, when western Virginia voted against secession, the *Wheeling Intelligencer* reported that one grievance against eastern Virginia was that tidewater plantation owners denied western Virginians common schools.<sup>59</sup>

In western North Carolina, where Regulators had protested unfair planter control of the legislature in the 1820s, where “people had showed a distaste for nullification and secession philosophies,” where Quakers and churchmen talked of anti-slavery feelings, and where the Whig Party was strong, there the common school movement enjoyed more success than any other place in the South. In the late 1830s, a common school law set the stage for further improvements in the system including a bill passed in 1852 to establish the office of superintendent.<sup>60</sup>

Superintendent Calvin H. Wiley’s first annual report to the North Carolina legislature in 1854 demonstrated the progress the state was making in public education reform. He documented the growth of both common schools and the number of children who attended

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<sup>57</sup> Henry A. Wise, “Address to His Constituents, 1844,” in *American Writings on Popular Education: The Nineteenth Century*, ed. Rush Welter (Indianapolis: The Bobbs-Merrill Company, Inc., 1971), 122 and 128.

<sup>58</sup> Wise, 131.

<sup>59</sup> Kaestle, 210.

<sup>60</sup> Kaestle, 211.

them. The 1840 census, he reported, showed the state with 632 common or subscription schools and 14,937 enrolled. By 1850 that number jumped to 2,131 common schools and 83,873 pupils in attendance.<sup>61</sup> Whereas Virginia distributed about eight cents per capita for white education, North Carolina spent fifty cents. This compared favorably with Connecticut and Pennsylvania at ninety-five cents per capita and Ohio and New York at one dollar.<sup>62</sup> North Carolina had three times as many children in school as South Carolina and six hundred more common schools than Virginia and Virginia's population was 340,000 more than the Tar Heel State. Wiley wrote, "Upon a calm review of the entire facts, it is neither immodest nor unjust to assert that North Carolina is clearly ahead of all slave-holding states with their system of public instruction, while she compares favorably in several respects with some of the New England and Northwestern states."<sup>63</sup> The superintendent predicted that in ten to twenty years the state would produce as well educated a citizenry as Massachusetts. The 1860 Census confirmed North Carolina was on the right educational path. Massachusetts had fifty-seven percent of their children between five and nineteen in common schools, and North Carolina had forty-two percent. These numbers were in stark contrast to Virginia's twenty-one percent and South Carolina's dismal eighteen percent.

Yet, North Carolina, like the entire South had significant cultural obstacles to overcome before it educated all its children. Many men believed "book learn'n" useless and, as a result, many male teachers had to travel North to receive proper training and common schools often had to rely on Northern instructors. Again, the institution of slavery was written into the

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<sup>61</sup> C. H. Wiley, *First Annual Report of the General Superintendent of Common Schools* (Raleigh: 1854), at *Documenting the American South* (Chapel Hill: University of North Carolina, 2003), [docsouth.unc.edu/nc/schools1854/schools1854.html](http://docsouth.unc.edu/nc/schools1854/schools1854.html) (accessed July 22, 2012).

<sup>62</sup> Charles Lee Smith, *The History of Education in North Carolina* (Washington: Government Printing Office, 1888), 170.

<sup>63</sup> Smith, 170.

equation. At the Louisiana Constitutional Convention of 1845, the “Report of the Committee on Education” read, “Southern men should have southern heads and hearts, with sentiments untarnished by doctrines at war with our rights and liberties. It is of the first importance that correct impressions be made upon the minds of children; for it is difficult to unlearn what has been learned amiss.”<sup>64</sup> When young scholars returned home from their Northern school experience, often, the report note, these men had to be “re-acclimated” to the Southern way of life.

In comparison to Northern states, the Southern states suffered from little interest in schooling, a lack of funding and teacher training, and a powerful planter class whose vision of a harmonious world did not include universal education. A state such as Tennessee was not overly concerned about the negative influence of Northern teachers, nor were they opposed to providing educational opportunities to all their white children. They just did not want to pay for them.<sup>65</sup>

The education Southern children did receive was bread and water learning—basic instruction in reading, spelling, grammar, writing, and arithmetic. Southerners relied on textbooks from the North since there was no textbook industry in the South, and this also placed them at a disadvantage. Furthermore, the Northern concept of the school district and the active engagement by those who administered common schools provided opportunities to evaluate curriculum needs. Thus, in many states mental arithmetic, bookkeeping, and farming principle and farm chemistry were introduced. Finally, when the young Northern student left

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<sup>64</sup> *Report of the Committee on Education, Louisiana Constitutional Convention, 1845*, in *American Writings on Popular Education: The Nineteenth Century*, ed. Rush Welter (Indianapolis: The Bobbs-Merrill Company, Inc., 1971), 139.

<sup>65</sup> Welter, 30.

school to find a farm to work or mechanical skills to learn, they entered a society that valued education and had vehicles in place to assist in continuing their education.

At the outbreak of Civil War, the new Southern Confederacy took stock of its institutions to determine which ones had been tainted by excessive Northern influence, and then offer the proper prescription to correct the illness. Education was wounded because of the “curse of New England Society, and the great revolutionary element of the North.” Edward Pollard, associate editor of the Richmond *Examiner* wrote: “We believe that the education of the New England common school is carried out to that point where learning is dangerous.”<sup>66</sup> Other writers also believed that common school education in the North had produced an indoctrination and radicalism among the masses. “Nothing is more to be dreaded than a community half-educated, and who consider themselves learned.”<sup>67</sup>

The problems faced by Southern educational reformers like Calvin Henderson Wiley were daunting. The war would require significant economic resources from the states, and the central government in Richmond would not encourage the promotion of public education. As a result, public school systems were not developed during the war.

The easiest problem to manage for educators in the Confederacy was that of textbooks. Textbooks were produced quickly as part of a call for Confederate cultural nationalism and educational independence. As Michael T. Bernath pointed out in his book *Confederate Minds: The Struggle for Intellectual Independence in the Civil War South*, the new Southern textbooks, often edited copies of Northern schoolbooks, “were safe for southern children because any

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<sup>66</sup> Edward Alfred Pollard, “Hints on Southern Civilization,” *Southern Literary Messenger* 32, April 1861, 310.

<sup>67</sup> “Editor’s Table,” *Southern Literary Messenger* 33, July 1861, 75.

poisons hidden within northern textbooks had been carefully screened by watchful southern eyes.”<sup>68</sup>

Finding teachers to instruct the Confederacy’s youth in the ways of cultural independence and homogeneous values under the rubric of Christianity, however, would prove as difficult as recruiting men to serve as engineer troops in the army. Most men joined the army or worked farms to support the war effort and very few were available to teach. This situation placed educational reformers in a conundrum. Before the war, Southern men believed that the female mind was inferior to the male, and therefore, little educational opportunities were given to young girls. Women who did receive an education were most often daughters of the planter class, and the expectation was that they would marry well, rear children, and carry on the cultural refinements of the *noblesse oblige*. Now, in 1861, “Patriotism calls women to the school room.” Editor J. D. Campbell of the *North Carolina Journal of Education* wrote in January 1862, “Ladies, it is a *duty* that you owe your State, in this her time of trial; think of it, act upon it.”<sup>69</sup> Normal schools for teacher training were not yet in place. Furthermore, as the war dragged on and women were required to run businesses and farms, buy and sell slaves, work in hospitals, make homespun uniforms, and deal with wartime shortages, few women entered the teaching ranks.

Poor public school systems, an inadequate number of textbooks, a dearth of teachers, and an ideological belief that education for the masses was a repulsive Northern concept, limited basic literacy, mechanical aptitude, and inventiveness in the antebellum South. The region, nonetheless, did witness the rise of an emerging middle class, with non-agricultural

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<sup>68</sup> Michael T. Bernath, *Confederate Minds: The Struggle for Intellectual Independence in the Civil War South* (Chapel Hill: University of North Carolina Press, 2010), 131.

<sup>69</sup> Bernath, 144.



professionals making up about ten percent of urban populations.<sup>70</sup> Before the war, the sons of these men did receive a solid education at an institution that would make its mark on Southern society in the antebellum period and in the years that followed—the Southern military academy.

In her careful analysis of schools such as the Virginia Military Institute (VMI), historian Jennifer R. Green saw a link between middle class alumni of military schools and Southern elite, although the former possessed “a separate status.”<sup>71</sup> VMI alumni by 1850 made up twelve percent of the total of all students who attended colleges in the South that year, Green argued. These young men served as instructors or superintendents in the ninety-six military secondary schools or military colleges in the South by 1860. Some served in the twelve military schools in the North.<sup>72</sup>

The South Carolina Military Academy (now the Citadel) superintendent reported that of the eighty-seven men who graduated in 1854, ten percent became agriculturally employed and the rest served as teachers, businessmen, attorneys, or doctors. Unlike non-military private academies and colleges, some private and all state military schools received public funding, and unlike civilian schools, military academies taught advanced mathematics, science, and French. (Most military engineering treatises were written in French.) The Southern elite received a classical education, which included ancient history, literature and poetry, the classics, Greek and Latin.<sup>73</sup> Finally, academy cadets did share with Northerners an appreciation for self-discipline

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<sup>70</sup> Jennifer R. Green, “Networks of Military Educators: Middle-Class Stability and Professionalism in the Late Antebellum South,” *Journal of Southern History* 73 (February 2007): 41.

<sup>71</sup> Green, 42.

<sup>72</sup> Bruce Allardice, “West Points of the Confederacy: Southern Military Schools and the Confederate Army,” *Civil War History* 43, (December 1997).

<sup>73</sup> Green, 45-48.

and industry, but they were also schooled in Southern values of community, hierarchy, honor, and, of course, these young men were pro-slavery.<sup>74</sup>

Just as the southern upper class felt no compunction to lead in the common school movement, they felt no responsibility to lead the lyceum movement.<sup>75</sup> This meant that lyceums could form only in more densely populated areas where middle class artisans and mechanics had a vested interest in joining a society that supported continuing education. It was not surprising then to learn that the few cities in the South that did have lyceums included large urban areas with a middle class like Richmond, Savannah, Macon, and Nashville. Thomas Grimké attempted to start a lyceum in Charleston in 1834, but nothing ever came of it, and a “Yankee enclave” in New Orleans established the Library and Lyceum Society in 1844.<sup>76</sup>

In addition to population density, there were other factors that worked against the South in terms of education. First, with easy transportation available only to cities, it was difficult to bring in outsiders to lecture, especially from the North. Second, starting after Nat Turner’s Rebellion, a culture of caution informed decisions about inviting Yankees to speak. The fear of abolitionist viewpoints led to a pervasive anti-intellectualism. Third, the prevailing technique of “shifting cultivation...stunted rural population growth.”<sup>77</sup> Southern farmers added unimproved acres to their property so they could cultivate a portion of their land for five years, strip it of its nutrients and then burn another section of their fallow fields or woods. The burning would add nutrients to the soil, this land would be cultivated, and the previously used field

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<sup>74</sup> Green, 43.

<sup>75</sup> Bode, 75.

<sup>76</sup> Bode, 79-84.

<sup>77</sup> John Majewski, *Modernizing A Slave Economy: The Economic Vision of the Confederate Nation* (Chapel Hill: University of North Carolina Press, 2009),

would sit fallow for twenty years in preparation to be again burned.<sup>78</sup> In his book, *Modernizing A Slave Economy: The Economic Vision of the Confederate Nation*, John Majewski wrote, “A region composed of isolated farms and plantations generated fewer subscribers for periodicals and newspapers, had fewer potential members for mechanics’ institutes or literary associations, and provided fewer students for schools and colleges.”<sup>79</sup>

The lyceum movement, born and raised in New England did stretch over the mid-western states making significant strides in Ohio, Illinois, and Michigan. By 1850, Wisconsin would boast of lyceums in Milwaukee, Madison, Beloit, Racine, and Sheboygan, and in Iowa, Davenport and Iowa City had organizations. Yet, in the South, where a plantation economy and a social hierarchy was embedded into the regions culture, the lyceum movement made little headway.

The differences between the North, West, and South were significant when it came to the common school and lyceum movements. Yet these were not the only opportunities people had at self-improvement. When the *Saturday Evening Post* reported on February 14, 1824, that the Franklin Institute in Philadelphia formed to “advance the general interests of Manufactures and Mechanics,” this ushered in a new wave of organizations that by 1861, would produce large numbers of skilled mechanics, artisans, and farmers, and encourage entrepreneurs and inventors. Soon these same men in the North would become soldiers and their mechanical skills would prove critical to the success of the Union Army.

The Institute’s transformation over the next three decades reflected the changing nature of the role manufacturing played in what citizens identified as both improvements in the quality of their lives, and in the opportunities technology provided in improving their financial

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<sup>78</sup> Majewski pointed out the South developed this farming system because of the acidity of the soil. Southerners burned forests and undergrowth to “fertilize.” The burning produced ash.

<sup>79</sup> Majewski, 44.

positions. Technology was perceived as a great leveler in mid-nineteenth century America because with mechanical ability you would make more money than the average worker or you could sell what you invented. The skills you had could advance you economically and help overcome any perceived disadvantage you had by being born into a lower class family. Learning mechanical skills or inventing new technologies was the possible pot of gold at the end of the rainbow. There was, however, debate over pedagogical questions of how information was disseminated to workers who wanted to learn new skills and techniques. The early history of the Franklin Institute demonstrates these growing pains.

Just sixteen months after the Institute was founded, the cornerstone for the new building on Seventh Street, between Market and Chestnut Streets was laid on June 8, 1825. Governors Geddes of South Carolina and DeWitt Clinton of New York listened with the other guests as chairman of the building committee, Peter A. Browne delivered the principal address. He said, "Knowledge ceases to be monopolized by few and is becoming the property of the many...the workman and the philosopher are united in the same person."<sup>80</sup> Then, in a prescient remark, Browne, referencing Europe, challenged Old World attitudes about education. These "Old World" positions would be echoed by plantation Southerners when they revealed their reasons opposing the common school movement. Aristocratic governments "trembled in apprehension of the mischiefs [sic] of education among the working people," but in America "we had no such fears, where the rights of all were equal."<sup>81</sup>

The Institute wrestled, nonetheless, with the mission of its program. First, members of the Committee of Instruction proposed establishing a high school to prepare students from the

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<sup>80</sup> *United States Gazette*, June 9, 1825. See also Bruce Sinclair, *Philadelphia's Philosopher Mechanics: A History of the Franklin Institute, 1824-1865* (Baltimore: The Johns Hopkins University Press, 1974), 48.

<sup>81</sup> Sinclair, 48.

public schools for university studies. Peter Browne argued that a classical education, including knowledge of Greek and Latin, was a waste of time since the central purpose of the Institute was to provide technical education to boys before they were apprenticed to crafts and trades.<sup>82</sup> Ultimately, the committee adopted their own plan rejecting the “idea that secondary education should be vocational....Knowledge should be the vehicle for social advancement, as well as a useful occupational tool.”<sup>83</sup>

The Institute’s efforts at establishing a high school in the liberal arts tradition were not successful. Yet as historian Bruce Sinclair pointed out, the Franklin Institutes experiment was significant. “They were an essential part of the larger process whereby Americans worked out their ideas about technical education.” The New York Mechanic and Scientific Institution under the direction of John Griscom opened a “science-oriented high school in 1825,” and in Troy, New York educational reformers Stephen Van Rensselaer and Amos Eaton opened a school that taught “the application of science to the common purposes of life.”<sup>84</sup>

By the 1840s changes were essential to bring vibrancy to the Institute, and John F. Frazer, a member of the Board of Managers and a leading citizen in Philadelphia applied his organization’s skills to the job of reforming the Institute. He recruited speakers with superb reputations to lecture adult members and guests on topics such as hydraulics, civil engineering, and practical chemistry. He successfully repositioned the Institute’s previously derailed *Journal*

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<sup>82</sup> Sinclair, 123.

<sup>83</sup> Sinclair, 124.

<sup>84</sup> Sinclair, 130. See also John Griscom, *Monitorial Instruction: An Address, Pronounced at the Opening of the New York High School* (New York: Mahlon Day, 1825), 213. Samuel Rezneck, *Education for a Technological Society: A Sesquicentennial History of Rensselaer Polytechnic Institute* (Troy: Rensselaer Polytechnic Institute, 1968), 3.

by enlisting specialists to submit articles for the new journal.<sup>85</sup> For example, John C. Trautwine wrote articles on various engineering problems including one on a route survey for a ship canal through the Panamanian isthmus.<sup>86</sup>

Frazer encouraged Trautwine and others such as Colonel Joseph Totten of the Corps of Engineers, to publish their research in book form, which they did. Once published, the Institute became the copyright proprietor of Trautwine's and Totten's work.<sup>87</sup> These articles were a significant resource for the entrepreneurs in the city and their manufacturing of heavy machinery like large lathes, railroad turntables, and large boring machines. These articles also helped to sustain the Franklin Institute.<sup>88</sup> In addition, in 1841 the Institute, under Frazer's leadership, made the decision to hold annual fairs that provided fivefold benefit. First, the prize money at the fairs encouraged new inventions and improvements to machines and tools, which buoyed domestic manufacturing throughout the country. Second, the fairs provided craftsmen, artisans, and working men with an opportunity to study the new machinery, learn valuable information about repairs to their own equipment, and to immerse themselves in the culture of America's emerging technological revolution. Third, the fairs brought in essential revenue for the Franklin Institute. Fourth, the fairs reinforced the notion that education, scientific study, and mechanical aptitude were appropriate masculine pursuits. Finally, not only did the fairs inspire

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<sup>85</sup> The new title was *Journal of the Franklin Institute and American Repertory of Mechanical and Physical Science, Civil Engineering, the Arts and Manufactures, and of American and Other Patented Inventions*.

<sup>86</sup> Sinclair, 285. See also the *Journal* index for Trautwine's "Rough Notes of an Exploration for an Interoceanic Canal Route by way of the Rivers Atrato and San Juan, in New Granada, South America." This first installment appears in volume 57 (April 1854), 217-231.

<sup>87</sup> Sinclair, 285-286. Trautwine's books included *The Field Practice of Laying Out Circular Curves for Railroads* (1851) and *A New Method of Calculating the Cubic Content of Excavations and Embankments* (1852). The complete title of Totten's was *Essay on Hydraulic and Common Mortars, and on Lime-Burning, Translated from the French of G. Treussart, M. Petot, and M. Courtois, and an Account of Some Experiments made therewith at Fort Adams, Newport Harbor, Rhode Island, from 1825 to 1838* (Philadelphia: The Franklin Institute, 1838).

<sup>88</sup> Sinclair, 294.

the creation of other fairs throughout the North, but they also led to collaborative efforts with the Massachusetts Charitable Mechanics' Association "for proper American representation" at the 1851 Crystal Palace exhibition in London.<sup>89</sup> By 1854, approximately 100,000 people were visitors to the Institute's exhibitions.<sup>90</sup>

One year before the Crystal Palace exhibition in London, the Massachusetts Charitable Mechanics' Association opened its sixth exhibition in Boston on September 11, 1850. Groups from Bangor, Portland, Salem, Lowell, Worcester County, Providence, the New Bedford Mechanics Association, and the Franklin Institute were present. Notes of support were received from the American Institutes, the New York Agricultural and Mechanic Institution, and the Montreal Mechanic Institute. Chairman of the Board of Managers, Henry H. Hooper, remarked on the contributions the exhibition received from around the country, but lamented that there were not more contributions from the West and South. "It was highly gratifying to find in the Exhibition, specimens of the skill of Machinists and Manufacturers of the West and South. We regret that we had not more of this honorable competition."<sup>91</sup> The managers had made a concerted effort to attract artisans and inventors from different sections of the country. Within the cauldron of simmering sectional tension including the free soil movement and the Compromise of 1850, the managers wished it "to be distinctly understood that the Exhibitions held under the sanction of our Association bear no sectional character. They are designed to promote the interests of our whole country...." The managers implored every section of the

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<sup>89</sup> Sinclair, 298.

<sup>90</sup> Sinclair, 295.

<sup>91</sup> *The Sixth Exhibition of the Massachusetts Charitable Mechanics Association: Faneuil and Quincy Halls, in the City of Boston, September 1850* (Boston: Eastburn's Press, 1850), v. At [books.google.com/books?id=8QwAAAAAAMAAJ&pg=RA3-PA144&lpg=RA3-PA144&dq=georgiana+ball+Hughes](https://books.google.com/books?id=8QwAAAAAAMAAJ&pg=RA3-PA144&lpg=RA3-PA144&dq=georgiana+ball+Hughes)&source (accessed November 9, 2012).

country to “unite with us on this occasion, and thereby strengthen the cords which unite us as one body striving to promote the best interests of the whole.”<sup>92</sup>

The reasons for the absence of Southern and Western participation in the exhibitions could be explained partially by distance. Time and money were needed to transport new inventions or machinery to Boston and the requisite stay of nearly three months was an onerous burden for many to undertake. There was the cost of getting yourself to the city, finding lodging and food for the required two months residency before the fair, then the seventeen days the fair operated, and then getting home. Another reason, however, for a lack of participation from the South was explained by the limited interest in manufacturing and in little economic support demonstrated by the powerful businessmen. Manufacturing accounted for a small percent of the South’s wealth in the years before the Civil War, and the industrial goods sought after and purchased were imported from the North. This had a downward spiral effect when it came to education and life-long learning. The planter class was reluctant to support general education initiatives. Staple crops such as sugarcane, rice, tobacco, indigo, and cotton generated extreme wealth. This wealth was used to great advantage for the very few that controlled it. Planters were the best educated and they learned to rule their slaves and to serve as a patriarchal figure to the rest of white society.<sup>93</sup> Patronage and political power was their lot in life. Since they could afford to import manufactured goods from the North, there were a very limited number of artisans and mechanics in the region. A limited number of artisans meant few opportunities in continuing education because there were not enough money people interested in investing in

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<sup>92</sup> *The Sixth Exhibition of the Massachusetts Charitable Mechanics Association*, x.

<sup>93</sup> In David Donald’s book *Lincoln Reconsidered* the author quotes Alexis de Tocqueville: “The citizen of the Southern states becomes a sort of domestic dictator from infancy; the first notion he acquires in life is that he was born to command, and the first habit he contracts is that of ruling without resistance. His education tends, then, to give him the character of a haughty and hasty man—irascible, violent, ardent in his desires, impatient of obstacles.” See David Donald, *Lincoln Reconsidered* (New York: Vintage Books, 1961), 223.



mechanics institutes. The mechanics in the South, therefore, were few in number, faced with constrained educational opportunities, and unable to stay abreast of the latest developments in new technology.

Before 1800, manufacturing was a viable option for economic growth in the South, especially in Virginia. Yet, the expansion of slavery, the wealth produced by cotton, the growth of urban areas, transportation improvements, and geographic circumstances, led to the creation of early industrial growth in the North. For example, textile mills in Rhode Island, Massachusetts, and Connecticut provided opportunities for the creation of industries in machine building.

“Under urban influences a cabinetmaker’s shop became a furniture factory and a smithy expanded into engine works.”<sup>94</sup> Cheap coal made steam available in Philadelphia. Expanding rural settlements in New York and Pennsylvania produced more lumber than any state in the Union, but their consumption exceeded their output. Maine was a small consumer of lumber so by 1832 their annual output was 38,000,000 board feet.<sup>95</sup> Bangor was the greatest sawmill center in the country, yet by the 1850s Saginaw, Green Bay, and sections of Minnesota and Wisconsin rivaled Bangor. After the introduction of the steamboat, Cincinnati, Buffalo, Cleveland, Pittsburg, and Louisville became the center of the river steamboat industry. By the 1840s the industry attracted capital and workmen from the east, “encouraged local manufacturers of cordage and naval stores,” increased the number of sawmills, led to the creation of machine-shops and engine works, and “disseminated a knowledge of mechanical arts and science....”<sup>96</sup>

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<sup>94</sup> Victor S. Clark, *History of Manufactures in the United States*, Volume I 1607-1860, 1929 edition (New York: Peter Smith, 1949), 465.

<sup>95</sup> Clark, 467. See also *Niles’ Register*, L, 378, August 6, 1836.

<sup>96</sup> Clark, 467 and 471. See also *American Annual Register*, 1826-1827, II, 460; Buffalo, *Annual Statement of Trade and Commerce*, 1856, 26.

The growth of industry in the West coincided with the development of the region's common school movement and the formation of mechanics institutes. The Ohio Mechanics Institute founded in Cincinnati in 1828 was established to facilitate the "diffusion of useful knowledge" to "ingenious artisan and mechanics," and the Akron Mechanics' Association founded in 1846 was established to do the same.<sup>97</sup> By 1860, Illinois, Indiana, and Ohio boasted of having approximately 5,000 civil mechanical engineers, 43,000 carpenters, and 4,000 ironworkers. At the same time, Virginia, North Carolina, and South Carolina reported a combined total of 1,300 civil and mechanical engineers, 14,000 carpenters, and 880 ironworkers.<sup>98</sup>

A report, both praiseworthy and resolute, made by Joseph Whitworth and presented to the House of Commons in 1854 identified the "energy" and "peculiar aptitude" of the laborers of the North to capitalize on their natural resources and ingenuity to produce machinery in "almost every department of industry."<sup>99</sup> After recognizing the great fertility of the soil in the South, Whitworth believed the natural resource most skillfully used in the North was wood. "In no branch of manufacture does the application of labour-saving machinery produce by simple means more important results than in working in wood."<sup>100</sup> From the building of saw mills, planing machines, furniture, agricultural implements, mowing machines, and carriages and wheels, the skill of carpenters provided options for any scheme imaginable. Whitworth keenly observed that the intelligent and educated artisan was free to earn all he could "by making the

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<sup>97</sup> Morgan Bibliography of Ohio Imprints, 1796-1850, [oc17.ohiolink.edu/morgan/titles.cgi?chunk=title-15](http://oc17.ohiolink.edu/morgan/titles.cgi?chunk=title-15)

<sup>98</sup> Eighth Census of the United States.

<sup>99</sup> Joseph Whitworth, "New York Exhibition. Special Report of Mr. Joseph Whitworth. Presented to the House of Commons by Command of Her Majesty, in Pursuance of Their Address of February 6, 1854," in *The American System of Manufactures*, introduction by Nathan Rosenberg (Edinburgh: Edinburgh University Press, 1969), 387.

<sup>100</sup> Whitworth, 343.

best use of his hands,” and particularly in the North, “education is, by means of the common schools, placed within the reach of each individual, and all classes avail themselves of the opportunities afforded.”<sup>101</sup>

Throughout the antebellum period patterns were cut out around the economic fabric of the three regions of the country. Geography played a role in establishing favorable conditions for particular economic development, especially the fertile soil and growing conditions in the South, the important river systems in the West, and the running streams and woodlands of the North. This alone, however, was not the only reason for regional differences. How each section of the country defined democracy, community, labor, education, and upward mobility determined how resources were spent, laws made, schools formed, and labor regarded. These were choices. To encourage common school education or to warn of the dangers of learning, to establish institutions to improve workers’ skills or to regard labor as nothing more than a necessary cog in the social hierarchy. These were the conscious decisions woven into each region’s fabric.

The development of manufacturing, agriculture, science, technology, and higher education was also a choice for each region of the United States. How these endeavors were adopted and utilized was important to each region, and consequently, became important to the individuals living in those regions. Aspirations, goals, values, and dreams guided people on their journey. On the eve of the Civil War, more than one million Northerners worked in large and small factories scattered throughout the states. Technological innovations increased industrial production. Mechanics such as Christopher Spencer, Francis Pratt, and Amos Whitney worked out ideas in their years at the Colt Armory in Hartford, Connecticut, and then built their own business. Henry and Clement Studebaker learned the trade of blacksmithing from their father in

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<sup>101</sup> Whitworth, 388-389.

South Bend, Indiana, and then turned a small carriage and wagon shop into a major manufacturing operation in 1860.

Equally impressive to the North's industrial growth was the West's economic development. By people's willingness to move into the new states of Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, and Iowa, they demonstrated their natural entrepreneurial spirit. To be able to replicate and advance what was happening in the northeast demonstrated skill and tenacity. Capital, land, and education were available. And there was not the obstacle of slavery.

In the South, before the war, farming generated great wealth, and slavery served as the foundation of that wealth. Any attempt to question the value or integrity of the "Peculiar Institution" met with harsh rebuttals on the grounds that this labor system provided the essential component to the South's continued social stability and wealth. The South's hierarchical structure and aristocratic character created an ethos unique to the region. As the country drew toward civil war, little did it appreciate or understand how these regional differences would influence the fighting and impact the outcome.

## CHAPTER 3

### MANUFACTURING, AGRICULTURE, SCIENCE, AND TECHNOLOGY

**It's well known among engineers that the most important inventions in a particular field are often made by people who are new to that field—people who are too naïve and ignorant to know all the reasons why something can't be done, and who are therefore able to think more freely about seemingly intractable problems.**

#### *The Contrarian's Guide to Leadership*, by Steven B. Sample

We begin with a tale of two men and two places: David Ross of Campbell County, Virginia and Chauncey Jerome of Canaan, Connecticut. In 1811 Ross was approximately seventy-two years old and Jerome was eighteen. Ross had emigrated from Scotland to the American colonies sometime in the mid-1750s, established himself as a tobacco merchant and ship-owner in Richmond and Petersburg, and by 1788, according to the tax lists, owned four hundred slaves and more than one hundred thousand acres of property scattered across twelve Virginia counties.<sup>102</sup> Sometime around 1777 (the precise time is undocumented) Ross opened the Oxford Iron Works south of the James River eight miles from Lynchburg. By 1811, he employed 220 black bondsmen at his works.<sup>103</sup> This number represented ninety percent of his labor force. The slave labor force in other industrial operations in Virginia told a similar story. By 1850 the Buffalo Forge and Etna Furnace, (combined to form the Bath Iron Works) both in Rockbridge County had 100 to 120 bondsmen between the two sites. The Tredegar Company in Richmond, by 1860, employed approximately 800 slave laborers.<sup>104</sup>

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<sup>102</sup> The Library of Virginia, "A Guide to the David Ross Papers, 1813, 1822," <http://ead.lib.virginia.edu/vivaead/published/lva/vi00317.document>. See also Ronald L. Lewis, *Coal, Iron, and Slaves: Industrial Slavery in Maryland and Virginia, 1715-1865* (Westport, CT: Greenwood Press, 1979), 27.

<sup>103</sup> Lewis, 28.

<sup>104</sup> Lewis, 33 and 35.

At Oxford Ironworks, slaves were taught every job and so worked as carpenters, blacksmiths, colliers, founders, forge men, miners, and general furnace hands.<sup>105</sup> The small percentage of whites employed served as supervisors and bosses. The red-hot glow of the furnaces, however, did nothing to ignite Ross's profit margins. Instead by 1812, profits were significantly dampened, and his iron business faced insolvency. Increased competition, mismanagement, and poor workmanship led Ross to chide, "The ruin of the estate is founded in the management of it."<sup>106</sup> He believed that his manager and clerks were "a very trifling people and incapable of making use of the means in our power." Oxford had "Mechanicks & labourers [sic] adequate to every purpose," yet his nephew, Robert Richardson "has not improved in the Smallest [sic] degree." Ross continued with venom directed at his nephew, "those that ought to represent the master are not infrequently inferior to the Servant."<sup>107</sup>

Ross recognized that his slaves had little incentive to increase productivity and improve the quality of their work, yet good supervision, he believed, would have corrected the bondsmen's poor and redundant performances. Forever hopeful, Ross developed plans to move his operation nearer the James River, but severe credit problems prevented Ross from acquiring the necessary loans and thus his business continued to spiral downward. Plagued by continuous health problems, he died on May 4, 1817. His accrued debts were finally paid off with the liquidation of the Oxford slave force by 1819.<sup>108</sup>

The paradox of this story was that Ross understood that the system of slavery limited his ability to improve his workers performance, not only because bondsmen lacked incentive, but also because he would not allow traveling free ironworkers access to his slaves for fear free

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<sup>105</sup> Lewis, 30.

<sup>106</sup> David Ross to Robert Richardson, n. d. [probably December 1812], David Ross Papers, Accession 37815, Library of Virginia, Richmond, VA.

<sup>107</sup> Ross to Richardson, December 1812.

<sup>108</sup> Lewis, 190.

workers would spread incendiary ideas. He recognized his slaves lacked fresh technological knowledge, but he was also consciously willing to deprive them of this knowledge because he believed it was more important to protect the institution of slavery than to educate his workers. He admired and wanted to emulate the technological growth taking shape in the North, but he did not want his labor force to have contact with those who might be able to share the information necessary to spawn that growth.

Historian Charles B. Dew, in his book *Bond of Iron: Master and Slave at Buffalo Forge* pointed out that in contrast to Ross, William Weaver, owner of Buffalo Forge actually paid slaves for “overwork” and some slaves like Phill Easton built up considerable earnings on the overwork ledgers or “Negro Books” as they were called, to improve his family’s quality of life, and as Dew suggested, “...to stake out some precious independence...in the midst of a system that theoretically held him totally bound to the will of his owner.”<sup>109</sup>

Weaver, like Ross, recognized the cost effectiveness of using slaves instead of free labor, but unlike Ross, by adopting an overwork system, Weaver provided his slaves with some positive incentives, and as a result, he curtailed incidents of manufacturing sabotage. To discipline a slave by beating or threatening to sell them only destabilized the business and slowed or significantly damaged production. Weaver believed in a system that trained a group of skilled slave artisans and provided them with some monetary incentive, and it worked. The result was that Weaver came to emphasize, for four decades, stability in the work force not innovation.<sup>110</sup> Weaver ignored the technological innovations that had revolutionized northern industry, and during the Civil War when the Confederacy need wrought iron, Weaver’s forge and others like it, could only produce a limited amount. Furthermore, slaves skilled in industrial arts,

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<sup>109</sup> Charles B. Dew, *Bond of Iron: Master and Slave at Buffalo Forge* (New York: W. W. Norton & Company, 1994), 108-115.

<sup>110</sup> Dew, 107-108.

by virtue of their social position, could not contribute, or if they had been given the opportunity, would not contribute to successful Confederate engineer operations during the war.<sup>111</sup>

Therefore, a central reason why there was a shortage of skilled engineering soldiers in the Confederate army was because during the antebellum period many artisans and mechanics who worked for southern manufacturing businesses were slaves.<sup>112</sup>

Extending along the spine of the Appalachian Mountains, approximately 550 miles northeast of Ross, Chauncey Jerome was born in Canaan, Connecticut in 1793. At the time of Ross's death, Jerome's life had been as painful as the crude shoes he walked in. When he was eleven years old, his father died of the "black colic," and consequently, made him the man of the family. His mother sent him off to be a farm hand until at fifteen he became a carpenter's apprentice. Neither enamored with his work nor pleased with his lack of boots and warm clothing, Jerome arranged to have four months during the winter to find other work by which to earn enough money to purchase a coat. He went to Waterbury, Connecticut and found work-making dials for old-fashioned long clocks.<sup>113</sup> Jerome continued as a carpenter and part-time clock dial maker until after the War of 1812 when by chance he landed a job in Plymouth, Connecticut helping clock maker Eli Terry set up his new business manufacturing his patented shelf clock.<sup>114</sup>

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<sup>111</sup> Dew, 333.

<sup>112</sup> See Charles B. Dew, *Ironmaker to the Confederacy: Joseph R. Anderson and the Tredegar Iron Works* (New Haven: Yale University Press, 1966), 26-32. Dew pointed out that slave labor at Tredegar Iron Works in Richmond centered on the rolling mill operations. The owner of the iron works, Joseph R. Anderson, believed slaves helped to control white labor strikes and reduced labor costs. Yet, in other areas of Anderson's business, white workers from the North or foreign-born made up the vast majority of the labor force. The machine shops and locomotive works were staffed almost exclusively with white labor.

<sup>113</sup> Edmund Fuller, *Tinkers and Genius: The Story of the Yankee Inventors* (New York: Hastings House Publishers, 1955), 246.

<sup>114</sup> Fuller, 248.



Jerome studied Terry's operation and the machinery used to produce his clocks including "arbors" and "mandrels," prototypes of lathes and jigs, and Terry's secret weapon, a circular saw, a novelty only Terry possessed.<sup>115</sup> After learning from Terry, the master of his craft, Jerome went into business for himself as a "jobber" assembling clocks, casing them, or manufacturing cases. Four years later things started to get interesting for Jerome. Relying on his mechanical education, business acumen, and desire to improve his station in life, he sold his house and lot to Terry for six hundred dollars, one hundred of it in wooden clock movements, "with dials, tablets, glass, and weights."<sup>116</sup>

Then travelling to Bristol, Connecticut in 1821, Jerome bought a two-story house with seventeen acres of land. The price asked for by the original owner was two hundred and fourteen Terry Patent Clocks. Jerome wrote, "I told him I would give it, and closed the bargain at once. I finished up the one hundred parts which I had got from Mr. Terry, exchanged cases with him for more, obtained some credit, and in this way made out the quantity for Mitchell [the seller]."<sup>117</sup>

With his brother, Jerome's clock business began to make a self-described Bronze Looking-Glass Clock to compete with Terry's "Patent Shelf Clocks." To manufacture his clocks, Jerome installed the first circular saw ever seen in Bristol, although quite familiar to Plymouth, Connecticut and Mr. Terry. Fifteen years later Jerome introduced a one-day brass clock, which he cheaply mass-produced and sold for between one dollar and fifty cents and two dollars.<sup>118</sup>

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<sup>115</sup> Fuller, 241.

<sup>116</sup> Fuller, 248.

<sup>117</sup> Fuller, 248.

<sup>118</sup> In Chauncey Jerome's *History of the American Clock Business*, the author estimates his costs to manufacture a clock as follows: for the O-G case [O-G was a standard designation in the clock trade referring to the shape of the molding around the case] Jerome estimated forty-five cents in labor and wood (pine) per case. For the clock itself, he estimated forty-four to forty-eight cents for the brass sheet and the labor to cut the teeth to produce the wheels (there were eight

By comparison, wooden one-day clocks sold for fourteen dollars and brass eight-day clocks sold for twenty dollars.

Business boomed as Jerome sold his inexpensive timepieces domestically and overseas. As a result of his business success, he moved his entire operation to New Haven, Connecticut, discovered a method of stamping rather than using casting gears, formed a joint-stock company with Benedict & Burnham, brass manufacturers of Waterbury, Connecticut, became the New Haven Clock company, and by 1853 was selling 444, 000 clocks annually.<sup>119</sup>

Yet, like David Ross in Virginia, as a result of a poor business decision, Jerome found himself bankrupt by 1855. In a buyout of a clock company in Bridgeport, Connecticut, owned by the great bamboozler of the nineteenth century, P. T. Barnum, (a cousin to my great grandmother, Mabel Watson Whaley, who was as kind and considerate as Barnum was devious and cunning), Jerome found Barnum had sold off important assets and left Jerome with considerable debt. He never recovered from the burden, and he died penniless in 1868.

David Ross and Chauncey Jerome shared parallel experiences in the course of operating their nineteenth-century American businesses. Both enjoyed success and both suffered from the vicissitudes of doing business. Both made good and bad investment decisions, and both took risks. Each man died broke. Yet, they were also different from each other in ways that revealed the influence their surroundings had on each business and the influence each business had on their surroundings.

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to ten wheels in every clock,) five cents for the dial and face, one cent for the decorative tablets, which also included four cents for the glass and labor, thirteen cents for the weights, and ten cents to box the weights. His profit margin was approximately forty to fifty percent of his costs. Jerome also estimated that whereas his cost to make a case was forty-five cents per clock, it would cost a cabinetmaker approximately five dollars to make the same case by himself.

<sup>119</sup> National Clock Repair, "Jerome Clock History,"  
[http://www.nationalclockrepair.com/Jerome\\_Clock\\_History.php](http://www.nationalclockrepair.com/Jerome_Clock_History.php)

Ross arrived in Virginia and immediately understood the value of shipping and commerce with Great Britain. Tobacco was in demand, and he shipped enough of it to purchase an enormous plantation and more than two hundred slaves. Having imagination enough to see the potential for mining operations and iron production, he started a business venture that generated a huge profit. Using some of his own slaves along with bondsmen he rented from other slave owners, Ross used his black labor force in his companies' mines and forges. He recognized the mechanical abilities and skills of white miners and ironmen, many from the North, and he recognized the need for skilled whites to train his workers in areas of new technical developments. He also recognized, like his fellow slaveholders did, the dangers of allowing whites, who might have radical ideas, to come in contact with his bondsmen. Also, white workers' attempt to gain economic security was viewed as a threat to the status quo. In 1851, James Henry Hammond wrote in Marxian terms but with a different solution that, "in all other countries, and particularly manufacturing states, labor and capital are assuming an antagonistical [sic] position. Here it cannot be the case; capital will be able to control labor, even in manufactures with whites, for blacks can always be resorted to in case of need."<sup>120</sup>

Ross understood, albeit superficially, that his black workers had little incentive to work hard, minimize the waste of resources, and carefully follow directions. He expected his management team to compensate for all these problems, by remaining current with recent technological changes, better supervising his workers, and demanding more productivity from them. Finally, after his death, Ross's slaves were sold to other plantations and the mining and forging business ended. The slaves, who had learned the skills necessary to work in the iron business, were forced either to work in other forges or to keep their skills and ideas of about

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<sup>120</sup> Ronald L. Lewis, *Coal, Iron, and Slaves: Industrial Slavery in Maryland and Virginia, 1715-1865* (Westport, CT: Greenwood Press, 1979), 231.

iron making to themselves. Any slave risked a severe beating or even death if he or she presumed to know more than a white overseer or owner.

Chauncey Jerome started out with nothing, working as a farm hand and carpenter's apprentice, neither of which he liked. In the surrounding towns, however, new mechanical inventions were cropping up, and he was fortunate enough to find work with clockmaker Eli Terry. Terry's mechanical skills and imagination rubbed off on Jerome and the young man, in turn, designed and built his own clocks using Terry's work as his own model. Related inventions and businesses contributed to Jerome's success—circular saws, lathes and jigs, planing machines, a sandpaper wheel, and the brass industry. Laborers, at first paid by the piece, had incentive both to produce a number of parts and perhaps invent a new machine or process and then leave and start their own business. Jerome was an example of this.

In his book, *A New Nation of Goods: The Material Culture of Early America*, historian David Jaffee argued that men such as Terry and Jerome represented the “face of a manufacturing and market revolution that drew in a broad range of consumers throughout the United States.”<sup>121</sup> It was in rural communities where innovative artisans and Yankee peddlers transformed American material culture. Jaffee wrote: “The flexible and decentralized rural system of production—pioneered by clockmakers and soon to be found elsewhere—relied on the labor of countless young men and women in the countryside willing to work for wages and on the desire of middle-class families across the nation to fill up their parlors with consumer goods.”<sup>122</sup>

Craftsmen working the floors of the factory were given the freedom to suggest improvements and even design their own tools. All this created a unique and evolving work

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<sup>121</sup> David Jaffee, *A New Nation of Goods: The Material Culture of Early America* (Philadelphia: University of Pennsylvania Press, 2010), 186-187.

<sup>122</sup> Jaffe, 187.

environment that gradually created a sociological phenomenon difficult to pinpoint, but real nonetheless. The job of laboring in mills or factories was a completely different experience from working in the fields. Thus, it was not just the type of employment that changed, but men had to make psychological and emotion adjustments to this new kind of work.

For many centuries most men and women farmed. It was hard, backbreaking work, and it was also isolating. Large farms of the seventeenth and eighteenth centuries needed farm hands—peasants, indentured servants, or slaves—to manage the planting and harvesting. These farms required some teamwork from everyone working the property, but most farmers, large or small, in the new thirteen colonies, celebrated farming as the embodiment of individuality, freedom, and independence.

The new machinery and technology made Americans in the North redefine democracy and freedom. Inventor Robert Fulton believed that technology assisted republicanism because it led to economic opportunity “of equality in class status, and of the welfare of the many as opposed to the special privileges of the few.” Fulton said, “Every order of things, which has a tendency to remove oppression and meliorate the condition of man directing his ambition to useful industry, is, in effect, republican.”<sup>123</sup> At the 1851 Crystal Palace Exhibition in London, Edward Riddle, who reported to the commissioner of U. S. patents on the exhibition wrote, “The Russian exhibition was a proof of the wealth, power, enterprise, and intelligence of Nicholas; that of the United States an evidence of the ingenuity, industry, and capacity of a free and educated people.”<sup>124</sup>

Manufacturing changed the idea of working alone to the idea of working as a group, as part of the wheel of production. Everyone had to do his or her job in order to build the finished

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<sup>123</sup> Hugo A. Meier, “The Ideology of Technology,” in *Technology and Social Change in America*, ed. Edwin T. Layton, Jr. (New York: Harper & Row, Publishers, 1973), 81.

<sup>124</sup> Meier, 81 and 85.

product. In the case of Jerome's clocks, the carpenters built the clock's case, others built the dial, glass tablet, machinery, and weights. Eventually, Jerome's business faltered, but his workers moved on with marketable skills, and they spread their knowledge to others within the region and perhaps improving upon machinery in the new and evolving manufacturing endeavors.

The clock business was only one of hundreds of new industries emerging in the North and Northwest in the decades before the Civil War. The growth, for example, in textile, iron, lead, shoes, lumber, glass, paint and tobacco manufacturing over the first six decades of the nineteenth century was staggering. Between 1810 and 1860 the manufacturing value of the aforementioned products grew by a factor of ten to \$1,885,861,676.<sup>125</sup> Furthermore, comparing numbers from the three regions of the country between 1840 and 1860 revealed remarkable evidence of the differences in these sections when it came to economic development during the antebellum period.

The American population in 1820 was 9,638,453 of whom 1.5 million were slaves. The South's total cotton crop amounted to 160,000,000 pounds or 40,000 bales of 400 pounds each. In North Carolina the state's total amount of capital invested for manufacturing was \$353, 460 with New Hanover and Stokes the largest districts reporting. In the former, seventy-eight thousand dollars was invested in making vats for evaporation in sugar refining, and in the latter thirty-eight thousand dollars for producing leather goods and whiskey. South Carolina reported a capital investment of \$380,700 and Georgia reported \$309,543 in investments.<sup>126</sup> During the

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<sup>125</sup> U. S. Department of the Interior, *Manufactures of the United States of America in 1860; Compiled from the Original Returns of the Eighth Census under the Direction of the Secretary of the Interior*, (Washington, DC: Government Printing Office, 1865), v.

<sup>126</sup> U. S. Bureau of the Census, Population Finder, <http://factfinder.census.gov>. U. S. Department of State, *Digest of Accounts of Manufacturing Establishments in the United States and their Manufactures. Made under the direction of the Secretary of State in pursuance of a Resolution of*

same period Massachusetts, Rhode Island, and Connecticut together showed a capital investment in manufacturing to be around \$10, 000,000.

The skyrocketing economic growth in the North from the turn of the nineteenth century to 1820 reflected changes in technology and market demand. Men such as Joshua Lindly of Providence, and Samuel Slater of Pawtucket, Rhode Island improved upon the first English made carding and spinning machines, and eventually Slater built a water-frame of forty-eight spindles and two carding machines. Seven years later opened a new cotton mill in Pawtucket.

In 1800, fourteen mills operated fewer than two hundred spindles. By 1804, the number of mills in Rhode Island, Massachusetts, and Connecticut had doubled. Furthermore, men who had learned the business from Slater founded mills in New Hampshire, the upper Mohawk Valley, and the central lake region of New York.<sup>127</sup> By 1820, there was approximately one loom for every one hundred sixty spindles, and an estimated 167,000 spindles in Rhode Island, Massachusetts, Connecticut, and New Hampshire.

Although inchoate in the early years of the century, the growth in all manufacturing in the northern and western states increased between 1820 and 1840. By 1860, the rate of manufacturing development was phenomenal. The Southern states also experienced unprecedented economic development in the same four decades earning the sobriquet, "The

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*Congress 30 March 1822*, (Washington: Gales and Seaton, 1823) in *American Industry and Manufactures in the Nineteenth Century: A Basic Source Collection compiled from U. S. Government Documents*, vol. 3 (Elmsford, NY: Maxwell Reprint Company, 1970). In South Carolina, St. Philips' Parish invested \$93,000 in leather goods, and the Greenville district invested \$60,000 to make muskets. Georgia's largest counties, Richmond and Jackson invested \$80,500 in saddles, bridles, and clothing and \$57,095 in hats, cotton cleaning, and furniture respectively.

<sup>127</sup> Victor S. Clark, *History of Manufactures in the United States, 1607-1860*, vol. 1 (1929; repr., New York: Peter Smith, 1949), 535-536. Benjamin S. Wolcott and his son Benjamin, Jr., both employed by Slater, built the first cotton mill (1807) in Oneida County, New York, four miles west of Utica. A Mr. Robbins, another Slater workman, built a mill in 1804 at New Ipswich, New Hampshire. See Appleton and Batchelder, 50-51.

Cotton South,” and “King Cotton,” but the region’s focus was on producing the raw material not refining it. As the North and West demanded raw materials from the South, and the South demanded finished products from the North and West, a symbiotic relationship developed between the various sections of the country. This led to distinct labor patterns, business and management systems, and tangential ideas to support and develop the differences in each section. These distinctions were prevalent on the eve of the Civil War.

The cotton plant, from which extraordinary wealth derived, was commercially known as short-staple (black seed), green seed, and Upland cotton and the amount of cotton grown was remarkable. The cotton crop in 1830 was 350,000,000 pounds. By 1840 the crop grew to 790,000,000 pounds, and by 1860 2,154,820,800 pounds were picked and ginned by four million African American slaves. The latter produced 5,387,052 bales of four hundred pound each.<sup>128</sup>

Rice, sugar, and tobacco also generated considerable wealth. All of these staple crops were refined and produced by the hands of slaves. Iron manufacturing and coal mining operations also hired slaves to do most of the work, much to the grievance of the white artisans or mechanics. Plantation owners hired out their slaves to work as masons, coopers, and carpenters. In 1847, the white mechanics in the Tredegar Iron Works of Richmond struck because the owner hired mechanics from the North to teach slaves the skilled processes of puddling and rolling.<sup>129</sup> The owners ignored the strikers. The *Richmond Times and Compiler* declared that such strikes attacked the foundations of slavery by maintaining the principle that “the employer may be prevented from making use of slave labor.”<sup>130</sup>

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<sup>128</sup> *Manufacturers of the United States in 1860; Compiled from the Original Returns of the Eighth Census*, xv.

<sup>129</sup> Clement Eaton, *The Growth of Southern Civilization, 1790-1860* (New York: Harper & Row Publishers, 1961) 166.

<sup>130</sup> Eaton, 166.



Where white operators did outnumber slaves was in the small and modestly successful textile industry in the South. Of course some mills employed slaves as workers, such as the Rocky Mount Manufacturing Company, located at the falls of the Tar River in North Carolina or the Salem Cotton Manufacturing Company in the Piedmont section of North Carolina.<sup>131</sup> William Gregg of South Carolina, however, advocated the establishment of textile industries to diversify the economy of the South, and he proposed using poor whites as the labor force. Many in the state's legislature, controlled by the planter class, were hostile to Gregg's ideas.<sup>132</sup> He continued to work toward his goal of building a mill and employing white operatives and in 1846 finally constructed a factory in Graniteville, South Carolina. This factory combined with mills in Macon, Eatonton, Columbus, and Athens, Georgia gave rise to a stable textile industry. The 1840 census reported 1,581 hands employed in textile factories in Georgia, 2,122 in South Carolina, 1,830 in North Carolina, and 6,081 in Virginia.<sup>133</sup>

Twenty years later the textile industry in the South had flat-lined. Thirty-three mills operated in Georgia with approximately eighty-three workers per mill for a total of 2,813

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<sup>131</sup> Eaton, 223-224.

<sup>132</sup> Eaton, 225.

<sup>133</sup> Department of State, *Statistics of the United States of America as Collected and Returned by the Marshals of the Several Judicial Districts under the 13<sup>th</sup> section of the act for taking the Sixth Census corrected at the Department of State June 1, 1840*, vol. 4, "Aggregate Value and Produce, and Number of Persons employed in Mines, Agriculture, Commerce, Manufactures, etc., Exhibiting a full view of the Pursuits, Industry, and Resources of the United States of America including the District of Columbia, and the Territories of Wisconsin, Iowa, and Florida," (Washington: Blair and Rives, 1841), 16-22. These numbers are not entirely helpful because they do not differentiate between white men and women, free black men and women, slave men and women, and both white and black boys and girls. The following breaks down the total invested in manufacturing for these states in 1840: Eastern Virginia \$7,443,024 of which \$2,999,108 was invested in cotton textile mills and \$241,840 in machinery manufactured; Western Virginia \$11,360,861 of which \$5,184,669 was invested in cotton textile mills and \$429,858 in machinery manufactured. North Carolina \$3,838,900 of which \$1,670,228 was invested in cotton mills and \$43,285 in machinery manufactured. South Carolina \$3,216,970 of which \$1,668,804 was invested in cotton textile mills and \$65,561 in machinery manufactured. Georgia \$2,899,565 of which \$1,491,973 was invested in cotton textile mills and \$131,238 in machinery manufactured.

employees. South Carolina listed 891 factory hands in seventeen mills, North Carolina 1,755 workers in thirty-nine mills, and Virginia declined to 1,631 workers in just seventeen mills. As well, by the 1850s bondsmen were supplied by slave owners to factories to defer operating costs.

Other forms of manufacturing in the aforementioned states that also represented over one million dollars of capital investments included tobacco manufacturing, coal mining, and iron production (bar, sheet, and railroad) in Virginia, turpentine distilleries in North Carolina, and steam-engine manufacturing in Fulton County Georgia, the county that included Atlanta. All four states invested in lumber mills and the manufacturing of flour and meal. The total capital investments in manufacturing in these states came to \$54,451,894. Yet, this number fell short of the capital investments made just in the counties of Middlesex, Essex, and Worcester, Massachusetts.<sup>134</sup> These numbers encapsulate the significant difference in manufacturing output between sections of the country. They also provide a transparent view of the labor forces associated with economic growth in the country during the antebellum period, and the education and training necessary to sustain sanguinary fiscal expansion.

As the demand for cotton grew to feed the nascent Northern industry, mills built on the Slater model sprung up in the Quinebaug-Shetucket and Blackstone River valleys. Census figures showed unprecedented expansion in textile manufacturing. For example, Massachusetts employed 26,000 people in the textile business in 1840 with a capital investment in the same industry of \$17,414,099. By 1860 those numbers grew to 37,145 workers and \$32,685,514 in

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<sup>134</sup> *American Industry and Manufactures in the 19<sup>th</sup> Century*, 251. Middlesex County reported capital investments in manufacturing at \$26,946,527 (larger than Virginia), Worcester County \$13,934,769 (larger than Georgia), and Essex County \$20,885,580 (larger than North Carolina and South Carolina combined).

capital investments.<sup>135</sup> In addition, unlike the period before the War of 1812, when most textile mills made their own machinery, machine shops separated from the mills and began to specialize in machine construction.<sup>136</sup>

In the early nineteenth century there was also no distinction between mill and machine. The water wheel was built with the mill and each operation within the mill had its own wheel, controlled by its own water gate.<sup>137</sup> Therefore, increased improvements in machinery demanded improvements in “water wheels, speed controls and power distribution.”<sup>138</sup> Power was generated to the machines through a system of shafts, gears, and pulleys. Shafts were first made of wood then iron, and often water power initiated by the total fall of a river passed by so many machine works, gristmills, lumber mills, and textile factories that they rendered a mill’s water wheel inefficient, as a result of the water’s overuse. The replacement of heavy gearing with lightweight leather belting, and improvements in metallurgy and iron water turbine technology, first developed in France in 1832, captured the efficient use of rivers and canals. To cope with the complexity of a mill operation, traditional millwrights gave way to men who specialized in engineering the construction of mills and their power sources.

These mechanical engineers were trained through an apprentice system. Like Chauncey Jerome of clock making fame, Paul Moody, a mechanic with the Merrimack Manufacturing Company in Lowell, Massachusetts, learned his engineering skills first as a machine-shop laborer. Other workers left the textile mill to design and make their own metal products,

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<sup>135</sup> *American Industry and Manufactures in the 19<sup>th</sup> Century*, 252. See also *Statistics of the United States of America as Collected and Returned by the Marshals of the Several Judicial Districts under the 13<sup>th</sup> section of the act for taking the Sixth Census*, 56-57.

<sup>136</sup> Douglass C. North, *The Economic Growth of the United States, 1790-1860* (Englewood, NJ: Prentice-Hall, Inc., 1961), 162.

<sup>137</sup> Paul E. Rivard, *A New Order of Things: How the Textile Industry Transformed New England* (Hanover, NH: University Press of New England, 2002), 51.

<sup>138</sup> Rivard, 52.

machine tools, locomotives, sheet-iron ware, carpenter's tools, and brass clocks. Between 1840 and 1860 the Northern labor force dramatically changed. Approximately seven times more carpenters, civil and mechanical engineers, and factory hands worked in the North than in the South. New York and Pennsylvania together employed 67,000 carpenters, 8,300 engineers, and 5,000 ironworkers in 1860. Virginia and North Carolina together employed 12,000 carpenters and 1,000 engineers. Only 600 ironworkers worked in those two southern states.<sup>139</sup>

English observers reported on the quality of the mills and skills of the work force throughout the Northeast. Joseph Whitworth presented his report on New England manufacturing to the House of Commons in February 1854. Whitworth was no stranger to machine operations and engineering. He pointed out that industrial development "on a national scale demanded that nuts and bolts of the same diameter be interchangeable" he wrote.<sup>140</sup> Interchangeability required a standard system of measurement, "which fixed the contour of screw threads and established for each diameter the number of threads per inch."<sup>141</sup> Whitworth had proposed such a system in 1841 and by 1854 it was in common use in England. He was considered the world's foremost manufacturer of machine tools. At the Crystal Palace Exhibition in London in 1851 he had displayed his lathes, his machinery for planing, shaping, slotting, drilling, boring, punching, and shearing, and his standard gauges and measuring apparatus.<sup>142</sup> He also devised a rifled breech loading cannon and a rifled gun with a hexagonal bore, both of which were used by the Confederacy during the Civil War.

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<sup>139</sup> Eighth Census of the United States.

<sup>140</sup> Bruce Sinclair, "The Direction of Technology," in *Technology and Social Change in America*, ed. Edwin T. Layton, Jr. (New York: Harper & Row, Publishers, 1973), 65-66.

<sup>141</sup> Sinclair, 65-66.

<sup>142</sup> Nathan Rosenberg, ed., *The American System of Manufactures* (Edinburgh: Edinburgh University Press, 1969), 20.

It was not until 1857 that the United States, however, would begin to develop standards for screw threads. Other measurement standards were already developed in the clock and firearms industry.<sup>143</sup> It was William Sellers of Philadelphia who first introduced a gear-cutting machine in 1857 that “marked the advent of commercially interchangeable nuts and bolts.”<sup>144</sup> Before this machinists developed their own system to meet particular construction needs, and because the use of special threads prevented outside repairs on their own machinery. This, at least in part, explained the use of various track gauges by American railroad companies, especially in the South.

Whitworth commented extensively on both the manufacturing companies he visited and the labor force he observed. For example, he noted how the Hadley Falls Company was formed in 1847 for the purpose “of turning to account the water power supplied by the river Connecticut, buying water privileges, and purchasing land to form the site of a manufacturing town.”<sup>145</sup> The town laid out streets and constructed across the river a dam, 1,000 feet long. Whitworth also applauded town officials for appropriating \$3.72 per student for the education

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<sup>143</sup> Simon North had partially accomplished interchangeability in the firearms industry when John Hall’s new machinery produced a uniformity of parts that John Tipton of Indiana, chairman of the Senate committee on military affairs in December 1837 described as “the greatest improvement in the mechanical arts ever made by one man.” Hall also produced a set of gauges used to measure parts and detect deformities in the machine work. See Merritt Roe Smith, *Harpers Ferry Armory and the New Technology: The Challenge of Change* (Ithaca: Cornell University Press, 1977), 223-225.

<sup>144</sup> Sinclair, 71. Philadelphia was considered the machine-tool building center in the country. Sellers began his career as an apprentice in his uncle’s machine shop in Wilmington, Delaware. After this he was superintendent of Fairbanks, Bancroft and Company, a family connected machine shop in Providence, Rhode Island. He returned to Philadelphia in 1848 and started his own business with Bancroft. They manufactured machine tools and mill gearing. See Bruce Sinclair, “At the Turn of a Screw: William Sellers, the Franklin Institute, and a Standard American Thread,” in *Technology and Culture*, 10 (January 1969), 20-34.

<sup>145</sup> Joseph Whitworth, “New York Industrial Exhibition. Special Report of Mr. Joseph Whitworth. Presented to the House of Commons by Command of Her Majesty, In Pursuance of Their Address of February 6, 1854,” in Nathan Rosenberg, *The American System of Manufactures* (Edinburgh: Edinburgh University Press, 1969), 357.

of each child. In seven years Holyoke, Massachusetts had two cotton mills employing 1,100 workers, a machine shop employing 365 workers, and a paper mill up and running.<sup>146</sup>

He concluded his report by saying that “the intelligent and educated artisan [sic] is left...free to earn all that he can, by making the best use of his hands, without hindrance by his fellows. It may be that the working classes exhibit an unusual independence of manner, but the same feeling insures the due performance of what they consider to be their duty with less supervision than is required where dependence is to be placed upon uneducated hands.”<sup>147</sup> Furthermore, he found that any workman who developed “peculiar skill,” could rise to become a superintendent of the mill. This was so, Whitworth wrote, because of common schools, “placed within the reach of each individual, and all classes avail themselves of the opportunities afforded.”<sup>148</sup>

Whitworth did not visit the South on his tour of the United States, but conversations, no doubt, raised questions in his mind about the effectiveness of slave labor. Whitworth was part of a commission appointed by the British government to attend the New York Exhibition, and the commissioners gathered in the city to discuss their observations, before returning home. Another commissioner, George Wallis, reported, “...in some middle States...attempts are being made to bring slave labour to bear upon manufacturers, to the reduction of prices, and, consequently, of the remuneration of free labour.” Wallis continued, “...the prevailing idea is, that slave labour can never by any possibility be made to compete, or to pay in comparison with

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<sup>146</sup> Whitworth, 358.

<sup>147</sup> Whitworth, 389.

<sup>148</sup> Whitworth, 389.

free labour. This is held equally by the opponents and advocates of the institution of slavery....”<sup>149</sup>

The New York Crystal Palace Exhibition in 1853 placed on display new technology from around the world, and the city’s mayor Jacob Aaron Westervelt, member of the General Society of Mechanics and Tradesmen, presided over the exhibition. Westervelt was not only a skillful politician, but he was also credited with the designs of some of America’s fastest clippers and steamships.

In the two decades before the Civil War, skilled labor and new machinery was at a premium and sought by owners of factories and mills, especially in the North. Unskilled workers, and there were many of them, were not as effusive in their assessment of how new tools and inventions offered remunerative opportunities to the laborers. Many people were impoverished and machinery threatened to take away the finite number of jobs available. In addition, with immigration burgeoning in the 1840s and 1850s, it appeared to many that there were an infinite number of unskilled laborers ready to fill those jobs. This was particularly true in the South where even skilled labor felt threatened by new machinery. Inventions could displace workers, yet unlike in the North, there were fewer factories and thus fewer opportunities to labor elsewhere. Owners of iron forges, coaling operations, and textile mills further weakened the white labor market by using slave labor for both skilled and unskilled jobs. The difference in attitude toward machinery among skilled workers North and South can be no better explained than in the manufacturing of guns, cannons, and ordnance in the twenty years before the Civil War. The operations of the United States armories in Springfield, Massachusetts and Harpers

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<sup>149</sup> George Wallis, “New York Industrial Exhibition. Special Report of Mr. George Wallis. Presented to the House of Commons by Command of Her Majesty, In Pursuance of Their Address of February 6, 1854,” in Nathan Rosenberg, *The American System of Manufactures* (Edinburgh: Edinburgh University Press, 1969), 205.

Ferry, Virginia demonstrate that to one side technology was progress, and to the other side anathema.

Sometime before 1819, Thomas Blanchard, a New England inventor, designed an apparatus for manufacturing gunstocks. After revising his patent specification in 1820, he presented to the superintendents at Springfield and Harpers Ferry his “engine for turning or cutting irregular forms out of wood, iron, brass, or other material or substance, which can be cut by ordinary tools.”<sup>150</sup> Springfield’s superintendent Roswell Lee embraced the new machinery; Superintendent James Stubblefield at Harpers Ferry did not. Other technological improvements in water wheels, trip hammers, and machines for milling, drilling, and trimming iron components were also slow to take hold at Harpers Ferry. As historian Merritt Roe Smith pointed out, traditional artisans were not receptive to mechanization because it threatened their job security and their traditional way of life. “Combined with close-knit local kinship groups that held outsiders suspect and outside ideas alien to customary practices, these inbred feelings fostered curious technological conservatism at Harpers Ferry.”<sup>151</sup>

The relationship between Stubblefield and his workers grew out from a culture of patriarchy and patronage. Stubblefield was a leading member of Harpers Ferry’s leading family. His brothers-in-law operated the major businesses in town, and Stubblefield was friends with Virginia senator James Barbour and Kentucky’s Henry Clay.<sup>152</sup> In order to maintain his business interests, quell class antagonism, and hold his political power, Stubblefield protected worker’s jobs at the armory, and in return, workers voted as he desired and accepted his paternalism.<sup>153</sup> Change felt threatening to everyone, so change, and anyone associated with it, was a pariah.

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<sup>150</sup> Merritt Roe Smith, *Harpers Ferry Armory and the New Technology: The Challenge of Change* (Ithaca: Cornell University Press, 1977), 129.

<sup>151</sup> Smith, 139.

<sup>152</sup> Smith, 146.

<sup>153</sup> Smith, 151.



The Clock Strike of 1842 embodied this prejudice against new ways of operating at the Harpers Ferry factory.

The origins of Clock Strike dated to the appointment of Major Henry K. Craig as the first military superintendent at Harpers Ferry. He inherited from Stubblefield a work force that still believed in the idealized craftsman, a skilled laborer who took pride in his work by applying individual attention and artistry to each piece he made. Not only did new machines devalue a laborer's expertise, but they also punctured an artisan's identity as a person. Technology challenged workers' belief in human agency. Skilled laborers found anonymity, rather than satisfaction, in their results. For several decades, innovations in arms manufacturing crept into their lives, lightened their physical labor, increased their output at least theoretically, and altered their culture. These men lived in two worlds: one defined by a lifetime of habits, traditions, and values unique to each man outside the armory's four walls. The early industrial revolution in America mesmerized northerners, and many Yankees were not sure they approved of the changes. At least industrialization in the North was visible to everyone. From farmers in upstate New York to teamsters in Providence, Rhode Island, if innovation was not a direct part of their daily lives, people could see it from where they stood. Conversely, the men at Harpers Ferry, and many people in the South, might enjoy the material goods industrialization produced, yet their culture and customs were still bound by farming, plantation life, paternalism, and slavery.

For years, James Stubblefield understood that to maintain harmony among his workers, in what they considered a threatening environment, he had to allow for certain customs such as twelve hour days so workers had time to complete piecework at their own pace, and in the same twelve hours allow for time to read a newspaper, argue and debate, drink alcohol, and

take long breaks in the middle of the day. Unfortunately for the workers at Harpers Ferry, Major Craig did not see things their way.

Written rules and regulations were needed to operate the armory efficiently. Furthermore, violations of the rules needed to be accompanied by stiff fines. One regulation that antagonized workers was a new ten-hour workday. No drinking or debating, no trips home at lunchtime, all work need to be finished in ten hours, and the work had to be of high quality. Craig dismissed their complaints. For craftsmen, Craig believed, time should not be governed for it degraded the workers and made them feel like “mere machines of labor.”<sup>154</sup> Consequently, on March 21, 1842, the entire labor force, led by the pieceworkers, walked off the job. This began the Clock Strike. A select handful boarded a boat headed to Washington to present their petition for the removal of Craig to President John Tyler.

The president told the petitioners to “go home and hammer out their own salvation.”<sup>155</sup> Tyler’s answer did not satisfy the workers. According to Merritt Roe Smith, Major Craig’s regulations “not only struck at the craft ethos but also threatened basic norms within the community. These factors awakened the armorers to a spirited defense of the old order.”<sup>156</sup> It was so spirited that by December 1858 Secretary of War John B. Floyd removed the current superintendent because the armory had fallen into disarray. The quality of the work was poor and expenditures had exceeded production.<sup>157</sup> Even as Southern politicians and business leaders in the 1850s encouraged some industrial development, the quality of the work suffered for reasons of limited access to improved materials, limited machine-tools and training, and general unease about how the new technology would alter their way of life. Industrial development also

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<sup>154</sup> United States Department of the Interior, “Harpers Ferry,” National Park Service, [www.nps.gov/hafe/forteachers/upload/materials%20packer...](http://www.nps.gov/hafe/forteachers/upload/materials%20packer...) (accessed December 20, 2012).

<sup>155</sup> Smith, 272.

<sup>156</sup> Smith 273.

<sup>157</sup> National Park Service, “Harpers Ferry,” 11.

required a skilled labor force, engineers who understood the latest technology, and competent managers who would adapt to new ways of doing business. For example, Southern railroads tripled their track mileage in the decade before the war yet, a shortage of skilled tradesmen, industrial managers, planners, and engineers, inhibited the South from creating a railroad system, and the quality of the work done left a lot to be desired.

The records of the men who led Southern railroads in the antebellum period are difficult to locate, but some provide a glimpse of the type of people who worked on the railroad below the Mason-Dixon. Some were Southern born and reared in families that owned and operated small businesses. Many of these sons of the South's middle class were educated at private academies and then studied civil engineering at colleges like Virginia Military Institute (VMI) and the University of North Carolina. After graduating they eventually went to work for newly formed railroad companies as engineers. Others were born into the planter class, were educated at the best schools, trained as lawyers, owned their own plantations, and finally expanded their business interests by building railroads. A fair number were born and educated in the North then migrated South to find their wealth and happiness.

William Mahone, for example, was born in the little town of Monroe, Virginia, in December 1826, and his father, Fielding Mahone was instrumental in bringing an end to Nat Turner's Rebellion five years later. The Mahones then moved to Jerusalem, Virginia, on the Nottoway River when young William was thirteen, and the father opened a tavern and hotel business, with the help of his family and three slaves. William, described as a "sandy-haired, freckled-face little imp, who hung around the stores in Jerusalem.... He was the leader in all deviltry, and the terror of all good country mothers whose boys occasionally went to town."<sup>158</sup>

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<sup>158</sup> Nelson Morehouse Blake, *William Mahone of Virginia: Soldier and Political Insurgent* (Richmond: Garrett & Massie Publishers, 1935), 10-11.

Unlike many of his mischievous companions whose fathers paid little heed to education, Mahone was forced to attend a private school in Rosedale, Virginia, held at the home of Captain William J. Sebrell and conducted by Hannah and Sarah Armstrong, natives of Maine.<sup>159</sup> At fifteen he was enrolled at the Littletown Academy, where prominent families sent their sons, and then two years later he received an appointment to the Virginia Military Institute as a State cadet, consequently given free board and tuition.<sup>160</sup>

Whereas his upper class classmates excelled in literature and foreign language, Mahone was at the top of his class in mathematics, engineering, and chemistry. He graduated eighth in a class of thirteen. Mahone may have been described as a tobacco chewing, prolific swearing, gambler of the coarse, unrefined middle class, but he dedicated himself to becoming a civil engineer working on several railroad project, surveying expeditions, and on building plank roads, which many Southern leaders believed were superior and much less expensive than railroads.<sup>161</sup>

By 1850, however, in the State of Virginia, businessmen began to question what they considered the shortsighted nature of the state's transportation policy. Plank roads were fine, but the commercial future of cities like Norfolk depended on the railroad. The railroads that did exist had established short-line roads that cut-off crucial connections to the major cities. In particular, the city of Norfolk had failed to keep pace with other seaports along the Atlantic coast. Therefore, a railroad running from Norfolk to Petersburg and connecting there with other

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<sup>159</sup> Blake, fn. 65, 10.

<sup>160</sup> Blake, 12-13.

<sup>161</sup> Blake, 23-24. William Gregg of South Carolina wrote, "The plank road is capable of meeting all the wants of our country, and superior to the railroad in every particular but that of indulging our fancy in rapidly passing from one point to another; it is so simple and cheap in its construction and management, that there is scarcely a village or an agricultural section of our country that cannot afford to build and maintain one." See Mitchell Broadus, *William Gregg, Factory Master of the Old South* (Chapel Hill: University of North Carolina Press, 1928), 152-156.

railroads extending into the interior of the South was essential for future economic development. Norfolk would become the taproot of transportation and trade with the rest of the United States and even Europe.<sup>162</sup>

Mahone was elected the chief engineer of the proposed Norfolk & Petersburg Railroad in 1853 and within five years the line was completed. The entire project was well engineered, including Mahone's innovatively designed twelve-mile roadbed that skirted the edge of the Great Dismal Swamp between South Norfolk and Suffolk, Virginia, and a log foundation laid at right angles beneath the surface of the swamp. By 1861, Mahone was both president and chief engineer of the railroad. By 1861, Mahone was both president and chief engineer of the railroad.<sup>163</sup> The phlegmatic Confederate leader who stopped the Union advance at the Battle of the Crater in 1864, which earned him a place of honor in Confederate folklore, built one of the great railroads of the South.

In contrast, David Levy Yulee, John Motley Morehead and William Sheppard Ashe were men of refinement, plantation and slave owning elite of the "Old South" who became involved in railroad building as a horizontal expansion to their lucrative sugar, cotton, and rice businesses. All had studied law and promoted Southern railroad expansion. Yulee, known as the father of Florida's railroads, was the first Southerner to use state grant money. With it he successfully built a line from the Atlantic to the Gulf of Mexico.<sup>164</sup>

Yulee was born in the West Indies and at nine years old was sent to a private school in Norfolk, Virginia. He eventually moved to St. Augustine, Florida Territory, where he was

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<sup>162</sup> Blake, 25.

<sup>163</sup> "William Mahone, (1826-1895), <http://www.thelatinlibrary.com/chron/civilwarnotes/mahone.html> (accessed January 4, 2013).

<sup>164</sup> See the Florida Internal Improvement Act of 1855. The Florida Railroad, as it was called, opened in early 1861 and went from Fernandina on Amelia Island in the Atlantic to Cedar Key on the Gulf of Mexico. See <http://bioguide.congress.gov/scripts/biodisplay.pl?index=Y000061> (accessed December 30, 2012).

admitted to the bar in 1836. He devoted considerable efforts toward Florida statehood with slavery, and when it became the Union's twenty-seventh state in 1845, Yulee was elected its first Democratic senator. The following year he purchased a 5,000-acre sugar cane plantation along the Homosassa River in the western part of the state. To provide transportation to deepwater ports on the Gulf of Mexico and Atlantic Ocean, Yulee started to plan building a railroad. Using federal and state land grants, in 1853 he chartered the Florida Railroad. Construction began in 1855 and the railroad was opened in 1861 running from Fernandia on the Atlantic coast to Cedar Key on the Gulf of Mexico.<sup>165</sup> The Florida Railroad was his private enterprise. In 1862, when the Union navy captured both Fernandia and Cedar Key, the Confederate government hoped to dismantle the railroad's track so it could be used elsewhere. Yulee argued for an injunction against the state and won. The track remained untouched for the rest of the war.<sup>166</sup>

John Motley Morehead was a keen proponent of internal improvements in North Carolina in the 1840s and 1850s. As a boy he attended private schools and then went on to graduate from the University of North Carolina in 1817. As an attorney, politician, and businessman, Morehead advocated for the western part of the state, calling for constitutional reform to recognize the growing population in the western half of the state. He promoted the common school movement and the construction of railroads. He served four years as governor, and shortly after his tenure became invested in a cotton mill. Recognizing the need to move

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<sup>165</sup> Maury Wiseman, "David Levy Yulee: Conflict and Continuity in Social Memory," University of Florida, Gainesville, Florida, [fch.ju.edu/FCH-2006/Wiseman-David Levy Yulee.htm](http://fch.ju.edu/FCH-2006/Wiseman-David%20Levy%20Yulee.htm) (accessed October 26, 2013).

<sup>166</sup> Wiseman, 1.

textiles from plantation to mill to consumer, he started the North Carolina Railroad and became its first president.<sup>167</sup>

Henry Varnum Poor, editor of the *American Railroad Journal*, preached that the most successful railroads were the ones where the chief executive knew the business from top to bottom. This was not the case with Morehead. Yet, his financial and political skills made up for his lack of technical knowledge. For Morehead, between 1850 and 1855, when the road was under construction, he viewed his job as hiring a good engineer and letting that man worry about the details of building the line.<sup>168</sup>

The man Morehead hired as chief engineer was Walter Gwynn, an 1822 graduate of West Point, and an accomplished civil engineer. Born in western Virginia, Gwynn had work on a sizeable number of railroad projects, and he managed the North Carolina Railroad construction with professionalism and skill. The line was completed in early 1856. Morehead also hired a New Englander, Thomas E. Roberts, to serve as master mechanic, a position he held until 1860.<sup>169</sup>

Unlike the Florida Railroad that operated as David Yulee's own business, three-quarters of the North Carolina Railroad were owned by the state. As a result of this, state representatives on the board of directors kept a tight handle on the purse strings. NCCR salaries for the

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<sup>167</sup> Allen W. Trelease, *The North Carolina Railroad, 1849-1871, and the Modernization of North Carolina* (Chapel Hill: The University of North Carolina Press, 1991), 59.

<sup>168</sup> Trelease, 111. Trelease pointed out that two-thirds of the railroad's labor force was African American slaves. Most, like white men, worked as unskilled laborers, but some were employed as machinists. Blacks also worked as boilermakers, patternmakers, and coppersmiths, and this was because there were few white machinists in the South. Most of them were recruited from the North. The master machinist was from Massachusetts. Of the fifty-two men who were listed as machinists in 1857, twenty-seven were from outside North Carolina, and twenty of them were from the North. Firemen and brakemen were also considered skilled position and in 1857, the NCCR employed thirty, twenty-seven of whom were black, and of that number twenty-one were slaves. See Trelease, 62-69 and fn. 50, 391. See also Stephen Ray Henson, "Industrial Workers in the Mid-Nineteenth Century South: Atlanta Railwaymen, 1840-1870" (PhD dissertation, Emory University).

<sup>169</sup> Trelease, 118.

president, superintendent, road master, and treasurer were near the bottom of comparable size railroads. In addition, there were frequent disagreements over how much money should be spent for company shops.<sup>170</sup>

Like Morehead, William Sheppard Ashe was also not a railroad man. Born in North Carolina, he studied at Trinity College in Hartford, Connecticut, became a lawyer and owned a plantation that cultivated rice. His stature in the local community and the state qualified him to become president of the Wilmington & Weldon Railroad. Ashe's chief engineer, however, was from the North. Sewall L. Fremont was born in Vermont, appointed to West Point from New Hampshire and graduated from the United States Military Academy in 1841. After serving in various postings he resigned from the army and became assistant engineer in the service of the United States on improvement of the Cape Fear River, North Carolina, in 1854. In the same year he was appointed chief engineer and superintendent of the Wilmington & Weldon.<sup>171</sup>

William M. Wadley, another New England native moved to Savannah, Georgia at twenty years old after learning the blacksmith trade. Known for building the railroad bridge over the Oconee River, he served as superintendent of the Georgia Central Railroad (1849 to 1852), the Western & Atlantic (1852 to 1856), and the New Orleans, Jackson and Great Northern Railroad (1858).<sup>172</sup>

The president of the New Orleans railroad was also a Northerner. Henry Joseph Ranney was born in Middletown, Connecticut, and educated at the Partridge Military Academy from

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<sup>170</sup> Trelease, 118-119.

<sup>171</sup> George W. Cullum, *Biographical Register of the Officers and Graduates of the United States Military Academy at West Point, New York since its establishment in 1802*, vol II, p. 81, [Penelope.uchicago.edu/Thayer/E/Gazetter/Places/America/United\\_States/Army/USMA/Cullums\\_Register/1075\\*.html#no](http://Penelope.uchicago.edu/Thayer/E/Gazetter/Places/America/United_States/Army/USMA/Cullums_Register/1075*.html#no) (accessed December 30, 2012). According to Cullum when Fremont graduated his name was recorded as Sewall L. Fish.

<sup>172</sup> Confederate Railroads, "Biography of William M. Wadley," [http://www.csa-railroads.com/Essays/Biography\\_of\\_William\\_M.\\_Wadley.htm](http://www.csa-railroads.com/Essays/Biography_of_William_M._Wadley.htm) (accessed January 3, 2013).



which he graduated as a civil engineer in 1828.<sup>173</sup> Working first as an assistant engineer for the railroad Ranney eventually became its president in 1861. Ranney, like all of his Southern colleagues tried to establish a rudimentary management system with a chain of command that included a general superintendent, resident engineer, treasurer, general freight agent, conductors, baggage masters, a master machinist, journeymen machinists, carpenters, and watchmen.<sup>174</sup> Unlike many Northern railroads that required the addition of separate divisions of personnel to operate over several hundred miles of the company's roads, Southern railroads did not develop the divisional system because most companies had less than 200 miles of track, and a decentralized management system required a skilled work force.<sup>175</sup> Furthermore, the "patriarchal principle" preached by the Virginian intellectual George Fitzhugh, after the Panic of 1857, reinforced the "positive good" theory of slavery, and this ideas tacitly supported the concept of the owners complete control of every aspect of plantation life or business.<sup>176</sup>

As Professor John E. Clark, Jr. argued, railroad management involved constant inspection, superintendents, mechanics, track repair supervisors, and stationmasters all along the line. This was especially true for railroads that operated over two hundred miles of track. "Decentralized management required unprecedented delegation of authority. Size and distance

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<sup>173</sup> Alden Partridge, West Point Class of 1806, founded the Partridge Military Academy in 1825. Partridge served as a first lieutenant of engineers and assistant professor of mathematics before establishing his own school. In 1834 he founded the American Literary, Scientific and Military Academy (later Norwich University), and was president until 1848. <http://www.stpius.addr.com/academy.html> (accessed January 4, 2013).

<sup>174</sup> Robert C. Black, III, *The Railroads of the Confederacy* (Chapel Hill: University of North Carolina Press, 1998), 28. Discipline within the system was not always assured. The superintendent wrote in his March 1, 1861 Annual Report to Ranney that from the machine and carpenter shops "the books not posted, and not being able to find any memoranda of the working of the shops for three months preceding May 1860 we can only make a correct report of the work done in these departments for nine months." [Http://www.csa-railroads.com/Essays/Original1%20Docs/AR/AR,\\_NOJ\\_and\\_GN\\_3-1-61\\_P.htm](http://www.csa-railroads.com/Essays/Original1%20Docs/AR/AR,_NOJ_and_GN_3-1-61_P.htm) (accessed January 4, 2013).

<sup>175</sup> Black, III, 28.

<sup>176</sup> Huston 82.

dictated that local managers had to master every aspect of their responsibility. They alone would have to resolve whatever problems arose, to find solutions and make decisions regardless of the problem's nature or complexity."<sup>177</sup>

In "The Corps of Engineers and the Rise of Modern Management, 1827-1856," historian Charles F. O'Connell, Jr. argued that early military management procedures had a significant influence on the development of railroad management.<sup>178</sup> Between the efforts of Secretary of War, John C. Calhoun (October 1817 to March 1825) and Brigadier General Winfield Scott's *General Regulations for the Army*, completed in 1821 and revised in 1825, the Army built a comprehensive organizational hierarchy, which included personal, and for officers, financial accountability especially in the quartermaster, ordnance, and engineer departments.<sup>179</sup>

Then with the passage of the General Survey Act of 1824, the Army became involved with private internal improvement projects, and by 1827 eleven military engineers were assigned to the new Baltimore & Ohio Railroad Company. One officer, Captain William G. McNeill, was asked by the company's president to draft an official code of regulations to govern the operations of the B & O's Engineering Department. McNeill drew upon Scott's *General Regulations of the Army*, and McNeill succeeded in establishing a management structure to be followed by all railroad employees.<sup>180</sup> O'Connell wrote: "These concepts were not completely alien to the American business community, but there were few, if any, business organizations

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<sup>177</sup> Clark, Jr., 14.

<sup>178</sup> Charles F. O'Connell, Jr., "The Corps of Engineers and the Rise of Modern Management, 1827-1856," in *Military Enterprise and Technological Change: Perspectives on the American Experience*, ed. Merritt Roe Smith (Cambridge, MA: The MIT Press, 1985), 87.

<sup>179</sup> O'Connell, Jr., 91-94.

<sup>180</sup> O'Connell, Jr., 101.

that could boast of such a detailed management hierarchy or such advanced bureaucratic management procedures.”<sup>181</sup>

The management, financing, accounting, and building and repairing of the railroads continued, however, to present enormous challenges to owners, trustees, superintendents, and workers. Working with the Pennsylvania Railroad in the early 1850s, Herman Haupt, West Point class of 1835, modified the B & O management model, devising an organization plan that divided responsibility for the operation of the railroad among four departments: Transportation, Maintenance of Way, Motive Power, and Maintenance of Cars. Haupt also created a General Transportation Office whose responsibility consisted of “regulating all the other offices of the line, and in securing accuracy and uniformity in their accounts.”<sup>182</sup> Furthermore, Haupt’s innovations were shared among companies through periodicals, the most prominent of which was the *American Railroad Journal*.

It was in the *Journal*, that editor Henry Varnum Poor, first commented on the new management system established by the general superintendent of the Erie Railroad, Daniel C. McCallum. Poor wrote, “Mr. McCallum’s strong point lies in his power to arrange and systematize, and in his ambition to perfect his systems.”<sup>183</sup> McCallum designed a management chart marking the five operating divisions and the various subdivisions under them. Orders had to follow a chain of command within the proper branches of the company. “All subordinates,” McCallum commented, “should be accountable to, and *be directed by their own immediate*

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<sup>181</sup> O’Connell, Jr., 101. See also Alfred D. Chandler, Jr., *The Visible Hand* (Cambridge, MA: The Belknap Press of Harvard University Press, 1977).

<sup>182</sup> O’Connell, Jr., 111-112.

<sup>183</sup> *American Railroad Journal*, 28: 568 (September 8, 1855). See also the *American Railroad Journal*, 28: 129-130 (March 3, 1855).

*superior only*; as obedience cannot be enforced where the foreman in immediate charge is interfered with by a superior officer giving orders directly to his subordinates.”<sup>184</sup>

McCallum attended common school in Rochester, New York, and then became a carpenter and eventually a design expert before working with and then becoming president of the Erie Railroad. Poor was impressed with McCallum’s work, as he was with that of John Edgar Thomson of the Pennsylvania Railroad. Thomson took McCallum’s ideas to create, according to historian James A. Ward, the first line and staff managerial organization in American corporate history. Ward wrote, “Thomson’s scheme allowed men at the lower levels enough authority to demonstrate their talents, although always under the oversight of higher line officers.... The new corporate structure, which took effect in early 1858, freed Thomson from the necessity of overseeing his road’s daily operations for the first time in six years.”<sup>185</sup> This new system would become the model for the United States Military Railroad in 1862. Southern railroad superintendents before the war were aware of Thomson’s ideas, but had little time to implement the new manage system before hostilities broke out between North and South. Moreover, given the South’s traditional views about centralized authority, and the relationship

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<sup>184</sup> *American Railroad Journal*, 28: 555-556 (September 1, 1855). See also *Reports of the President and the Superintendent of the New York and Erie Railroad to the Stockholders for the Year Ending September 30, 1855* (New York, n. d.), 40. Although there is some debate over the origins of modern industrial management in the United States, and certainly the development of the railroads and McCallum’s system had much to do with this development, the army corps of engineers was one of the first organizations to produce a regular reporting mechanism. In 1825 Brigadier General Winfield Scott wrote the “General Regulations for the Army,” which established guidelines throughout the service. In 1847, J. Edgar Thomson, hired West Point graduate Herman Haupt as “principle assistant.” Haupt devised a plan to divide the operation of the railroad into four departments: transportation, maintenance of way, locomotive repair, and maintenance of cars. All four were under the general transportation office responsible for the day-to-day operation of the railroad and concentrated on “problems of cost determination, competitive rate making, and strategic expansion.” See James A. Ward, *That Man Haupt: A Biography of Herman Haupt* (Baton Rouge: Louisiana State University Press, 1973), 28.

<sup>185</sup> Ward 108.

between master and slave, it was hard to imagine the Confederacy establishing an administrative structure beyond anything outside their cultural and societal norms.

The South's rudimentary management system, with a limited number of skilled supervisors to operate it, however, was only one of five major problems Southern railroads faced before the Civil War. The other four included a lack of capital investment in building and maintaining railroads, insufficient trunk lines, a limited number of companies where equipment and engines could be built and repaired, and a limited number of white men would had the mechanical ability to maintain the tracks and trains. Each of these problems would impact the Confederacy's ability to command and control the essential features of transportation and logistics during the war.

By 1861 Southerners boasted of a capital investment of \$237,138,482 in railroads, which included iron rails, rolling stock, ties, turntables, machinery, and engines. These numbers were particularly impressive, argued historian James Ward, considering Southern railroads received less government assistance in the 1840s and mid-1850s than their Northern counterparts.<sup>186</sup> Ward claimed that "the depression of 1839, the reduced market price of cotton, and the weakened European markets in the mid-1850s, due to the Crimean War," injured the South's transportation network.<sup>187</sup>

Yet, the South's capital investment in railroads (this included Kentucky and Missouri) represented only twenty percent of the nations' total investment of \$1,177,993,818. As Robert C. Black, III in his book, *The Railroads of the Confederacy* wrote, "in terms of capital investment

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<sup>186</sup> James Ward, "Development of the Blue Ridge Railroad in South Carolina," History Engine: Tools for Collaborative Education & Research, <http://historyengine.richmond.edu/episodes/view/4144> (accessed October 30, 2013).

<sup>187</sup> Ward, "Development of the Blue Ridge Railroad in South Carolina."

per line mile,” the South fared poorly when compared with the expenditures and investments made by Northern railroad companies.<sup>188</sup>

Second, where major railroads in the North succeeded in building and operating trunk lines, the largest lines in the South—and few were longer than 200 miles—had to rely on thirty to fifty mile roads built by local investors to serve local needs. For example, the Hartford & New Haven had 65 miles of secondary track and siding connected to 61 miles of main line. Between Albany and Buffalo, the New York Central had approximately 550 miles of track; it also boasted of 314 miles of secondary track.<sup>189</sup> In the South, the longest line operated by a single railroad company was the Mobile & Ohio, which ran from Columbus to Mobile covering an impressive 469 miles. The directors first proposed that the railroad should run through the towns of Columbus and Aberdeen, Mississippi, but the towns refused. After several months of deliberation Columbus decided it did want the railroad, yet by then the owners had moved the trace of the line west and the line cut through Artesia, Tupelo, and Cornith, Mississippi. Eventually, a trunk line was built, the only one on the Columbus & Mobile line, about twenty miles from Artesia east to Columbus, Mississippi, which rested beside the Tombigbee River.

Furthermore, there were few junction points along these main lines of operation and the lines that formed junctions with the main lines were often part of a series of tracks managed by different railroad companies, with different gauges, designed to serve different purposes. A line such as the Southern Railroad of Mississippi, from Meridian to Vicksburg carried local freight to the Mississippi River, and consequently, was built of material that could withstand only a limited amount of tonnage. Before the war began there was no line that extended beyond

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<sup>188</sup> Louisiana invested \$40,223 per line mile. Virginia invested \$38,548, Mississippi \$28,841, Alabama \$26,845, Georgia \$19,709, and North Carolina \$19,161. These numbers compared unfavorably to Massachusetts where capital investment in per line mile was \$45,500. New York and Pennsylvania were close to \$52,000. See Black, III, 4.

<sup>189</sup> Black, III, fn. 9, 303.

Meridian east to the Tombigee River about fifty miles. Along the 469 miles of track running north/south there were only three junctions along the Columbus & Mobile.<sup>190</sup>

In addition, serious gaps existed between lines. As trunk and small railroad company lines reached toward other lines, they often did not connect. There was no direct line from Wilmington and Charlotte, North Carolina to Atlanta, Georgia. In Nashville no track was built west of the city, and the central line from Nashville to Chattanooga was broken off before reaching Tullahoma. Competing interests between railroad men and teamsters, and shortsightedness and parochialism among city fathers prevented the creation of “integrated transportation service.”<sup>191</sup> The teamsters had lobbied the Virginia legislature to pass a law that prohibited railroads from laying track in the streets of the city without permission of the local authorities, and “as late as 1861 local liverymen had prevented the intersection of *any* of the five railroads entering Richmond.”<sup>192</sup> Because of bridging difficulties, the line between Savannah, Georgia and Charleston, South Carolina ended on the riverbank opposite of Charleston, where passengers and freight were unloaded and reloaded onto to ferry boats to complete the final 500 yards over the Ashley River.<sup>193</sup>

Next to the tracks themselves, the spewing, roaring, rattling, and hissing locomotives were the central ingredients to the existence of the railroad. But in the South, the final two problems they faced were the lack of repair facilities and the skilled workmen to maintain them.

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<sup>190</sup> The junction farthest north was the Memphis & Ohio meeting at Humboldt, Tennessee. Next was the Memphis & Charleston intersecting at Corinth, Mississippi. Freight and passengers traveling from Memphis to Charleston, however, would be required to ride four different railroads—the Memphis & Charleston, the Western & Atlantic, the Georgia Railroad, and the South Carolina Railroad. The final junction was at Meridian, Mississippi along the Southern Railroad of the Mississippi. For a complete map of Confederate railroads as of June 1, 1861 see Robert C. Black, III, *The Railroads of the Confederacy*.

<sup>191</sup> Black, III, 9.

<sup>192</sup> Black, III, 9. See also *The War of the Rebellion, the Official Records of the Union and Confederate Armies*, Series IV, vol. I, 485-486.

<sup>193</sup> Black, III, 9, See Colton’s *Map of Savannah*, 1855.

Unfortunately, Southern railroads had few engines compared to their Northern brethren and Southern companies were often destitute of repair parts and the mechanics to fix the trains. Although no one in the country could anticipate the scope of the war to come, the comparison of the railroad industry in the South and North foreshadowed the availability of track mileage, locomotives, and men skilled enough keep the trains operating. Similar to the development of educational reforms, technological innovations, labor formations, and new management systems, railroad operations exposed an Achilles heel in the South's future ability to conduct a war over vast spaces.<sup>194</sup> The South relied too much on Northern engineers to build, maintain, and manage their railroads to the detriment of their logistical operations in the war to come.

According to the 1860 census, nineteen American companies built 470 engines worth \$4,866,900. Fifteen of the companies were in the North, two in Kentucky, one in Maryland, and one in Virginia: the Tredegar Iron Works. Two shops in Philadelphia alone constructed 172 locomotives. Most companies averaged 600 workers and purchased their machinists' tools from seventeen companies, nine of which were in Massachusetts, three in New York, two in New Haven, and one each in New Jersey, Delaware, and Philadelphia, which turned "out machinists' tools of acknowledged excellence."<sup>195</sup> In Massachusetts, the two largest locomotive shops were

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<sup>194</sup> An examination of the Wilmington & Weldon Railroad in 1860 illustrates this point. Since 1839 the company had built two engines in company shops and purchased the remaining twenty-eight from locomotive manufacturers, twenty-five of which were located in the North. The Baldwin Locomotive Works produced thirteen engines, and the most dominant producer of locomotives in the mid-nineteenth century, the Norris Locomotive Works, manufactured eight for the railroad company. Both works were located in Philadelphia. The Manchester Locomotive Works, in Manchester, New Hampshire built three, and the Hinkley Company, officially known as the Boston Locomotive Works built one. Before 1855 a small Richmond company, Burr, Pea & Simpson (known before it closed as Burr & Ettinger) manufactured two, and the Tredegar Iron Works built one. See North Carolina Business History, "Railroads—Wilmington & Raleigh (later Weldon) Locomotives," <http://www.historync.org/railroad-WWRRLocomotives.html> (accessed January 4, 2013).

<sup>195</sup> *American Industry and Manufactures in the 19<sup>th</sup> Century: A Basic Source Collection*, clxxxviii-clxxxix.



in Taunton. One with 175 workers built twenty-three engines, and the other with 425 men built “cotton machinery and fourteen complete locomotives.”<sup>196</sup>

For most of the backbreaking track repair, and in some cases the skilled work of carpenters, brakemen, and firemen, slaves were used. Again, as was the case with blacks working in iron foundries or textile mills, many of them learned and developed unique mechanical ability, but were not allowed to pass their skills onto white workers or bring them to other companies. When it came to investing in “cognitive and aspirational” capital, during the antebellum period the South earned low marks.<sup>197</sup> Many lines spent as much as \$125,000 per year to purchase slaves. Remarkably, the twenty-nine mile, five foot six inch gauged Baton Rouge, Gross Tete & Opelousas invested \$115,000 in slaves.<sup>198</sup> An article in the December 16, 1861 Richmond *Daily Examiner*, reported that the Virginia & Tennessee Railroad was looking to hire bondsmen as laborers, carpenters, train hands, and blacksmiths to work on the roads and in the repair shops.<sup>199</sup>

Whether or not individual companies used slave or free labor, operated hundreds of miles of track or just twenty-nine miles, or managed their business with tight or loose controls, the antebellum period in the United States was the “age of the railroad.” These lumbering

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<sup>196</sup> *American Industry and Manufacturers in the 19<sup>th</sup> Century*, clxxxix. The table for *Statistics of locomotives engines produced in the United States during the year ending June 1, 1860* indicated the shop in Baltimore produced six locomotives with sixty hands, and Tredegar produced nineteen locomotives with thirty workers. The census date is not specific, but I don’t think it is a leap of faith to suggest that most workers in the Baltimore and Richmond facilities were slaves, not counted by the Department of the Interior, who published their findings after the Thirteenth Amendment to the Constitution, was proposed in 1865.

<sup>197</sup> David Brooks, “Psst! ‘Human Capital,’” *New York Times*, November 2005. Brooks defined cognitive capital as the ability to evaluate situations, solve problems, share information, and develop brainpower. His “aspirational capital involved the ability to achieve something society believed you could not accomplish. He wrote this is “the fire-in-the-belly ambition to achieve.”

<sup>198</sup> Black, III, 30. See [http://www.csa-railroads.com/Baton\\_Rouge,\\_Grosse\\_Tete\\_and\\_Opelousas.htm](http://www.csa-railroads.com/Baton_Rouge,_Grosse_Tete_and_Opelousas.htm) (accessed January 4, 2013).

<sup>199</sup> Black, III, 305, fn. 7.

leviathans rumbled across the American landscape moving passengers and freight to small towns and growing cities, bringing with them American pride and American wealth. The railroads' importance as part of the country's transportation revolution was clear, and the merchandise and products the trains most often moved were agricultural.

Railroads hauled enormous quantities of grains, fruits, dried and salted beef and pork, cotton, and sugar to major urban centers and port cities throughout the United States. The wealth derived from such freight directly contributed to economic growth of the country. In fact, agricultural historian Paul W. Gates wrote, "Northern farming was more important to the economic growth of the United States than the plantation economy of the South...."<sup>200</sup> It was also true, however, that Southern cotton made up the largest American export. Thus, the business of surveying, sectioning, advertising, selling, banking, and collecting the proceeds from crop sales, according to Gates, represented the largest single area of economic development in the country.<sup>201</sup> In 1850 sixty-four percent of Americans worked as farmers.<sup>202</sup> Many of the soldiers who served as engineer troops or pioneers during the Civil War described themselves as farmers. What type of education did farmers receive? What type of mechanical skills did farmers need to do their work? Who designed new farming equipment and made new tools? Once a farmer, was continuing education available as there was for metallurgists, machinists, carpenters, gunsmiths, clock builders and railroad men? Most important, did farming, and consequently farming skills, differ depending on where you lived?

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<sup>200</sup> Paul Wallace Gates, *The Farmer's Age: Agriculture, 1815-1860* (New York: Holt, Rinehart and Winston, 1960), 51.

<sup>201</sup> Gates, 51.

<sup>202</sup> The total population of the United States in 1850 was 23,191,786. The farm population was 11,680,000 (estimated) with the number of farmers registered as 1,449,000. The average acreage per farm was 203. See *Growing a Nation: The Story of American Agriculture*, [www.agclassroom.org/gan/timeline/1840.htm](http://www.agclassroom.org/gan/timeline/1840.htm) (accessed January 6, 2013).

New England farming in 1820 was altered by the country's expansion northwest. Steamboats, canals, and railroads transported east to expanding urban areas, enormous quantities of agricultural produce. Millions of bushels of wheat funneled into railroad yards in Chicago waiting to be transported across the country.<sup>203</sup> To take the place of crude winnowing machines, which separated wheat from chaff, dirt, and weed seeds, inventors designed and built threshing machines.<sup>204</sup> In the 1830s, businesses in Worcester, Massachusetts manufactured cast-iron plows with replaceable parts by the thousands each year. In 1847 John Deere mass produced stronger steel plows and Cyrus McCormick moved his reaper factory from western Virginia to Chicago to be closer to grain farmers in the Midwest. Commercial farmers in New York, Ohio, and Illinois also sold wheat, cattle, dairy, wool, and pork to eastern cities both for domestic consumption and export.

New Englanders continued to practice self-sufficient farming. Yet, the production of other agricultural products was essential. As a result, farmers raised beef cattle, cows, pigs, and lambs, grew rye and root crops (onions, carrots, turnips, potatoes), and harvested trees.<sup>205</sup>

Farmers in the upper South grew corn, wheat, tobacco, flax, and hemp and most of the corn and wheat was consumed locally.<sup>206</sup> The deep South grew rice, harvested sugar, and made a king's ransom in the sale of cotton both to the mills in the North and buyers overseas. By 1860, cotton accounted for two-thirds of American exports. Growing cotton, rice, sugar, and tobacco was labor intensive, and when machines were required to refine the sugar cane or remove the cottonseeds, the task was relegated to African American slaves. When machines jammed or

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<sup>203</sup> See William Cronon, *Nature's Metropolis: Chicago and the Great West* (New York: W. W. Norton & Company, 1991).

<sup>204</sup> Gates, 135.

<sup>205</sup> Percy W. Bidwell, "The Agricultural Revolution in New England," *The American Historical Review* vol. 26 no. 4 (July 1921): 683-702, <http://www.capecodhistory.us.20th/Bidwell-agriculture-1921.htm> (accessed January 5, 2013).

<sup>206</sup> Gates, 135.

broke down, the mechanics that repaired them were African American. Often the large plantation owner operated the gristmill where local farmers brought their wheat. For the most part, the planter's slaves also ran these machines. Planters invested in slave labor and also in steamboats and railroads to transport their goods. They did not invest in factories, or in institutions that could train and produce skilled white farmers and workers.

In the North states like Massachusetts and New York took the lead in promoting agricultural societies and efforts to introduce basic farm studies into common schools. In New York State's "Second Report of the Special Committee for Promoting the Introduction of Agricultural Books in Schools and Libraries," the authors noted that the Massachusetts legislature passed an act in 1819 suggesting that agricultural societies should raise \$1,000 for the improvement of agriculture and receive a subsidy from the state of between \$200 and \$600 per year.<sup>207</sup> The report went on to recommend that scientific developments in farming should be spread "among the mass of practical and laboring farmers.... It is believed that no more effectual instrument can be employed for reaching both the rising generations and the adult population than the school district libraries."<sup>208</sup> The committee also recommended that near every common school in the state, two acres should be set aside and cultivated, under supervision, "exclusively by the male children." The young women of the school would tend to an "ornamental garden."<sup>209</sup>

The New York State Agricultural Society, officially called The American Institute of the City of New York, established in 1832, had begun to receive state appropriations for its work in the 1840s, and the Society's business was published as documents of the New York

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<sup>207</sup> Transactions of the New York State Agricultural Society, vol. 1, 1841 to vol. 4, 1844, Reel 1 microfilm, *Second Report of the Special Committee for Promoting the Introduction of Agricultural Books in Schools and Libraries*, no. 85, 391.

<sup>208</sup> *Second Special Report*, 374-375.

<sup>209</sup> *Second Special Report*, 381.

Legislature.<sup>210</sup> The annual fair hosted by the Institute, offered handsome cash prizes (premiums) for practical inventions that would assist the farmer in his work and make life more comfortable and efficient for his wife. The fair attracted people from all over the United States, and it assumed the character of a competition anyone could enter, an idea factory, an outdoor classroom, and a gathering place—in other words a sort of nineteenth-century Home Depot. The list of premium winners included C. H. McCormick (Chicago) for a Virginia grain reaper, William Hovey (Worcester, MA) for a hay and straw cutter, and Reuben Daniels (Woodstock, VT) for a self-sharpening straw cutter. Others agricultural tools included an excavating scraper, new cradles, scythes, and snaths, and built by H. L. Emery and Company of Albany, New York, a seed sower.<sup>211</sup>

Since many northern farmers spent the bleak winter months working on machinery they sold for cash, the 1850 fair also exposed rural communities to other technologies being developed to perhaps assist in winter jobs or to aid in the repair of equipment. Wood planning tongue and groove machines with stationary cutters, a large engine lathe, water wheels, a machine for salting meat, a rotary fire engine pump, and a hot and cold air furnace for making pig iron; all of them were on display.<sup>212</sup> By 1856, there were 912 local and state agricultural organizations in the United States, of which all but 165 were in the North and West.<sup>213</sup>

As staple crops such as wheat and cotton generated great wealth and agricultural technology attempted to keep pace, the work of a German chemist took on significance. Justus

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<sup>210</sup> Margaret W. Rossiter, *The Emergence of Agricultural Science: Justus Liebig and the Americans, 1840-1880* (New Haven: Yale University Press, 1975), 67.

<sup>211</sup> Adelaide R. Hasse, *Index of Economic Material in Documents of the States of the United States: New York, 1789-1904* (Washington, DC: Carnegie Institution, 1907). Documents of the Assembly of the State of New York, 74<sup>th</sup> session, 1851 vol. 5. No. 132 to 149, Inclusive. Document 149: Transactions of the American Institute of the City of New York for the Year 1850, 31, 53-62, 133-139, 139-140. A snath was the shaft or handle of a scythe.

<sup>212</sup> Hasse, 53, 180, and 317.

<sup>213</sup> Gates, 314.

von Liebig worked at a German university where he studied agricultural chemistry and where he began the organization of organic chemistry. Farm journals began to write about the need for American colleges to teach agricultural science. An editorial appeared in September 1847 in Chicago's *Western Prairie Farmer*, calling for common schools, private schools, high schools, and colleges to introduce the study of agriculture into their curricula. "There is no rational doubt, that a general introduction...of such studies as bear upon agriculture, is demanded by the general interests of society, and will be demanded by society itself, so soon as the case is made clear to its apprehension."<sup>214</sup>

In Connecticut, a leading pioneer in agricultural science, Samuel William Johnson, spent two years abroad and then returned to the Yale Scientific School where he became professor of analytical chemistry analyzing fertilizers for crops. By 1859 he was professor of agricultural chemistry.<sup>215</sup> Johnson's work caught the attention of politicians who hoped to establish agricultural colleges in their own states. Michigan and Pennsylvania passed legislation in 1855 for the establishment of the Michigan Agricultural College and the Farmers High School later to be renamed Pennsylvania State College.<sup>216</sup> New York Governor Washington Hunt, in his 1857 Annual Message proclaimed, "It cannot be doubted that an institution of the character proposed (an institution for advancement of agricultural science and of knowledge in the mechanic arts) would promote the dissemination of agricultural knowledge and elevate the condition of people...." Whether the governor's motives were economic, social, political, or

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<sup>214</sup> "Agricultural Education," *Western Prairie Farmer* VII (September 1847): 266-267.

<sup>215</sup> Rossiter, 69.

<sup>216</sup> *Growing a Nation*, [www.agclassroom.org/gan/timeline/1840.htm](http://www.agclassroom.org/gan/timeline/1840.htm) (accessed January 6, 2013).

altruistic, he spoke about the importance of education and about how “the elevation of the laboring classes...is worthy of the highest ambition of the statesman and patriot.”<sup>217</sup>

Thirty-three months later another politician spoke to the importance of agricultural education, both in schools and through the vehicle of the state fair. In an address to the Wisconsin Agricultural Society’s fair held in Milwaukee, Abraham Lincoln told an audience anxious to get on with the awarding of the premiums, and not necessarily interested in what the speaker had to say, that “the chief use of agricultural fairs is to aid in improving the great calling of *agriculture*...to make mutual exchange of agricultural discovery, information, and knowledge....” In general, education enabled the farmer to study soils and seeds, diseases of crops, implements and machinery, and a “thousand things of which these are specimens....” Lincoln concluded by saying, “A capacity, and taste, for reading, gives access to whatever has already been discovered by others. It is the key...to the already solved problem.... It gives relish, and facility, for successfully pursuing the unsolved ones.”<sup>218</sup>

Reading did open up a world of information to northern and western farmers, but in the South, where fewer than a third of those between five and nineteen years of age attended school and illiteracy was common, the ability to diffuse agricultural information to yeoman and poor farmers was increasingly problematic. Philip St. George Cocke, president of the Virginia State Agricultural Society, complained, “Seventy thousand of our adult population can neither read nor write!”<sup>219</sup> He implored his fellow Virginians to open their “hearts and means until every

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<sup>217</sup> *Messages from the Governors of the State of New York*, vol. IV, 1843-1856, Washington Hunt, January 7, 1857. Legislature, 74<sup>th</sup> Session Annual Message, 553.

<sup>218</sup> Abraham Lincoln, “Address to the Wisconsin State Agricultural Society, Milwaukee, Wisconsin,” in *Abraham Lincoln: Speeches and Writings, 1859-1865*, ed. Don E. Fehrenbacher (New York: Library of America, 1989), 90-101.

<sup>219</sup> “Education in Rural Districts,” *Southern Cultivator* XV (July 1857): 218-219.

child within the limits of our broad Commonwealth shall, at least, have the advantage of a Free School education.”<sup>220</sup>

To improve conditions in the South for the middle and lower classes, especially small farmers, would require disengagement from the institution to which wealthy and powerful southerners were inexorably committed—slavery. Slavery had provided plantation owners with the labor force to plant, grow, and harvest cotton, sugar cane, rice and tobacco, making approximately ten percent of the population very wealthy people. The protection of slavery was the paramount goal of politicians yoked to the “peculiar institution.” James Goode, a Virginia secessionist asked rhetorically, “Are we not a people of like habits, of like institutions, and like religion? Are we not all deeply and vitally concerned with the preservation of the institution of African slavery?”<sup>221</sup>

Plantation agriculture, John Majewski pointed out in his book *Modernizing A Slave Economy: The Economic Vision of the Confederate Nation*, had come with a high price tag. The acidity of the Southern soil made it difficult to supply fallow fields with the proper nutrients so that they could recover quickly. Hay and clover, used to fix nitrogen in northern fields, failed to thrive in the warm, humid climate. Cattle were fed with low nutritional grasses and peas, and erosion from heavy rains (cotton and corn were row crops) “created channels that carried away topsoil.”<sup>222</sup> Instead of relying on crop rotation, farmers burned forests, and used the ash as fertilizer. But it took approximately twenty years for the forest to regenerate so it could be burned again. This meant that plantation owners would grow on a plot of land for five years and then move to another plot for the next five years. At any one time only a quarter of their

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<sup>220</sup> *Southern Cultivator*, 218-219.

<sup>221</sup> John Majewski, *Modernizing A Slave Economy: The Economic Vision of the Confederate Nation* (Chapel Hill: University of North Carolina Press, 2009), 153.

<sup>222</sup> Majewski, 35-36.



property was under cultivation. This meant “adding unimproved acres required larger farms and larger plantations without increasing the size of the workforce, thus stunting rural population growth.”<sup>223</sup> Areas composed of isolated farms and plantations had a small market for periodicals, a small interest in agricultural fairs, and a small supply of those interested in attending agricultural schools and colleges.<sup>224</sup>

By the mid-1850s southern nationalists envisioned an independent confederacy with a modern economy that “integrated slavery, commerce, and manufacturing. Political independence...would unleash the South’s economic potential” that secessionists believed was caused by “unfair subsidies to northern industry.”<sup>225</sup> Southerners perceived the Federal government’s tariff unfair, but in reality the Buchanan tariff lowered rates. The South’s attempt at an agricultural reform movement called for improvements in farming that would contribute to the growth and wealth of plantations and yeomen’s farms. Information about agricultural experiments was disseminated in periodicals like Edmund Ruffin’s *Farmers’ Register* and reformers in 1854 proposed the establishment of the “Southern Central Agricultural College.”<sup>226</sup> The reform movement, however, remained tied to the institution of slavery. For example, Edmund Ruffin declared at the Virginia Agricultural Society fair in 1852, “slavery was of divine

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<sup>223</sup> Majewski, 39. The author showed that in Virginia, North Carolina, South Carolina, and Georgia there were 20.3 rural residents per square mile and 11.7 free rural residents per square mile. New England had 33.0 rural residents per square mile, the mid-Atlantic 49.0, and the old Northwest 35.0

<sup>224</sup> Majewski, 44. See also Lee Soltow and Edward Stevens, *The Rise of Literacy and the Common Schools in the United States: A Socioeconomic Analysis to 1870* (Chicago: University of Chicago Press, 1981), 166-176.

<sup>225</sup> Majewski, 3.

<sup>226</sup> Majewski, 61-62.

origin and promoted the industry, civilization, refinement and general well-being of mankind.”<sup>227</sup>

The great fortunes in the South generated by slavery and cotton made it improbable that southern leaders might see the economic forest through the trees. As they imagined an independent Confederacy, they understood at a gut level the importance of establishing their own manufacturing and commercial capacity, but like farming it was to be carried out on the backs of African American slaves. This meant a continuation of social controls to buttress the established social hierarchy, but it would also require educational controls. Information would need to be gained, but disseminated carefully. The proposal for an agricultural college, open to the sons of the planter class, was an example of this model where the upper classes would remain the society’s intellectuals, acquire new knowledge and parse it out as necessary.

The foundation of southern life was built on the intellectual defense of slavery. As northern abolitionists attacked the institution of slavery and called the men who practiced it indolent, inimical, invidious, and immoral, southern politicians and intellectuals grew more determined to defend and justify the institutions and themselves. Thomas R. Dew, an intellectual disciple of Thomas Jefferson, analyzed the proceedings of the Virginia State Constitutional Convention in 1829-1830, and as a result published the first systematic defense of slavery in a *Review of the Debates of the Virginia Legislature*. At the center of the debate was the relationship between slavery and the apportionment of political power in the state. The slaveholder faction won and consequently, controlled the legislature for the next thirty years. Dew argued that the South had inherited slavery from the colonial fathers and once introduced,

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<sup>227</sup> Majewski, 61. See “Address of Mr. Ruffin,” *Journal of Transaction of the Virginia State Agricultural Society* (Richmond: P. D. Bernard, 1853), 16. See also Edmund Ruffin, “Address,” *Southern Planter* 12 (February 1852): A8, for a full reprint of Ruffin’s address.

it could not be abandoned because blacks would face unbearable misery and thus to abandon them would be immoral.<sup>228</sup>

John C. Calhoun, no doubt, read Dew's book, because seven years later in a speech to the United States Senate he rebuffed abolitionists' charges that men who practiced slavery were evil. The relationship between the two races was not evil: "far otherwise; I hold it to be good, as it has thus far proved itself to be to both, and will continue to prove so if not disturbed by the fell spirit of abolition."<sup>229</sup> Calhoun, with a nod to Dew then said, "There never has yet existed a wealthy and civilized society in which one portion of the community did not...live on the labor of the other. Broad and general as is this assertion, it is fully borne out by history...."<sup>230</sup>

A colleague of Dew's at William & Mary College was William Barton Rogers. A Philadelphian by birth, Rogers went to school at William & Mary and then taught chemistry and natural philosophy at the college beginning in 1828. His papers on greensand and the calcareous marl of eastern Virginia and its value as a fertilizer grabbed the attention of the Virginia legislature and in 1835 the lawmakers placed him in charge of a geological survey of Virginia. Concurrently, he took a position on the University of Virginia faculty as professor of natural philosophy.<sup>231</sup> The scholarly Rogers found the results of the geological survey to be a tale of two regions. Whereas the eastern part of the state provided the natural resources essential for the

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<sup>228</sup> *Review of the Debates of the Virginia Legislature*, [archive.org/stream/reviewofdebateon00dew#page/36/mode/2up](http://archive.org/stream/reviewofdebateon00dew#page/36/mode/2up) (accessed on December 30, 2012). See also "Thomas R. Dew Defends Slavery (1852)," at [http://www.norton.com/college/history/archive/resources/documents/ch15\\_03.htm](http://www.norton.com/college/history/archive/resources/documents/ch15_03.htm) (accessed December 29, 2012). Also by Thomas R. Dew, *Digest of the Laws, Customs, Manners, and Institutions of Ancient and Modern Nations* (1853).

<sup>229</sup> Columbia American History Online, "Slavery as a Positive Good," <http://caho-test.cc.columbia.edu/ps/10157.html> (accessed on January 7, 2013).

<sup>230</sup> "Slavery as a Positive Good." See John C. Calhoun, "Speech on Slavery," United States Senate, Congressional Globe, 24<sup>th</sup> Congress, 2<sup>nd</sup> Session (February 6, 1837), 157-159.

<sup>231</sup> A. J. Angulo, *William Barton Rogers and the Idea of MIT* (Baltimore: Johns Hopkins University Press, 2009), 23-25.

state's plantation owners and small farmers, the western half of the state provided a plethora of raw materials to meet westerners' interests in developing a center for southern industry.

Eastern planters, who made up the majority interest in the legislature, associated coal and other emerging industries with "Yankee interests."<sup>232</sup> Their skepticism and fear, and their commitment to slavery led them to cut off funding for the survey.

Rogers discovered, by reading about it in the newspapers, that his funding had been cut. In correspondence between Rogers and Judge J. F. May of the Virginia House of Delegates, Rogers wrote, "Indeed, without the assistance of the corps in the laboratory and at the drawing-table, and in arranging the cabinet...I should feel incompetent to perform the task of drawing up my Report without great additional delay."<sup>233</sup> May dismissed his concern and the report was not finished.

During the same year, the University hired mathematician James Joseph Sylvester who upon his arrival was greeted by students with verbal insults and physical assault because he was an English Jew. The *Watchman of the South*, a periodical of the Presbyterian Church wrote of Sylvester's hire, "This is the heaviest blow the University has ever received. The great body of the people of this Commonwealth are by profession Christians and not heathen, nor musselmen [sic], nor Jews, nor Atheists, nor Infidels."<sup>234</sup> Professor Sylvester was gone from the university in six months prompting Rogers to write to his brother Robert, "...I have been unable to shut out the contrast between the region in which I live and the highly cultivated nature and society of glorious New England.... Would you believe it, that a series of essays has been published

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<sup>232</sup> Angulo, 23.

<sup>233</sup> Rogers to Judge J. F. May, University of Virginia, March 13, 1841, in *Life and Letters of William Barton Rogers*, ed. Emma Savage Rogers, vol. 1 (Boston: Houghton, Mifflin and Company, 1896), 182-183.

<sup>234</sup> Angulo, 26.

condemning the Visitors for the appointments of a Jew and a Catholic, (Kraitzer) and sweeping charges at the same time made against the character...of the University!"<sup>235</sup>

Whether or not the events of 1841 had anything to do with the next crisis for Rogers at the university is speculative, but three years later the Committee on Schools and Colleges of the House of Delegates was instructed to investigate "the past history and present condition and influences of the University of Virginia, with a view of forming their opinion upon the question of repealing the Act of Assembly granting an annuity of \$15,000 to that Institution."<sup>236</sup> Rogers responded with a lengthy report answering the charges of Jewish influence against the university and the appropriations remained but not without scaring the embattled professor.

He had begun to imagine the model for a new type of scientific school unlike anything that had been attempted at universities across the country. Rogers saw relationships between developments in technology and developments in science, and envisioned a polytechnic institution that connected science to its practical applications. He tendered his resignation at the university and shortly after wrote his brother Henry regarding a place to establish the school he imagined. "The occupations and interests of the great mass of the people (in Boston) are immediately connected with the applications of physical science, and their quick intelligence has already impressed them with just ideas of the value of scientific teaching in their daily pursuits."<sup>237</sup>

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<sup>235</sup> Rogers to Robert Rogers, University of Virginia, September 11, 1841, 191-192.

<sup>236</sup> Emma Savage Rogers, ed., 239.

<sup>237</sup> Rogers to Henry Rogers, University of Virginia, March 13, 1846, 259. At UVA Rogers had included with his lectures instruction in laboratory demonstrations. This was considered radical in the 1830s and 1840s. The standard university classroom required students to study textbooks and then recite the memorized lessons learned in Greek and Latin. The expansion of the natural sciences raised questions about classical education and these questions were put to rest in what became known as the Yale Report of 1828. Yale President Jeremiah Day wrote, "Its [university education] object is to lay the foundation of a superior education." Collegiate education was to distinguish a man from mere practical studies and training. Rogers wanted to inspire "inventive

Rogers challenged conventional wisdom by insisting that the tools of science be placed in students' hands. "His plan offered a more intimate union of mind and hand."<sup>238</sup> He understood the growing desire in the United States for professional mechanics. "Who can doubt that the mechanical, manufacturing, and agricultural classes of the community would derive the highest advantages from the establishment of an institution directed by these views."<sup>239</sup>

In the fifteen years before the Civil War, colleges and universities in the North, following Harvard's and Yale's lead, expanded offerings in the applied sciences, yet programs received no financial support from the institution. The funding came from private donations. Harvard lacked adequate facilities, and consequently, laboratory experiments were not available for students. Charles W. Eliot recalled his experience at the Lawrence Scientific School: "The faculty had had no means of offering laboratory practice to the students except as a favor which could be granted to very few."<sup>240</sup> Francis Wayland, president of Brown University asked Rogers for guidance to change the curriculum to include the principles of the "useful arts," but by 1855 the trustees had rejected the plan and fired Wayland.

Other schools such as West Point "came close to Roger's ideal," but by 1855 the course of study turned away from the theoretical to just the practical.<sup>241</sup> The Rensselaer School used laboratories for instruction, yet by 1848 students could complete their course of study in one year. Henry Tappan promoted the idea of a graduate school in science at the University of

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thought." In his report to the Virginia legislature in 1845 he wrote, "But along with this modest deference to the oracles of knowledge, he [the student] cherishes that manly self-dependence of thought which springs from the conscious vigour [sic] due to the free training of his facilities...." See Emma Savage Rogers, ed., 399. See also Angulo, 76.

<sup>238</sup> Angulo, 77. MIT's motto, *Mens et Manus* (Mind and Hand) reflects the educational ideals of the founder.

<sup>239</sup> William Barton Rogers Papers, "For the Establishment of a School of Arts, Franklin Institute, Philadelphia 1837," MIT archives, folder 14b, box 1.

<sup>240</sup> Angulo, 80.

<sup>241</sup> Angulo, 87.

Michigan—only a handful of students enrolled and the program emphasized theory over the practical.<sup>242</sup> Other schools demonstrated interest in educational reform but none resembled, in entirety, Rogers’s goals. These schools included The Citadel (1843), the U. S. Naval Academy (1845), Polytechnic College of Pennsylvania (1853), Brooklyn Polytechnic Institute (1855), Glenmore School (1859), and Cooper Union (1859).<sup>243</sup>

By 1860 Rogers’ opportunity came knocking. The city of Boston was looking to make “educational improvements” in its Back Bay development. A conservatory was formed and at a meeting on October 5, 1860, Rogers presented his document for a plan to establish the Massachusetts Institute of Technology. The following year an act of the Massachusetts State Legislature incorporated MIT and Rogers was named the institute’s first president.

So as the sun rose on April 11, 1861, planters, farmers, and slaves headed to the fields. Men went to work in textile mills, clock factories, iron forges, coal mines, armories, machine shops, and railroad yards. Apprentices learned trades, children learned to read and write, university students learned Latin and Greek, and some tried to learn chemistry and biology. George Ross was dead, Chauncey Jerome bankrupt, William Barton Rogers prepared to open MIT, and Edmund Ruffin prepared to fire on the Federal fort sitting in the Charleston, South Carolina harbor. In a short time these farmers, planters, slaves, metal workers, tool makers, engine builders, carpenters, engineers, laborers, factory hands, draftsmen, professors, and students would become soldiers, and be organized into standing armies, the size and scope of which not even the professionals from West Point could foresee. The armies would need cannons, rifles, and ordnance. They would need infantry to fight and die, artillerymen to kill and maim, cavalry to scout and raid, and officers to lead and sacrifice. And, yes, they would need

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<sup>242</sup> Angulo, 87-88.

<sup>243</sup> Angulo, 88.

engineers. Engineers to assist in getting at the enemy, engineers to deliver food and equipment through dangerous and often impassable terrain, engineers to build roads and bridges over distances unimaginable in April 1861. Yes, it was now time to go to war.



## CHAPTER 4

### PROFESSIONALS AND VOLUNTEERS

**“If mere volunteers can wear them (engineer insignia—a metal replica of an armory with battlemented towers) they are no longer badges of distinction.”**

**Captain James C. Duane, United States Army, Corps of Engineers, 1861**

Just three short months after the fall of Fort Sumter, new and untested Union and Confederate armies first drew blood thirty miles southwest of Washington, DC, near a railroad crossroads called Manassas Junction and a small river called Bull Run. Both sides believed this clash of arms would settle the question of an independent Confederacy. It did not. Instead, both sides came to the harsh realization that the war could be a bloody and protracted conflict, requiring more men and materials than first imagined, as well as the development of complex strategic and logistical plans. Part of this logistical planning required some consideration for the role of military engineers. At the time of the First Battle of Bull Run each side had engineering officers attached to army headquarters, but would this small cadre of officers be enough to meet the armies' growing needs? Also, as the war began, only the Federal army had a company of engineer soldiers, and some questioned whether this would be enough. Both sides, therefore, had to decide where to invest their manpower resources. Should men recruited as infantry be converted to engineer troops? Would making engineer soldiers from infantry recruits weaken each army's ability to fight? Would these men need special skills? Who would lead them?

The formation of the 50<sup>th</sup> New York Volunteer Engineers provides insight into how the Union army tried to address these questions. Twenty-six days after Bull Run, a newspaper article headed “A New Company From Rome” appeared in the *Rome* [New York] *Citizen* on August 16, 1861. Captain Wesley Brainerd, a member of the New York State Militia's Company “A” 46<sup>th</sup>

Regiment, the Gansevoort Light Guard, was now recruiting a company of engineers. Charles B. Stuart of Geneva, New York, had promised a captaincy to Brainerd if he could enlist approximately one hundred men. Brainerd's father and Stuart had been in the railroad business together and were old acquaintances, so Wesley received a favorable response from Stuart regarding the attempt to raise a company of soldiers. The article stated, "The Regiment is to be armed and equipped as a rifle regiment....But its main labors...will be the rebuilding of railroads and bridges destroyed by the enemy, the running of trains, or the performance of any other kind of mechanical and engineering work that may be necessary."<sup>1</sup>

Besides serving in the "fancy dress" militia company with "young men fond of show and with much leisure time on hand," Brainerd had no military experience.<sup>2</sup> As a young boy he dreamed about being a soldier and was intent on going to West Point until at the age of fourteen "my father ridiculed me out of the notion."<sup>3</sup> Yet, like many men living in Rome, New York, he did have engineering skills. With a common school background only and "a somewhat chequered life," he learned his mechanical skills operating a business planing, sawing, and turning lumber for, first, the manufacturing of railroad cars, and, second, for the manufacturing of bedsteads and fanning mills. Eventually, he converted a building into a gristmill "making a fair living when the war broke upon us."<sup>4</sup>

Brainerd believed Rome was the perfect place to collect volunteers for an engineer company. "The style of men required are able-bodied and experienced military, civil and mechanical engineers, mechanics, boatmen, lumbermen" and carpenters, farmers, and laborers. "There are a considerable number of young men in this village and the vicinity, of the classes

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<sup>1</sup> *Bridge Building in Wartime: Colonel Wesley Brainerd's Memoir of the 50<sup>th</sup> New York Volunteer Engineers*, ed. Ed Malles (Knoxville: The University of Tennessee Press, 1997), 269.

<sup>2</sup> Brainerd, 7.

<sup>3</sup> Brainerd, 7.

<sup>4</sup> Brainerd, 6.

above indicated who should be glad to join the Engineer Corps of Gen. Stuart.”<sup>5</sup> The article concluded by announcing “General Stuart’s” qualifications for the leadership position he was assuming, which included his graduation from West Point. Stuart did have extensive engineering experience before the war. He conceived the railway suspension bridge over the Niagara River two miles below the falls and supervised its completion in 1855 by John A. Roebling. He was state engineer for New York, engineer in charge of the Brooklyn dry docks, and had financial interests in building railroads in Iowa.<sup>6</sup>

Stuart, however, was not a graduate of West Point. He attended common schools in New York, graduated from Union College in Schenectady and through self-promotion managed to adopt the sobriquet, “the general.” It was perhaps this self-promotion and affect as martinet that led Brainerd to describe him as “overrated.” His stratagem was to surround himself with capable associates, filter and absorb their ideas, and then claim them as his own.<sup>7</sup> When the regiment was finally formed as the 50<sup>th</sup> New York Volunteer Infantry (not engineers just yet) and marched off to camp in Washington, DC, Stuart acted the part of a commanding officer as a combination “Old Fuss and Feathers” (General Winfield Scott) and “Old Rough and Ready” (Zachary Taylor.) In actuality he was pompous and plump.

Brainerd would find men in the Fiftieth that he would come to greatly admire. One that became his constant companion was Captain Ira Spaulding. Born in Oneida County, New York, and also a product of common schools, Spaulding had worked for “General” Stuart as assistant engineer (Stuart was chief engineer) for a division of the Erie Railroad. In 1843, Spaulding was engineer of the newly formed Bear Mountain Railroad Company charged with building lines from the coal region in the upper end of Dauphin county to the Pennsylvania canal twenty-eight

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<sup>5</sup> Brainerd, 269.

<sup>6</sup> Brainerd, 342, fn. 21.

<sup>7</sup> Brainerd, 23.

miles from Harrisburg.<sup>8</sup> He would become one of the most admired and successful officers of the regiment.

The other officer who would come to impress Brainerd was Captain Edmund O’Fling Beers. From Elmira, New York, Beers learned his mathematics, reading, and writing skills in common school, married his first cousin Mary A. Beers, and practiced dentistry.<sup>9</sup> Beers’s father, Jabez Holly Beers, was a carpenter and builder and taught his son the trade. So the captain, who would eventually become a major during the war, had extensive knowledge of mechanics and technology.<sup>10</sup>

By mid-September 1861 Brainerd, his companions, and the entire regiment of the 50<sup>th</sup> New York Infantry were encamped at Camp Lesley in Elmira, New York.<sup>11</sup> Within a month the unit would be converted into an engineering regiment and would see its first major action during General George B. McClellan’s Peninsula Campaign. Before that happened, however, both Union and Confederate military and civilian leaders would need to determine how they wanted to structure their forces based on the high commands’ assessment and development of their strategic plan. Stuart’s men had a role to play. At first the role was minor in character, but

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<sup>8</sup> *New York Commercial Advertiser*, November 23, 1843.

<sup>9</sup> American dentists in the nineteenth-century were not trained well. Many practitioners were barbers, blacksmiths, and apothecaries, and pulling teeth was their primary dental function. It was not until 1840 that professional training began with the opening of a dental school in Baltimore, Maryland. The greatest progress made in dental medicine before the Civil War was the development of nitrous oxide as an anesthesia. Otherwise, dentures did not fit well, hand drills were used to excavate a tooth, pain control was in its infancy, and infection control was non-existent. For more on this subject see Edward Feinberg, DMD, “A Short History of Modern Dentistry,” [www.edwardfeinbergdmd.com/history-of-dentistry.htm](http://www.edwardfeinbergdmd.com/history-of-dentistry.htm) (accessed November 24, 2013).

<sup>10</sup> Joyce M. Tice, “Tri-Counties Genealogy & History: Family History & Biography Section,” [www.joycetice.com/Kelsey/Kjwb.htm](http://www.joycetice.com/Kelsey/Kjwb.htm) (accessed January 26, 2013).

<sup>11</sup> Colonel Stuart named the camp in honor of “Mr. Lesley, chief clerk of the War Department.” See Brainerd, 272. Camp Lesley should not be confused with Fort Lesley A. McNair in Washington, DC. Fort McNair was named for Lieutenant General Lesley A. McNair who was killed in World War II. Thus, Colonel Stuart cannot take credit for naming the third longest serving army post in United States history.

it soon came to be major, one essential to the outcome. Engineers had served a vital part in the military campaigns of the past and they were about to again. Northern war planners would figure out the mechanical and technical capacity of their men. Between 1861 and 1865 the engineers' role would expand and become indispensable to Northern victory.

This transformation from a limited to a large role for the engineers needed to be recognized by the generals and politicians, and consequently, it took time to develop. One hurdle to overcome in expanding the role of engineers was to increase the number of engineers. This meant accepting the idea that civilian engineers could perform well as military engineers. A few professional soldiers had the wisdom, by the time the Civil War began, to challenge the well-established notion that only West Pointers made good engineers. These same men understood that with the expansion of the war engineering operations required skilled laborers. It was not enough just to have trained officers. It was incumbent upon the army to enlist personnel with the mechanical skills and ingenuity to solve problems often without adequate resources and in trying situations.

At first, the War Department and Congress saw no need to expand the Union army's engineering forces. Moreover, most senior officers believed the war would be over by the summer of 1861, and the size of the Corps of Engineers was adequate for the great battle ahead. To everyone—the government, the army, the public—a clash of arms would decide the fate of the Union and Confederacy. President Lincoln had called for 75,000 ninety-day volunteers based on the Militia Act of 1795 and then expanded the number on May 3rd to an additional 42,000 three year volunteers and called for an increase of 23,000 to the regular army of which the corps of engineers and corps of topographical engineers were attached. No additional engineer units, however, were authorized. The public's expectation and the administration's belief was that the Federal army would march into Richmond and crush the

rebellion. An undersized engineer corps did not matter as long as engineers could skillfully maintain harbor defenses, as they did at Fort Pickens, which guarded the ships' pass to Pensacola Bay, and Union held forts along the southern Atlantic, Gulf coast, and Great Lakes region. After the British invasion (military not musical) of the United States in 1813 and 1814 the War Department, Congress, and the Executive expended limited defense dollars on river, harbor, and coastal fortifications in preparation for the next possible war. Skilled engineers, all trained at the military academy at West Point were responsible for the building and maintenance of these facilities and waterways.<sup>12</sup>

After May 23, 1861 when the people of Virginia adopted that state's ordinance of secession, the corps of engineers and topographical engineers became even smaller, because engineers from Virginia went with their state, but no one in the Federal government or military appeared worried. Between May and July 1861 there were only forty engineers and thirty-seven topographical engineers active in the service of the Federal army. Nine engineers and seven topographical engineers had resigned their commissions and taken positions in the new Confederate army.<sup>13</sup> These small numbers, although not initially significant, eventually revealed problems that both the North and South would need to address—a significant shortage of engineering officers and troops. This shortage especially taxed the South because there were just not enough civilian engineers or mechanics, artisans, and railroad workers to meet the ever-growing demands of the Confederate army for fortifications, bridges, and roadways.

The expansion of both armies was staggering. On Sunday, July 21, 1861, Union general Irwin McDowell had approximately 28,000 men under his command from the Department of Northern Virginia and Washington as he prepared to attack 32,000 Confederates at Bull Run. At

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<sup>12</sup> Before the war army engineers William Rosecrans, George Meade, Robert E. Lee, and P. G. T. Beauregard, for example, all worked on harbor improvement and fortification projects.

<sup>13</sup> Ness, Jr., 187.

the time of the attack the Union army overall had approximately 187,000 soldiers spread throughout departments in Ohio, Kentucky, Missouri, and Florida. By January 1, 1862, the army had grown to 600,000, and by the 1863, 900,000 men divided into fourteen army groups scattered across the Mid-west, West, and South.<sup>14</sup> Army groups ranged in size between 40,000 and 120,000 men. In addition, to move an infantry regiment, for example, on a three day march of fifteen miles a day required approximately twenty wagons carrying 3,000 pounds of camp equipage, ordnance, quartermaster stores, and medical supplies per 1,000 men. An army of 100,000 could march twenty-five days with approximately 19,000 wagons. This included feed for about 33,000 animals.<sup>15</sup> Moving these armies over poor roads and rivers without bridges presented a daunting task. Forty engineers, thirty-seven topographical engineers, and one hundred engineer soldiers was a paltry sum to accomplish the strategic and tactical movements of the Union Army over the 750,000 square miles of the Confederacy.

The Confederate Army also grew in size and complexity. In July 1861, the South, from the Shenandoah Valley to central Kentucky to Pensacola, Florida scattered seven small armies totaling 60,000 men. By 1863, the army had expanded to approximately 465,000 men comprised of eighteen armies functioning as independent commands. Like their northern enemies at the time of the first battle of Bull Run, the South had only a handful of engineering

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<sup>14</sup> These army groups ranged from 40,000 to 120,000 men, operated independently from each other and the most famous became known as the Army of the Potomac, Army of the Tennessee, Army of the Ohio, Army of the Mississippi, Army of the Cumberland, and the Army of the James.

<sup>15</sup> Mark M. Boatner, III, *The Civil War Dictionary* (New York: David McKay Company, Inc., 1959), 25, 26, 169 and 858. See also "Size of the Union and Confederate Armies: Comparative Strength," <http://www.civilwarhome.com/armysize.htm> (accessed February 9, 2013). Edward Hagerman, *The American Civil War and the Origins of Modern Warfare: Ideas, Organization, and Field Command* (Bloomington, IN: Indiana University Press, 1988), 61. It is difficult to determine in Hagerman's numbers whether he includes horses for artillery. For an excellent overview of artillery operations at Gettysburg, including the number of horses used, see Philip M. Cole, *Civil War Artillery at Gettysburg: Organization, Equipment, Ammunition, and Tactics* (Cambridge, MA: DaCapo Press, 2002).

officers. Unlike the North, however, the South had no engineering soldiers and little in the way of mechanics, carpenters, machinists, and factory workers to fill the ranks of the engineers.

The United States Military Academy in the spring of 1861 had a monopoly on producing engineers whether for the army or for civilian life. While 1802 West Point graduates had served in the regular army as officers in the infantry, cavalry, and artillery, many cadets aspired to be assigned to the engineers. The Corps of Engineers was considered the most elite branch of the service. Beginning with the class of 1819, cadets received a class rank, and only the top three or four in the class qualified to enter the engineers. Between 1819 and 1860 eighty-seven graduates had earned the distinction of being placed immediately into the engineers. Sixty-eight of them came from a free state and nineteen from a slave state.<sup>16</sup> By the time of the Civil War forty-eight officers were serving in the corps of engineers. Of the forty who remained in the Union army twenty-nine served as northern engineers during the Civil War and thirteen served as Union field commanders. Of the eight engineers who joined the Confederacy five served as field commanders.<sup>17</sup>

More remarkable was where these cadets were born and from what states they were appointed. Between 1802 to 1860 of the one hundred-eight graduates who served in the Corps of Engineers, seventy-five of them came from New York, Massachusetts, Pennsylvania, Ohio,

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<sup>16</sup> Two other sets of numbers draw attention to the fact that students and graduates of West Point who entered the engineers were from the north by a factor of 3 to 1. Between 1802 and 1861 one hundred thirty-seven men served in the Corps of Engineers, (they did not necessarily begin their army careers in the engineers) and one hundred nine came from Union states and twenty-eight from Confederate states. Of those men between 1802 and 1861 who did begin their army careers in the engineers, eight-seven were from the North and twenty-four from the South.

<sup>17</sup> Cullum's *Register*. I shifted through all the classes between 1802 and 1861 noting where every cadet was born, the state in which he was appointed, his class rank, and the branch of the service he entered upon graduation. Pierre G. T. Beauregard, William Henry Whiting, Edward Porter Alexander, and George Washington Custis Lee all served as field commanders for the Confederacy. Robert E. Lee was not on the list of corps members because at the time Virginia seceded Lee was in command of cavalry.



and Vermont. Four of these states had adequate common school programs during the antebellum period, and one, New York, which produced twenty-seven engineers, had developed an exceptional common school program. Furthermore, as industry and mechanization altered the economic landscape in the free states, northern colleges and universities introduced more science into the curriculum. Northern boys of all classes, who had more access to education, would be exposed to the benefits of studying natural philosophy, mathematics, chemistry, and physics. Increasingly, northern educators and politicians would encourage and promote these courses in schools. It was not a coincidence that the number of northern graduates and southern graduates entering the engineers was different by a factor of close to four to one.<sup>18</sup>

Within the Corps of Topographical Engineers of the seven men who resigned their commissions to join the Confederate Army, only two held a rank above second lieutenant. Experience remained in the Federal Army. This experience included West Point graduates who served initially in other branches of the service before the war. These men amassed a wealth of engineering knowledge as a result of being transferred into the engineers or, after resigning their commissions, serving as civilian engineers or teaching science and engineering at their *alma mater*. For example, Montgomery C. Meigs and Daniel P. Woodbury, class of 1836 both entered the artillery after graduation and were transferred to the engineers. John M. Wilson class of 1860 was another artillery officer transferred into the engineers. William S. Rosecrans, class of 1842, attended common school in Utica, New York, and then moved to Mansfield, Ohio, where he was appointed to the military academy. After serving as a professor of engineering he opened a mining business in western Virginia around the time eastern planter interests feared

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<sup>18</sup> Massachusetts produced nineteen engineers, Pennsylvania thirteen, Ohio nine, and Vermont six. Eight cadets born in Virginia served in the Corps of Engineers, four from Tennessee, four from North Carolina, three from Louisiana, and two each from South Carolina, Georgia, Alabama, and Mississippi.

industrial competition and the influence of northern abolitionist ideas in the region. George Brinton McClellan served as an engineering officer after graduating in 1846, and he too eventually resigned his commission to follow civilian pursuits. In 1857, he became chief engineer of the Illinois Central Railroad and in 1860, president of the Ohio and Mississippi Railroad.

Rosecrans and McClellan's paths would cross immediately after the Civil War began, and both would have a major impact on the development of the engineering organization and operation during the war. McClellan was a rising superstar. He was a soldier of intellectual acumen and some distinction. He graduated number two in his class at West Point, served on Lieutenant General Winfield Scott's staff during the Mexican War, was sent to the Crimean as an army observer, and had considerable experience surveying river systems and terrain for the express purpose of developing future railroads and waterways. At the request of the governor of Ohio, he spent time organizing the first volunteer troops in the state, and in May 1861 was promoted to major general in the Regular army. He was thirty-four years old.

Placed in command of the Federal government's forces in western Virginia, McClellan was assigned several brigadiers including William Rosecrans. Rosecrans demonstrated skill as a tactical commander by defeating a Confederate force at the battle of Rich Mountain on July 11<sup>th</sup> and two days later defeated another Southern force led by Robert E. Lee at Corrick's Ford near the Cheat River. McClellan, to Rosecrans's indignation, took overall credit for both victories. Thus it was that McClellan, the only Union general with a victory to his name, was called to Washington after the North's devastating defeat at Bull Run on July 21<sup>st</sup>, to quell the panic, defend the city, and assume command of the Military Division of the Potomac.<sup>19</sup> Upon arriving

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<sup>19</sup> The battle was deemed devastating for two reasons: One, the Lincoln government fully expected to defeat the upstart Confederates in one Napoleonic crushing victory. Two, the battle turned into a full-blown panic with Union soldiers and civilians (who had come out from

in the capital he wrote his wife Ellen, “I find myself in a new and strange position here—Presdt [sic], Cabinet, Genl Scott & all deferring to me—by some strange operation of magic I seem to have become the power of the land...I almost think that were I to win some small success now I could become Dictator or anything else that might please me—but nothing of that kind would please me—*therefore I won’t* be Dictator. Admirable self-denial!”<sup>20</sup>

The Federal government could breathe a sigh of relief that General McClellan would not become dictator, but it did fear a southern invasion of the capital. Manassas Junction was only thirty miles southwest of the capital. The door was wide open. Yet in that moment the right man had been called to Washington. McClellan would fortify the capital, expand the Corps of Engineers, reorganize the army, and serendipitously introduce volunteer engineer officers and soldiers into the Union Army.

McClellan’s understanding of military science was significantly influenced by the writings of Simon François Gay de Vernon, Antoine-Henri Jomini, Dennis Hart Mahan, and Henry Wager Halleck. Mahan, a student of both Vernon and Jomini, taught both Halleck (1839) and McClellan (1846) at West Point. McClellan accepted, as historian Edward Hagerman pointed out in his book *The American Civil War and the Origins of Modern Warfare: Ideas, Organization, and Field Command*, “the two innovations in a basically eighteenth-century view of warfare that responded to the realities of the mid-nineteenth century: Mahan’s rejection of the open frontal assault for an offensive tactical organization that emphasized the primary role of field fortifications; and the general awareness of the strategic potential of railroads.”<sup>21</sup>

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Washington to witness the battle) fleeing back to Washington. Morale in the days that followed was torturous.

<sup>20</sup> George B. McClellan to Mary Ellen McClellan, July 27, 1861, in *The Civil War Papers of George B. McClellan: Selected Correspondence, 1860-1865*, ed. Stephen W. Sears (New York: Ticknor & Fields, 1989), 70.

<sup>21</sup> Hagerman, 65.

Mahan's book, *A Complete Treatise on Field Fortification*, was introduced to cadets in 1836, and although Mahan rejected Vernon's reliance on assault tactics, he did believe that "the chief object of entrenchments is to enable the assailed to meet the enemy with success...and then, when he has been cut up, to assume the offensive and drive him back at the point of a bayonet."<sup>22</sup> Mahan spent four years in France studying Vernon and Jomini's works and when he returned to West Point as a professor of engineering in 1830, he introduced both their writings into the curriculum. Mahan's favorite student at West Point, Henry Halleck, published *Elements of Military Art and Science* (1846) combining field fortifications with Jomini's concept of using internal lines of communication to concentrate manpower at the weakest point in the enemies' lines and attack at that point.<sup>23</sup> Halleck was building on a rich military tradition begun in eighteenth century France with Louis XIV's engineer Sébastien Le Prestre de Vauban and continued through the ideas of Vernon, Jomini, Mahan, and Halleck. Vauban's technical knowledge, love of applied science, and the *esprit géométrique* of the age carried great momentum into the nineteenth century and was reinforced by the rising industrial culture.<sup>24</sup>

McClellan was influenced by what he read at West Point and afterwards, and his experience in the Mexican War and in the Crimea only supported his predisposition for field fortifications and turning movements rather than frontal assaults. In Mexico, McClellan was assigned to Company "A", Corps of Engineers. On May 15, 1846 Congress finally passed

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<sup>22</sup> Dennis Hart Mahan, *A Complete Treatise on Field Fortification* (New York: Wiley and Long, 1836), 14.

<sup>23</sup> John Shy, "Antoine-Henri Jomini," in *Makers of Modern Strategy from Machiavelli to the Nuclear Age*, ed. Peter Paret (Princeton, NJ: Princeton University Press, 1986), 176-177.

<sup>24</sup> Henry Guerlac, "Vauban: The Impact of Science on War," in *Makers of Modern Strategy from Machiavelli to the Nuclear Age*, ed. Peter Paret (Princeton, NJ: Princeton University Press, 1986), 74. Guerlac wrote: "Science and warfare have always been intimately connected. In antiquity this alliance became strikingly evident in the Hellenistic and Roman periods. Archimedes' contribution to the defense of Syracuse immediately springs to mind as the classic illustration." 68.

legislation to create an engineer component from enlisted personnel of the Regular Army.<sup>25</sup>

McClellan witnessed the important work of engineer soldiers, and saw the tactical effectiveness of turning movements especially at Cerro Gordo and Contreras. He also learned the destructive effects on attackers in a frontal assault on an entrenched position. He concluded that one of the reasons Americans succeeded was because Mexican fortifications were poorly constructed.<sup>26</sup>

In 1855, with Major Alfred Mordecai of the Ordnance Department and Major Richard Delafield of the engineers, Captain McClellan travelled to Europe and was a military observer at the siege of Sevastopol.<sup>27</sup> Here McClellan noted the significance of rifled weapons on a frontal assault, and consequently, was able to see with crystal clarity the central principle he would adopt as he was handed command in Washington seven years later: Defense wins wars, solid entrenchments and fortifications were the elements of defense, frontal attacks upon the enemy are to be avoided at all costs, excellent artillery must accompany successful siege operations, and engineer troops are essential to the army in order to conduct the type of warfare, which McClellan was philosophically bound.

McClellan's vision of a war dominated by field fortifications and entrenchments, planned and guided by professional military engineers no doubt was on his mind when he received word that on August 3, 1861, Congress authorized three additional engineer companies which brought the strength of the Corps of Engineers to forty-nine officers and 550 enlisted

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<sup>25</sup> Captain Alexander J. Swift had spent two years as a student at the School of Application for artillery and Engineers, before returning to the United States in early 1846. Congress had yet to establish a company of engineer soldiers. When the authorization came, Captain Swift was given command of the new unit.

<sup>26</sup> Russell F. Weigley, *History of the United States Army* (Bloomington, IN: Indiana University Press, 1984), 182-187.

<sup>27</sup> The Crimean War was fought between the Russian Empire and the Ottoman Empire, Great Britain, and France.

men.<sup>28</sup> As a result Company B, recruited in Portland, Maine, and Company C, recruited in Boston, Massachusetts became part of the provisional Engineer Battalion under the command of Captain James C. Duane. It was at this time that Duane began writing a *Manual for Engineer Troops*, which would be used along with extensive field training, to prepare the new battalion for the campaigns ahead. Duane's manual foreshadowed his boss's tactical policy for the fighting ahead. Duane's chapters included the following: Ponton [sic] Drill, Rules for Conducting a Siege, School for the Sap, Military Mining, and Construction of Batteries.<sup>29</sup>

Infantry commanders were skeptical of the engineers, because the infantry wanted to take the offensive and fight, whereas the perception was the engineers want to take the defensive and dig.<sup>30</sup> The administration, Congress, and members of the press believed McClellan's focus on the engineers might foreshadow a less aggressive approach to waging war against the South. McClellan's Peninsula Campaign in May-June 1862 did reveal that Lincoln's concerns about McClellan's recalcitrance were real and accurate. The administration and Congress wanted action. Anxious to take the war to the rebels and deliver a crushing victory, Lincoln and the Congress, therefore, were reluctant to sacrifice manpower resources for engineering troops. This desire to take the war to the Confederacy helped explain why Lincoln continuously encouraged the general to go on the offensive, and why McClellan, the professionally trained military engineer-soldier, considered these overtures anathema. He wrote to his wife on October 11, 1861, "I can't tell you how disgusted I am becoming with these wretched politicians—they are a most despicable set of men & I think Seward is the meanest of

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<sup>28</sup> Phillip Thienel, "Engineers in the Union Army, 1861-1865: Part I. Engineer Organization," in *The Military Engineer*, vol. XLVII, no. 315 (January-February 1955), 36. See also Hagerman, 234.

<sup>29</sup> Captain J. C. Duane, *Manual for Engineer Troops* (New York: D. Van Nostrand, 1862). A sap was an approach trench dug by soldiers when attempting to move within striking distance of the enemy's fortification. The sap was dug in a criss-cross pattern to avoid enfilading (from an angle) fire from the defenders.

<sup>30</sup> Hagerman, 234.

them all—a meddling, officious, incompetent little puppy—he has done more than any other one man to bring all this misery upon the country & is one of the least competent to get us out of the scrape. The Presdt [sic] is nothing more than a well meaning baboon.”<sup>31</sup>

Although an invidious narcissist and a self styled savior of the Union if ever there was one, McClellan did have a cogent point about the lack of engineer officers and troops, and it was here that he contributed most to the outcome of the war. In September 1861 the army had lost fifteen officers to the Confederacy (both engineers and topographical engineers) and the remaining officers were assigned to various staffs, coastal defenses, or continued their prewar function working on civilian internal improvement projects.<sup>32</sup> Finally, at least seven men left the engineers to accept line commands. So by October 1861, McClellan found he lacked engineer officers and men to expand the project to fortify Washington, begun in May, but made critical by the results of Bull Run and the belief an impending Confederate attack was coming (McClellan believed from at least 150,000 rebels). Eventually, a total of sixty-eight forts, ninety-three batteries, and twenty miles of rifle entrenchments were built to protect Washington.<sup>33</sup> Furthermore, the army had no pontoon trains or equipment to mount an offensive even if it wanted to do so.

Major John G. Barnard, superintendent of West Point in April 1861 and an apostle of Dennis Hart Mahan, was given the responsibility of designing and overseeing the building of the first forts around Washington. The results were Fort Corcoran, which commanded the approaches to the Aqueduct Bridge, Fort Runyon, which guarded the approaches to the Long Bridge and was built at the northern end of the Chesapeake and Ohio Canal, and a smaller Fort

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<sup>31</sup> McClellan to Mary Ellen McClellan, October 11, 1861, in *The Civil War Papers of George B. McClellan*, ed. Stephen W. Sears (New York: Ticknor & Fields, 1989), 106.

<sup>32</sup> Hagerman, 235.

<sup>33</sup> Ron Field, *American Civil War Fortification (2): Land and Field Fortifications* (Oxford: Osprey Publishing, 2005), 32.

Albany about one mile west on the Columbia Turnpike.<sup>34</sup> The major then began to build a chain of lunettes, called forts De Kalb, Woodbury, Cass, Tillinghast, and Craig. All these forts established a screen of outposts known as the Arlington Line, which faced southwest and connected forts Corcoran and Albany.<sup>35</sup>

Pleased with Barnard's work, General McClellan promoted the major to brigadier general of United States Volunteers and chief engineer of the newly formed Army of the Potomac.<sup>36</sup> "Little Mac" (the men's affectionate nickname for their beloved general) then handed Barnard an additional task beyond the continued construction of the Washington defenses—to build portable bridge trains. The army had no bridging equipment except for India-rubber pontoons left over from the Mexican War, which McClellan deemed unsatisfactory.<sup>37</sup> So with no bridging equipment or tools, forts under construction, and the number of engineer troops inadequate for the job, McClellan ordered Barnard to construct the new model French bateau pontoon and the wagon trains to haul them. Barnard in his turn assigned Lieutenant

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<sup>34</sup> Field, 26.

<sup>35</sup> Field, 31. A lunette was a detached fieldwork shaped like an irregular pentagon with the base open and the vertex facing in the direction of the enemy. Lunettes were used as advanced works placed in front of the main line covering the gaps between major fortifications.

<sup>36</sup> Being promoted in the volunteers instead of the regular army meant that the rank remained as well as the pay, so long as the volunteers were in service. Once the volunteers were mustered out of the army an individual's rank reverted back to its pre-war grade, pay, and pension.

<sup>37</sup> India-rubber pontoons were made from three cylinders, each twenty feet long and twenty inches wide bound together by rubber straps. Each cylinder had a brass air nozzle, and the pontoon was inflated using a large bellows that fit over the nozzle. This type of bridge was easy to transport and easy to repair, but if damaged while supporting a large number of men and horses it could prove disastrous. The other reason McClellan may have disapproved of the India-rubber pontoon was because Captain Duane preferred the French system. In Brigadier General Barnard's report of operations from May 23, 1861 to August 15, 1862 he wrote, "Captain Duane possessed a more extensive and thorough practical and experimental knowledge of military bridges than any other man in this country." Duane was not one to hide his light under a bushel, and I suspect he made his ideas known to McClellan.



Colonel Barton Stone Alexander to prepare the necessary equipment for the Army of the Potomac.<sup>38</sup>

McClellan then wrote Secretary of War, Simon Cameron to request army funds from the Quartermaster's Department to purchase and experiment with a suspension bridge designed and build by John W. Murphy, a civil engineer with a degree from Rensselaer. The bridge, built from factory-made wire ropes combined with wooden bracing, utilized abutments and piers of an earlier wooden bridge. The bridge constructed over the Gauley River in western Virginia was "built of heavy timbers, and in place of suspending rods a loosely-formed truss was hung upon the cable without fastening. This truss connected to the floor of the bridge", and it permitted the passage of General Rosecrans's men. Barnard was impressed with the ingenuity of Murphy's system.<sup>39</sup>

Cameron was also informed that although Congress had authorized two additional companies of engineer soldiers for the Engineer Battalion, they had yet to arrive in Washington. They would not arrive until mid-December. McClellan needed manpower, and he boldly suggested to the secretary that volunteers should be assigned to the engineers.<sup>40</sup> This suggestion crossed an important threshold whether at the time Little Mac knew it or not. Military engineers were the elite of the army because their technical skills were highly prized by commanding generals, such as General Scott in Mexico, but also because unlike the other branches of the service, engineers had performed valuable assistance to the nation working on critical internal improvement projects throughout the United States and the Territories. Now McClellan was requesting engineer troops from volunteers, which he would get, but along with these new soldiers he would get volunteer engineer officers as well. The army's corps of

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<sup>38</sup> *O. R. ser. 1, vol. 5, chapter XIV, 616-617.*

<sup>39</sup> *The Railroad Gazette, August 24, 1894, 579.*

<sup>40</sup> *O. R. ser. 1, vol. 5, chapter XIV, 617.*

engineers would need to “give way to the practical need for broader perspectives” in a war that was to demand “ad hoc improvisation.”<sup>41</sup>

The corps had held a unique and elite role within the army with a large amount of self-aggrandizement. When Captain Duane told his men not to wear the insignia of the engineers because if volunteers could wear it then they were no longer badges of distinction, he revealed a feeling held by many West Point engineers. Regular army engineer officers and men were better than any other soldiers. Duane said, “Why, President Lincoln can make a brigadier general in five minutes, but it has taken five years to make...an engineer soldier.”<sup>42</sup>

Fortunately for the North, in the years before the war, new ideas in technology and industrialization, developed by men from all walks of life altered the notion that ideas come from one class of society and laborers from another. McClellan was willing, under the circumstances and out of necessity, to expand the engineer battalion with men who had enlisted as infantry, but who the general believed had developed, as civilians, the basic skills and intelligence necessary to perform engineering tasks. The man who would bring the value of the volunteer into sharper focus and establish the military doctrine the army would follow to the successful conclusion of the war was Lieutenant Colonel Barton Stone Alexander. One day after McClellan wrote to the secretary of war, Alexander sat down at his desk and penned his visionary letter.

Writing to Barnard, Alexander rhetorically asked, “...we have as yet no bridge equipment, no engineer trains, and no instructed engineer troops.... What, then, are we to do?” He continued, “The answer must be, however, we must make them. Our country is full of

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<sup>41</sup> Hagerman, 234

<sup>42</sup> Bruce Catton, *Reflections on the Civil War*, ed. John Leekley (Garden City, New York: Doubleday & Company, Inc., 1981), 181-182.

practical bridge-builders. We must secure their services.”<sup>43</sup> Alexander was convinced that men who possessed mechanical talent could be found within the ranks of volunteers who had been originally recruited as infantry regiments. With roads and railroads to build and repair, telegraph lines to install, and bridges to construct and destroy, Alexander argued that men “with previous pursuits” that made them mechanically inclined would make excellent military engineers. The India rubber pontoon bridge could be used and perfected “if a proper proportion [of volunteers] are sailors,” and skilled carpenters could rapidly make canvas pontoon boats used by the Topographical Engineers on the expedition on the Colorado River. The Quartermaster’s Department had 100 corrugated-iron wagons that Alexander believed could be converted into a bridge. Finally, the lieutenant colonel told Barnard how impressed he was with Murphy’s suspension bridge. Alexander suggested three or four spans of the bridge be ordered, but that manila rope be replaced with wire rope for all running rigging, except for suspension cables. He told Barnard, “We can go to New York and get 10,000 men to splice or put a thimble in a manila rope. By going to Mr. Roebling’s establishment in Trenton it is possible that we might find 20 men who could do the same thing with wire rope.”<sup>44</sup> All of this work, Alexander concluded, would give the engineers several types of bridges that could be used depending upon the circumstance.

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<sup>43</sup> *O. R.*, ser 1, vol. 5, 617.

<sup>44</sup> *O. R.* ser. 1, vol. 5, 619. John A. Roebling, during the antebellum period, was famous for rope suspension bridge designs. The last project he completed before the war was a suspension bridge in Pittsburg over 1000 feet long. In the late 1840s he opened an industrial facility for wire production to which Alexander alludes. Roebling’s son, Washington A. Roebling joined the Union Army as a private, rose to the rank of brevet lieutenant colonel, and served in the artillery throughout the war. After the war and his father’s death, young Roebling continued and finished the Brooklyn Bridge project his father had started in 1870. Young Roebling was seriously injured in the bridge’s construction, and his wife, Emily Warren Roebling, managed the project to its successful conclusion. A thimble was a small teardrop shaped piece of metal that was inserted into a section of spliced rope to create an eye. The eye of the rope could then be attached to various stationary anchors without having to tie a knot.

The following day General McClellan wrote to Assistant Secretary of War Thomas A. Scott to say he had concluded that after considering the matter more fully, the time and manpower to construct bridge trains was limited. Therefore, McClellan continued, "It is necessary to avail ourselves at once of all the resources which the mechanical skill and ingenuity of the country can furnish in this matter."<sup>45</sup> He concluded his message to Scott with his second request to the War Department to secure the services of "such regiments of volunteers or such portions of regiments as may prove best adapted to the duty."<sup>46</sup>

Scott was an excellent choice as assistant secretary of war. As vice president of the Pennsylvania Railroad in 1860, Scott had worked along side of President J. Edgar Thomson, witnessed the development of Thomson's innovative management system, and he proved to be a skillful administrator. Scott responded to McClellan the following day, October 15<sup>th</sup>: "You have full authority to detail the whole or parts of volunteer regiments for engineer service, and will exercise your own discretion in relation thereto."<sup>47</sup> Yet, "Little Mac's" idea for converting infantry regiments into engineering regiments was probably not his own. Although there was no evidence to conclude that McClellan had seen Alexander's original memorandum to Barnard, there was no evidence to the contrary. Furthermore, as McClellan's chief engineer, it was more than likely that Barnard was in daily contact with McClellan. Finally, the language McClellan used in his note to Scott echoes the language Alexander used in his note to Barnard. Alexander had written, "Our country is full of practical bridge-builders," and "we ought to avail ourselves of the mechanical skill of our soldiers..." While McClellan's followed with, "It is necessary to avail ourselves at once of all the resources which the mechanical skill and ingenuity of the country

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<sup>45</sup> *O. R. ser. 1, vol. 5, 619.*

<sup>46</sup> *O. R. ser. 1, vol. 5, 620.*

<sup>47</sup> *O. R. ser. 1, vol. 5, 621.*

can furnish..." sounded too similar not to conclude that the rationale for creating engineer soldiers from volunteer infantry regiments was Alexander's idea rather than McClellan's.

Eleven days later the 15<sup>th</sup> and 50<sup>th</sup> New York Volunteer Infantry received orders to report to Washington to become the 15<sup>th</sup> and 50<sup>th</sup> New York Volunteer Engineer Regiments. Upon his arrival at the capital Captain Wesley Brainerd of the 50<sup>th</sup> wrote, "We crossed the Long Bridge for the first time and marched to our ground near the Navy Yard on the East Branch of the Potomac, sometimes called the Anacostia River. Here we commenced the establishment of our permanent camp."<sup>48</sup> Both of these regiments were selected because New York State had a considerable number of skilled mechanics, carpenters, blacksmiths, masons, and civil engineers within their ranks. For example, in the 50<sup>th</sup> New York Private Horace Herion was a mechanic, Isaac J. Cox a carriage maker, James B. McGregor a blacksmith, and Francis S. Newton was a carpenter.<sup>49</sup> The 50<sup>th</sup> had been originally recruited as an engineer regiment, but the War Department determined it would serve as volunteer infantry. The outfit was enrolled with men from areas which were impacted by the railroad and Erie Canal including the counties of Elmira, Geneva, Fulton, Oswego, Potsdam, Rochester, Albany, and Buffalo. New York also had a tradition of establishing engineer troops. Eight militia regiments that enlisted for ninety days in April 1861 all had engineer companies attached to them.<sup>50</sup>

The 15<sup>th</sup> Volunteers were organized as sappers and miners at New York City, Long Island, and Newark, New Jersey under the command of Colonel John McLeod Murphy. Murphy served

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<sup>48</sup> Wesley Brainerd, *Bridge Building in Wartime: Colonel Wesley Brainerd's Memoir of the 50<sup>th</sup> New York Volunteer Engineers*, ed. Ed Malles (Knoxville: The University of Tennessee Press, 1997), 44. See also fn. 5. "The Washington Engineer Depot was located one-half mile north of the Navy Yard, near the foot of East 14<sup>th</sup> and /or East 15<sup>th</sup> Streets."

<sup>49</sup> "Soldiers in the Civil War From Broome County Clerk's Office, Binghamton: Miscellaneous Records," [freepages.genealogy.rootsweb.ancestry.com/~marcri/civilwar.html](http://freepages.genealogy.rootsweb.ancestry.com/~marcri/civilwar.html) (accessed July 22, 2012).

<sup>50</sup> Frederick Phisterer, *New York in the War of Rebellion, 1861 to 1865* (Albany: Weed, Parsons and Company, 1890), 273.

as a midshipman during the Mexican War and then returned to civilian life where he worked as the chief engineer for the Brooklyn Navy Yard. At the time the war began he was also in the New York State Senate. In the late summer of 1861, the Federal government mustered Murphy's regiment into the Army of the Potomac as an infantry regiment. The average age of these men was twenty-six, with the youngest being eighteen and the oldest forty-two. Many were teamsters, dock builders, boilermakers, masons, and mechanics.<sup>51</sup> Both the 15<sup>th</sup> and 50<sup>th</sup> reported to Lieutenant Colonel Alexander under the pall of being volunteers in an organization that promoted itself as being elite. Brainerd recorded that until March 1863, "...those high in Authority would not consent to allow us to wear the Engineer button though the priviledge [sic] of wearing the *castle* on our hats [much to Captain Duane's chagrin] could not be denied us."<sup>52</sup>

Before the two regiments reported to Lieutenant Colonel Alexander in Washington to begin their training there was another volunteer engineer regiment from the East already in the field. Edward Wellman Serrell had offered to organize an engineer regiment to supplement the engineers in the Regular Army. Serrell had considerable political connections and the reputation of being a first class civil engineer. Before the war he served as assistant engineer to the commission on the Erie Canal. An assistant to the chief of the Corps of Topographical Engineers,

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<sup>51</sup> "Abstract of New York State Muster Rolls, Volunteers," 13775-83 MUI, Reel 959.

<sup>52</sup> Brainerd, 45-46. The engineer soldier either wore a single-breasted frock coat (dark blue) with a stand-up collar or a shell jacket. The edge of the collar and cuffs was trimmed with a yellow cord, the color designation for the Corps of Engineers. Sergeants and corporals were permitted to wear a yellow stripe down the outer seam of their trousers, which were dark blue. A black belt, tie, boots, and felt hat were also worn. The right side of the hat was folded up and held in place by a pin fastened to an eagle. On the left side of the hat soldiers wore an ostrich feather. A yellow cord circled the hat three times at the brim seam, and the turreted-castle pin was attached to the front of the hat. One-piece white cotton canvas overall were worn on work details and the castle pin was affixed above the visor on a dark blue forage cap. Officers wore a silver turreted castle with a gold embroidered wreath of laurel and palm on their hats. The 15<sup>th</sup> also wore New York State fatigue dress, and initially the 50<sup>th</sup> wore a gray trimmed jacket with green trim. Eventually the 15<sup>th</sup> and 50<sup>th</sup> adopted a dark blue fatigue blouse, sky-blue trousers, and a black slouch hat.

he was involved with the Hoosac Tunnel project, and he had planned and supervised the building of a suspension bridge across the Niagara River at Lewiston, and one at St. John, New Brunswick. Serrell spoke with Secretary of War Cameron about recruiting an engineer regiment, which Cameron approved as did the Governor of New York, Edwin D. Morgan. Mustered in on October 11<sup>th</sup>, the newly minted Lieutenant Colonel Serrell found himself the commanding officer of the 1<sup>st</sup> New York Volunteer Engineers also known as “Serrell’s Engineers.” Most of the men in the first five companies were from New York City (the members of Company K which was mustered in on December 3<sup>rd</sup> were all from northern New Jersey), and they were ordered to join Brigadier General Thomas W. Sherman’s South Carolina Expeditionary Corps and on November 8<sup>th</sup> they began operations to capture Port Royal, South Carolina near Hilton Head Island.<sup>53</sup>

While Serrell’s regiment sailed from Fort Monroe, Virginia to the Hilton Head Island, Colonel Stuart (50<sup>th</sup>) and Murphy’s (15<sup>th</sup>) soldiers and officers were learning their trade under the watchful eyes of regular army engineers. They built wooden, French type, and canvas, Russian type, pontoons, were taught how to construct wooden-plank roadways, and they learned with repeated practice how to build a pontoon bridge over a river, or in the jargon of the engineers, to “throw across the river” a bridge.<sup>54</sup> Brainerd found the men enjoyed the pontoon drill because it “was interesting,” and in writing to the editor of the *Roman Citizen* on January 17, 1862 he explained, “You must know that there is considerable science displayed in the construction of this bridge, as simple as it may appear when reduced to military order and precision.”<sup>55</sup> In building the bridge each company formed squads, and each squad had its own

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<sup>53</sup> Phillip M. Thienel, *Mr. Lincoln’s Bridge Builders: The Right Hand of American Genius* (Shippensburg, PA: White Mane Publishing, 2000), 27.

<sup>54</sup> Thienel, 16-17.

<sup>55</sup> Brainerd, 279. Brainerd described how a pontoon bridge was constructed. The boats were 31 feet long, 3 ½ feet deep, and approximately 3 feet wide at the bow and 4 ½ feet wide at the stern. “Each boat weighs 1,250 pounds, and has a buoyant power of about 15,000 pounds; 34 of

duty to perform. The cablemen board the first boat, “and pay out the cable; the balkmen march forward with the balks, place one end on the boat; the lashers lash them, and the boat is shoved off the length of the balk, when the other end is fastened; on come the chessmen with the flooring; the boatmen pass back and take another boat...” and the process was repeated. Brainerd concluded, “More boats, more balks, more chess, and more side rails, and so the bridge seems to push itself out like a huge telescope, and before we are hardly aware of it is across the stream.”<sup>56</sup>

Officers recited from Mahan’s treatise on fortifications and learned how to give the proper combat commands to the regiment when the engineers need to fight as infantry. Finally, the engineers practiced the art of making fascines and gabions for siege operations.<sup>57</sup> For the remaining months of 1861 the New York men trained hard in anticipation for General McClellan’s great campaign expected to commence in the early spring 1862. Many members of Congress demanded action. In late December 1861 when Barnard asked for an additional \$150,000 to complete the fortifications surrounding the capital several politicians rebuked him. Senator Preston King said, “I would not expend an additional cent on the fortifications of

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these are attached to one train. In forming the bridge, these bateaux are placed 20 feet apart, and every alternate one anchored up and down stream. Across the bateaux are laid five string pieces, called balk; these are five inches square, and are lashed to the bateaux; the chess, or flooring, is laid next over the balks. These chess are 1 ¼ inches thick, 1 foot wide, and 15 feet long; they are not nailed to the balks, but held in their position by side rails laid over them, one at each side, and lashed to the balks underneath, leaving a carriage way ten feet wide.” This formed the bridge.

<sup>56</sup> Brainerd, 279.

<sup>57</sup> Brainerd, 46. Fascines were tightly bound bundles of brushwood used in building the foundation for earthworks and batteries. Gabions were cylindrical wicker basket like objects, open at both ends standing three feet tall and two feet in diameter. The baskets were filled with earth to form a stationary defense.



Washington. In my opinion, the best defense for Washington is the destruction of our enemies where they can be found—at a distance from Washington.”<sup>58</sup>

Missouri and Kentucky were a distance from Washington and the enemy was in both places. As the country unraveled right before his eyes, Lincoln understood that any military effort to defeat the Confederacy was not possible unless Missouri and Kentucky remained in the Union. His strategic thinking, with tutoring from Scott, McClellan, and books he borrowed from the Library of Congress, was at an embryonic stage in the fall of 1861, yet he recognized four important objectives: 1. Concentrate troops from Ohio and Kentucky for a movement on East Tennessee (a pro-Union area). 2. Consider simultaneous advances on the South making it difficult for the Confederacy to defend two places at once. 3. Seek to operate from areas where men and supplies could be moved quickly to an extended battlefield and prevent the Confederacy from doing the same. 4. Pacify Missouri.<sup>59</sup> To move the distances Lincoln’s general strategy proposed, and with which, in theory, generals Scott and McClellan concurred, would require railroad and water transportation, and therefore, would require engineers to build bridges, repair roads, tracks, rolling stock, and engines. McClellan had adopted the regular army’s four engineer companies and converted two volunteer infantry regiments into volunteer engineering regiments. For the armies in the West the engineer soldiers would all be volunteers, as would many of their officers, and when these men were not enough to complete the tasks assigned them, infantry regiments would be drafted for the work and formed into detached companies known as pioneers.

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<sup>58</sup> Benjamin F. Cooling, *Symbol, Sword, and Shield: Defending Washington During the Civil War* (Hamden, CT: Archon Books, 1975), 79-80. See also U. S. Congress, *Congressional Globe*, 37<sup>th</sup> Congress, 2<sup>nd</sup> sess., 13 January 1862, 286.

<sup>59</sup> Herman Hattaway and Archer Jones, *How the North Won: A Military History of the Civil War* (Urbana: University of Illinois Press, 1983), 56-57.

To strike at the Confederate heartland west of the Appalachian Mountains required the consideration of four possible routes of invasion. Three of these approaches, the Mississippi, Tennessee, and Cumberland Rivers provided the North with lengthy supply lines protected from partisan raiders and cavalry. The fourth potential access point was along the Louisville and Nashville Railroad, where in Nashville another line connected to Chattanooga, and from there the army could advance northeast toward Virginia, southwest into Alabama, and south/southeast into Georgia.<sup>60</sup>

To prevent the Yankees from punching through the South's imaginary defensive line, Confederate President Jefferson Davis assigned the task to General Albert Sidney Johnston. Johnston was the quintessential soldier—handsome, brave, intelligent, and experienced. He had served in the Black Hawk War, the war for Texan independence, and led the Utah invasion against the Mormons.<sup>61</sup> He was the highest-ranking officer in the United States Army to resign his commission and join the Confederacy. He became the second ranked full general in the new southern army.<sup>62</sup>

Johnston's strategic defensive line included building forts along the major rivers—at Columbus, Kentucky on the Mississippi 175 miles south of St. Louis, Ft. Henry on the Tennessee, and Fort Donelson on the Cumberland. Finally, the general placed Brigadier General Simon Bolivar Buckner and approximately 25,000 men at Bowling Green where the Louisville and Nashville Railroad met the Memphis and Ohio Railroad. Johnston's plan to cover the entire Kentucky and Tennessee border with an undersized army was textbook Jomini. Johnston operated on interior lines of supply and communication, which meant that from Bowling Green

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<sup>60</sup> Hattaway and Jones, 58.

<sup>61</sup> Hattaway and Jones, 58.

<sup>62</sup> The highest-ranking officer in the Confederate Army was Samuel Cooper, the adjutant and inspector general.

he could quickly shift resources and manpower along the Memphis and Ohio to Forts Henry and Donelson, and using two additional lines he could send men and material to Columbus. All the critical points that blocked an invasion force were linked with each other by the railroads over a distance of 163 miles.<sup>63</sup>

Missouri was not among the four fingers the North could use to reach into the center of the Confederacy, yet it was crucial the state remained in the Federal government's hands. The Union controlled the Missouri River and the important railway hub of St. Louis. The lines extended west, east, and southwest. In the spring of 1861, however, Missouri Governor Claiborne Jackson offered assistance to the newly formed Davis government, as Confederate soldiers pressed along the Arkansas and Missouri border and occupied most of the southeastern portion of "The Show Me State." Francis Preston Blair, Jr., brother of Lincoln cabinet member Montgomery Blair, worked closely with Brigadier General Nathaniel Lyon to maintain control of St. Louis and stall for time as Blair asked Washington for help. Help arrived in the presence of John C. Frémont, the new military leader of the Department of the West.<sup>64</sup>

Frémont had no engineer troops to repair railroad tracks, cut new roads, or build fortifications. In July, Colonel Josiah Wolcott Bissell proposed to Frémont the establishment of an engineering regiment with men, "either mechanics, artisans, or persons accustomed to work as laborers under mechanics," recruited from Missouri, Iowa, and Illinois. Before the war Bissell was employed as an engineer working on several projects designed to improve roadways in the

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<sup>63</sup> Using the basic formula Distance=Rate x Time, we can approximate the time it would take to move men by rail from Columbus, Kentucky to Bowling Green, Kentucky over the available railroads. In 1860 trains averaged between 15 mph and 20 mph. It would take almost eleven hours by train to travel the distance between the two cities and it would take about fifty-four hours on foot.

<sup>64</sup> John F. Marszalek, *Commander of All Lincoln's Armies: A Life of General Henry W. Halleck* (Cambridge, MA: The Belknap Press of Harvard University, 2004), 108.

West.<sup>65</sup> He suggested to Frémont that to induce men to join the engineers the men should be promised regular army soldiers' pay and for mechanics forty cents and laborers twenty-five cents extra per day. The general agreed. This decision on Frémont's part was one of several that would get him in trouble with the War Department. A considerable amount of money passed through the Western Department's hands, and Washington called into question the department's expenses including pay and contracts. In 1861 the three New York volunteer engineer regiments were paid as infantry so naturally the army questioned Frémont's motives.

The general, like McClellan in the East, did have extraordinary respect for and appreciation of the work of engineers. As a member of the Corps of Topographical Engineers he had spent seven years (1838 to 1845) exploring and mapping the Rockies and California. It was during this time that he gained national prominence for his great adventures and was affectionately called "The Pathfinder." His chief-of-staff in 1861 was an engineer—Alexander Asboth.<sup>66</sup> General Frémont also understood the complex military situation he faced in the summer of 1861. St. Louis was threatened from the south and west by secessionists. Tennessee, Kentucky, Unorganized Territory (present day Oklahoma), and Arkansas all bordered Missouri. St. Louis enjoyed railroad connections with Jefferson City and St. Joseph, located in the northwest corner of the state, but those lines dead-ended and supplies coming from Kansas could arrive only by wagon trains. A direct line connected St. Louis to Cincinnati, but moving

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<sup>65</sup> W. A. Neal, *An Illustrated History of the Missouri Engineer and the 25<sup>th</sup> Infantry Regiments* (Chicago: Donhue and Henneberry, 1889), 9. Neal suggested that Bissell was colonel of the 10<sup>th</sup> Missouri Volunteer Infantry before he approached Frémont regarding an engineering regiment, yet there is no corroborating evidence. The Military Order of the Loyal Legion of the United States (MOLLUS), Missouri Commandery listed Bissell as only belonging to the volunteer engineers, not the infantry. See "Index to the Officers of Missouri Volunteers and Missouri State Militia," [home.usmo.com/~momollus/MOOfficersB1.htm](http://home.usmo.com/~momollus/MOOfficersB1.htm) (accessed March 1, 2013).

<sup>66</sup> Stephen Beszedits, "Hungarians with General John C. Frémont in the American Civil War," [http://www.skszeged.hu/statikus\\_html/vasvary/newsletter/03dec/beszedits.html](http://www.skszeged.hu/statikus_html/vasvary/newsletter/03dec/beszedits.html) (accessed March 1, 2013).

through lower Illinois might be problematic considering many pro-slavery sympathizers occupied the southern region of Lincoln's home state. Men who could build roads, construct fortifications, and repair bridges were essential to maintain the flow of men and material into St. Louis, and provide "the Pathfinder" with the resources needed to hold onto Missouri.

Bissell's Engineers or the Engineer Regiment of the West was composed of ten companies with only three companies, "A," "D," and "G" from St. Louis or Cape Girardeau County, Missouri. Three were from central Illinois, three from Iowa, and one from Michigan. By August, several companies made up of iron molders, railroad engineers, mechanics, and laborers were scattered principally in East St. Louis working on fortifications there or 115 miles south at Cape Girardeau along the Mississippi, building another fort to protect St. Louis from a land or water invasion by the Confederacy.<sup>67</sup> While the engineers were busy with their duties of cutting trees, building saw mills, leveling decrepit roads, and moving dirt, their commanding general was indecisive, which expanded and intensified the workload of Bissell's men, and eventually led to "the Pathfinder's" dismissal.

Historian T. Harry Williams described Frémont as a boy doing a man's job. "His every action was dramatic..." and "soon he imagined himself surrounded on all sides by dangers and difficulties...Frémont was a sincere and attractive person, but a giddy and fumbling general."<sup>68</sup> For the entire summer the general took no action to drive Rebels in southern Missouri out of the state. Unhappy with this inaction Brigadier General Nathaniel Lyon took matters into his own hands and attacked Confederates at Wilson's Creek on August 10, 1861. A fierce battle ensued that cost General Lyon his life along with 223 Federal soldiers and 257 Confederates. Facing

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<sup>67</sup> Neal, 9-15.

<sup>68</sup> T. Harry Williams, *Lincoln and His Generals* in Mark M. Boatner, III, *The Civil War Dictionary* (New York: David McKay Company, Inc., 1959), 314-315.

overwhelming numbers, the Yankees withdrew to Rolla where the southwest branch of the Pacific Railroad ended.

Orders now directed the Engineer Regiment of the West to operate at a frenetic pace. Company B recorded that they “had been engaged very nearly the whole time for the past two months [September and October] in working upon fortifications at this post [Cape Girardeau].<sup>69</sup> The engineers mounted guns, built blockhouses, welded iron in order to rim wheels, and keep the railroads operating. Bissell wrote, “The regiment had just completed a railroad bridge across La Mine River opening the Pacific Railroad to Sedalia.... A detachment of two companies was at Jefferson City for ten days, building extra track and extra storehouses for facilitating military operations.”<sup>70</sup> For the remainder of the year the men of Bissell’s Engineers helped prepare for a Confederate attack led by General Sterling Price, but none came. The forts were built and the railroads operated bringing supplies and manpower to Missouri. In December 1861 Missouri was in Union control and the engineers had received hands-on training, which prepared them well for the campaigns and demands to come.<sup>71</sup>

Kentucky’s loyalty to the Union in 1861 was also under siege, and if a relatively strong cord held Missouri, a gossamer thread held Kentucky. On September 3<sup>rd</sup> Confederate Brigadier General Gideon J. Pillow seized Columbus and violated the state’s neutrality. U. S. Grant responded by occupying Paducah. Both sides now began to recruit volunteers, and General

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<sup>69</sup> “Record of Events for Josiah W. Bissell’s Engineer Regiment of the West, July 1861-April 1864,” in *Supplement to the Official Records of the Union and Confederate Armies* Part II-Record of Events, vol. 36, no. 48, ed. Janet B. Hewett (Wilmington, NC: Broadfoot Publishing Company, 1996), 214.

<sup>70</sup> *Supplement to the Official Records*, 195-196.

<sup>71</sup> Three independent engineer companies were formed, two of which served only ninety-days—Balz’s Company Sappers and Miners and Wolster’s Independent Company Sappers and Miners. The latter’s known accomplishment was that, under General Lyon’s orders, they repaired the road from Rolla to Springfield, Missouri in May and June 1861. Gerster’s Independent Company Pioneers served twelve months for the Department of Missouri in the southwest region of the state.

Johnston established his extensive, and thin, defensive line in an attempt to prevent Northern incursions into Tennessee. The eastern portion of the Confederate line was anchored at Bowling Green but Major General George B. Crittenden with his 4,000 men from the Military District of East Tennessee was ordered to guard the Cumberland Gap, the entrance into pro-Union east Tennessee.

Three major transportation hubs ran almost due east of Bowling Green—Glasgow, Columbia, and Somerset, Kentucky. A road network at the latter connected the town to Lexington to the north, London to the east, Columbia to the west, and the Cumberland Gap to the south. London also connected with Lexington to the northwest and the Cumberland Gap to the south. Lexington was tied to the state capital at Frankfort, to Louisville and to Cincinnati. A supply line central to any Union operation in eastern Tennessee was only made possible by control of Somerset and London.

With rumors flying of impending doom, panic settled into Union controlled Kentucky. Robert Anderson of Fort Sumter fame, now promoted to brigadier general and commander of the Department of the Cumberland headquartered in Louisville, wrote desperately on September 19<sup>th</sup> to an independent battalion of riflemen in Cincinnati, to come quick because, “Kentucky has no armed men whose services I can command.”<sup>72</sup> Anderson believed he was in great peril from Confederate forces prepared to strike Louisville, Frankfort, and Lexington, and lay waste to the area around the Cumberland Gap. A calculated assessment of the situation was quickly needed to determine how a limited number of men should be deployed to do three things: First, halt any Confederate attempt to capture three critical Union supply depots: Next, Federal forces needed to prevent the enemy from establishing a base of operations for a movement into Ohio; finally, to maintain some initiative by occupying areas closer to the

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<sup>72</sup> *O. R. ser. 1*, vol. 4, 263.

Cumberland Gap which might support a movement into eastern Tennessee and pose a threat from the east to Confederate occupied Bowling Green. It was a tall order so the War Department sent an engineer.

On the day Anderson sent his message to Cincinnati, the War Department assigned Brigadier General Ormsby M. Mitchell to command the Department of the Ohio. Mitchell, an 1825 graduate of West Point, had already enjoyed a remarkable career before being called upon, once again, to render service to his country. Notwithstanding his time as an infantry officer, he was assistant professor of mathematics at West Point and later became assistant professor of mathematics and philosophy, and professor of astronomy at Cincinnati College. As a civil engineer before the war he worked on the Ohio and Mississippi Railroad, and he raised the money to build an observatory that held the second largest refracting telescope in the world.<sup>73</sup>

Mitchell's keen-witted grasp of the situation was just the tonic needed to bring pro-Union forces to action. Within six days of his arrival he wrote to the assistant adjutant-general of the army, "I deem the immediate occupancy of Kentucky as a matter of the greatest importance and the fall of Louisville as a disaster the consequences of which cannot be overestimated."<sup>74</sup> He immediately sent the few regiments he had to secure lines of communication by rail to Louisville and Cincinnati. Some were hurried to Lexington and Frankfort, and others were used to begin building fortifications around Cincinnati. Once secure, Mitchell operated toward the

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<sup>73</sup> Whitelaw Reid, *Ohio in the War: Her Statesmen, Generals, and Soldiers*, vol. 1 (Cincinnati, OH: The Robert Clarke Company, 1895), 591. An impact crater on the planet Mars is named in Mitchell's honor. During the war his men referred to him as "Old Stars."

<sup>74</sup> *O. R.*, ser. 1, vol. 4, 276.



Cumberland Gap, threaten Nashville, and “commence active and immediate operations to drive Zollicoffer and Breckinridge out of the State or to capture them.”<sup>75</sup>

As Kentucky volunteers poured into the camps, one outfit was Captain William F. Patterson’s company of engineer soldiers. Known as Patterson’s Independent Company of Volunteer Kentucky Engineers, this unit might well have been folded into a volunteer infantry regiment, where men were needed, without the intervention of Mitchell. The general understood the critical role communication links would play when the army went on the offensive. Engineer troops would be necessary to repair roads and build defenses around potential advance supply depots. The army had to build these depots if they had any thoughts of moving through the Cumberland Gap and occupying eastern Tennessee. Most likely Patterson’s engineers trained at Camp Dick Robinson seven miles north of Lancaster and astride the Wilderness Turnpike sixty-five miles north of the Cumberland Gap.<sup>76</sup>

In October, southern forces occupied Barbourville, a town sitting on the Wilderness Turnpike just ten miles from the gap. Lincoln was concerned that with the Virginia and Tennessee Railroad south of the gap, open to Confederate operations as a vital supply line,

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<sup>75</sup> *O. R.*, ser. 1, vol. 4, 276. Confederate Brigadier General Felix Kirk Zollicoffer was in command of one of Major General George B. Crittenden’s brigades and responsible for protecting the Cumberland Gap. Crittenden’s father, John J. Crittenden had proposed the “Crittenden Compromise” of 1860 and he remained loyal to the Lincoln administration throughout the war. Brigadier General John Cabell Breckinridge was an interesting case. At the time Mitchell wrote to the War Department, September 26, 1861, Breckinridge had just escaped arrest by the military government in Kentucky. He had been James Buchanan’s vice-president, and had run for president in 1860 on the southern Democratic ticket. Considered a traitor to the United States there was no doubt that General Mitchell was intent on capturing him, but more than likely he was not yet in a command role. Breckinridge was not appointed brigadier general until November 2, 1861.

<sup>76</sup> Frederick H. Dyer, *A Compendium of the War of the Rebellion* (Des Moines, IA: Dyer Publishing Company, 1908). Dyer listed Patterson’s engineers at “Camp Haskins” but further research suggests Dyer misspelled “Haskins.” Richard M. Robinson had leased prime real estate to the Federal government for the express purpose of establishing a training camp for soldiers. The exact location was at Hoskins Crossroads. It appears logical that when Patterson’s engineers advanced to Somerset they established Camp Hoskins not Camp Haskins.

Kentucky remained vulnerable to Rebel attacks from the southeastern part of Kentucky. Lincoln and Mitchell both wanted Zollicoffer driven from Barbourville and eventually from the state. In November, Union forces were successful in pushing the Confederates away from the turnpike, west, toward Somerset, where Patterson's men were ordered to build defenses at Camp Hoskins and Somerset in preparation for another Union strike at Zollicoffer. Patterson's engineers would remain at Somerset for the remainder of the year.

Meanwhile, Mitchell had secured the services of another engineer to plan the defenses of Cincinnati. Colonel Charles Whittlesey, born in Southington, Connecticut, was common school educated until attending, and graduating from, West Point in 1831. He was a lawyer, geologist, and archeologist in Cleveland, Ohio, when he joined the Union Army. Before the war he had done widespread surveying and mapping of the copper mines of northern Michigan, and he had begun geological research in Ohio. Now in Cincinnati, he began his army work.

If Kentucky's start to the Civil War in 1861 appeared confusing, disorganized, and inchoate, and many of its leaders appeared nonplussed (Mitchell and Thomas were welcome exceptions), other states also experienced muddled situations that autumn. This was certainly true in Michigan where men rushed to the recruiting stations to sign on as volunteers to teach the secessionists a hard lesson. The chaotic nature of northern mobilization was exacerbated when it came to recruiting volunteer engineers. By January 1, 1862 Michigan's governor had sanctioned, and the U. S. War Department mustered into service, a unit that could claim great notoriety by the end of the war—the First Michigan Engineers and Mechanics. Yet the five month journey the engineers experienced—from the first recruitment announcement to the first assignment—was another example of how difficult a task it was to build the Union Army, and how equally fortunate the army was in choosing to form volunteer engineer companies and regiments.

In the summer of 1861 James W. Wilson of Chicago began recruiting a regiment of engineers, and because the state of Michigan had organized more infantry companies than the War Department authorized, men of mechanical ability joined Wilson's regiment. By September companies for the Chicago regiment were being raised in Ionia, Marshall, Albion, and Grand Rapids, Michigan. In addition, Edwin P. Howland of Battle Creek had organized a company of engineers called the Battle Creek Corps who proceeded to St. Louis, Missouri, and were mustered into the army October 9, 1861.<sup>77</sup>

Two men recruiting the Grand Rapids company, one a surveyor and one a master carpenter, met in mid-September with others to decide if it "would not be better to raise an entire engineer regiment within the state...."<sup>78</sup> They agreed to ask a prominent civil engineer, William Power Innes, to organize and expand the efforts and as a result become the regiment's colonel. He agreed.

Innes sent telegrams to Secretary of War Cameron asking permission to form the regiment, and to Michigan Governor Austin Blair requesting that he send an endorsement to Cameron. Austin told Cameron that Innes was the general superintendent of the Grand Rapids Railroad, and this probably sealed the deal. Cameron, before the war, was involved in creating the Northern Central Railroad in Pennsylvania, and his assistant secretary, Thomas Scott, was vice president of the Pennsylvania Railroad, at the time the largest corporation in the world.<sup>79</sup>

In fact, Innes was not the superintendent of the Grand Rapids Railroad, but he did have a wealth of experience in the railroad business, not all of it, however, celebratory. His

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<sup>77</sup> Mark Hoffman, *"My Brave Mechanics": The First Michigan Engineers and Their Civil War* (Detroit: Wayne State University Press, 2007), 4. See also "Howland's Engineers," <http://www.michiganinthewar.org/engineers/howland.htm> (accessed March 10, 2013). The Chicago regiment never formed and continuous attempts to organize the regiment were finally abandoned in February 1862.

<sup>78</sup> Hoffman, 4.

<sup>79</sup> *O. R.*, ser. 3, vol. 1, 497 and 509.

engineering skills were learned as a laborer on the Erie Railroad and as a civil engineer for the Oakland and Ottawa Railroad, and he was responsible for a line running from Ada to Lake Michigan completed in 1858. During this time he also served as chief engineer for the “prospective Grand Rapids and Northern Railroad Company.”<sup>80</sup> Finally, the ambitious engineer had contracted the Amboy, Lansing, and Traverse Bay Railroad to build a line from Owosso to Lansing.

As Innes surveyed the road, he discovered that a massive sinkhole blocked the route. To address the problem he convinced the owners of the company to sink considerable capital into the effort to span the obstacle, but the project was suspended in 1860 and instead, Innes built a wagon road to carry passengers from the track that did operate the remaining few miles to Lansing.<sup>81</sup> The company was furious with Innes for the money wasted trying to cross the sinkhole, and he was fired.

Controversy aside, Innes had considerable engineering skills, as did the officers and men under him. Of his three senior officers, two were originally from New England and one from New York. One was a master mechanic, one a manufacturer, and one a railroad engineer. His company officers included civil engineers, carpenters, surveyors, a millwright, a joiner, and two farmers.<sup>82</sup> In Mark Hoffman’s *“My Brave Mechanics”: The First Michigan Engineers and Their Civil War*, the author provided a superb statistical summary of the regiment. In 1861, fifty-eight percent of the recruits were originally from New England or New York while approximately twenty percent were from Michigan and fifteen percent were foreign born. Fifty-two percent of

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<sup>80</sup> Hoffman, 9.

<sup>81</sup> Hoffman, 10.

<sup>82</sup> Hoffman, 14.

men enrolled in the regiment were mechanics or artisans, and about thirty-five percent were either farmers or laborers.<sup>83</sup>

During the fall of 1861, the officers of the First Michigan continued to recruit soldiers to fill out company rosters, and the men continued their training as engineer soldiers. By Christmas, General Halleck told the Battle Creek Engineers in St. Louis that they did not conform to Federal standards and, therefore, the men voted to disband, and an undersized unit calling itself Chadwick's Engineers from Marshall, Michigan also disbanded. All that remained was the First Michigan, and finally the regiment received its first assignment. Kentucky was regarded as the state where the Union Army in the West would launch its early 1862 offensive. So the Michigan men, anxious to begin their work, were sent to the Blue Grass State and deployed to several locations including to join Brigadier General George H. Thomas's division in Somerset.

As the Union Army groped its way through the fall and early winter of 1861-1862, it sought a plan to drive Confederate forces out of Kentucky and begin offensives against Tennessee and Virginia. The nascent Confederate Army was also trying to build a defense perimeter along the border of northern Virginia and the state's coastline, and out west from Columbus, Kentucky to the Cumberland Gap. Similar to commanders in the North, southern commanders were in urgent need of skilled engineers, so the government in Richmond along with the governor of Tennessee and General Johnston could begin to construct permanent fortifications. Unfortunately, the pre-war shortage of southern trained engineers combined with the few West Point engineers who resigned their commissions to join the Confederacy were not enough to meet the southern need. For example, in November 1861 the Secretary of War wrote General Joseph E. Johnston requesting an engineer be sent to General Thomas J. (Stonewall) Jackson in western Virginia. "General Jackson is urging me to send him an engineer,

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<sup>83</sup> Hoffman, 320.

and I have not one at my command. Have you one that you can possibly spare him?" Johnston responded the following day, "We have but one engineer officer, who is sick. We require more."<sup>84</sup>

The Confederate Congress had confirmed President Jefferson Davis's first appointments to engineer officers on March 16, 1861, and all of them were West Pointers. No orders or accommodations were made for engineer troops. Furthermore, these initial appointments included only two majors and five captains leaving the role of chief engineer (a colonelcy) vacant.<sup>85</sup> There was also no Engineer Department established. Major Josiah Gorgas, the chief of the Confederate Ordnance Bureau served as "Acting Chief Engineer."<sup>86</sup>

Gorgas found managing two major responsibilities very trying. Demands for engineers came from Tennessee, North Carolina, Georgia, and armies in the field. On April 19, 1861 North Carolina Governor J. W. Ellis telegraphed President Davis, "I am greatly in need of an engineer and artillery officers."<sup>87</sup> With virtually no assistance from Montgomery, Alabama (the first Confederate capital) and eventually Richmond, governors turned to state engineers and local civil engineers, many of whom were incompetent. Gorgas complained to the Confederacy's first Secretary of War, Leroy P. Walker that he could not effectively perform both jobs. An engineer

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<sup>84</sup> Robert E. L. Krick, *Staff Officers in Gray: A Biographical Register of the Staff Officers in the Army of Northern Virginia* (Chapel Hill, NC: The University of North Carolina Press, 2003), 15-16. See also *O. R.*, ser. 1, vol. 5, 953.

<sup>85</sup> James L. Nichols, *Confederate Engineers* (Tuscaloosa, AL: Confederate Publishing Company, Inc., 1957) 10-11. The two majors were William H. C. Whiting and Danville Leadbetter. The captains were Walter H. Stevens, William R. Boggs who served as first lieutenant of ordnance in the U. S. Army, Edward P. Alexander, Samuel H. Lockett, and William H. Echols a topographical engineer.

<sup>86</sup> Nichols, 11.

<sup>87</sup> Nichols, 15

officer was needed to command the Engineer Bureau. Major Danville Leadbetter was finally ordered to Richmond in August to take control of the bureau as “acting chief.”<sup>88</sup>

Immediately after Virginia seceded from the Union in May, the governor, John Letcher, did take steps to build a defensive system using state engineers. Andrew Talcott staked out his chosen locations for batteries along the James River, Thomas H. Williamson marked defenses for Aquia Creek, the terminus for the Richmond, Fredericksburg & Potomac Railroad, and Alfred L. Rives and Richard K. Meade designed a defensive line on the peninsula southeast of Richmond. Simultaneously, Talcott began to map out and construct the defenses of Richmond.<sup>89</sup> The city council’s “Committee on Defense” was responsible for providing the work force, and the Provisional Confederate Army was assigned the task of providing engineers to supervise the redoubts and entrenchments. Unfortunately, there were just not enough engineers available to manage the construction. An Engineer Department memorandum dated October 28, 1861 listed just five officers supervising the defensive works in Richmond while thirty-one others were assigned to other projects throughout the state.<sup>90</sup> Furthermore, there was a shortage of laborers to build the fortifications.

On July 23<sup>rd</sup> Governor Letcher asked an officer to discharge a Private George P. Hughes from his current duty station so “that he may be employed as overseer on the Richmond defenses.”<sup>91</sup> The following day engineers requested two balls and chains “for the benefit of runaway negroes,” and the Engineer Department’s “Slave Rolls” for July through October indicated the vast majority of men who worked on the Richmond defense to be slaves. Men

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<sup>88</sup> Nicholas, 24.

<sup>89</sup> Nicholas, 17-19.

<sup>90</sup> List of Officers in the Engineer Service of the State of Virginia, October 28, 1861, Military Affairs: Engineer Department Index to Letters Received 1861, Index to Letters Sent 1861, accession number 36887, box 4, number 73, The Library of Virginia, Richmond (hereafter cited as Letters Received and Sent, Library of Virginia).

<sup>91</sup> Letters Received and Sent, Library of Virginia, number 437.

named Buck Woods, Willie, Jack, Charles, and Bird worked twelve to fourteen hours a day for fifty cents.<sup>92</sup> (Slaves working on the Richmond fortifications had to pay for their own shoes, clothing, and food. The slave's owner decided if the slave could keep whatever money was left over.) There were anywhere between forty to seventy slaves working on the defenses at one time. Fewer than ten white laborers worked on the fortifications earning one dollar per day. There were usually an equal number of white and black carpenters, the former earning two dollars per day and the latter earning one-dollar per day. Slaves who had no shoes were provided with a pair and then had \$2.50 taken from their pay. Finally, the Engineer Department listed six overseers on their rolls each paid forty dollars per month.<sup>93</sup>

By December 1861, the Engineer Department appeared more concerned about reimbursing owners of slaves "at the rate of 70 cents per diem—50 cents only allowed when rations are furnished," than completing the defenses around the capital.<sup>94</sup> As the war began to heat up, Confederate organizers formed infantry regiments, artillery batteries, and cavalry battalions, but there were only a small number of engineer officers of skill to work on the various fortifications along the coastline, to construct defenses in cities, and to serve in the field with the army. There were no pontoon trains being built and no engineering companies formed. Moving dirt was to be the job of African American slaves. In the antebellum South, as we have seen, education was reserved for the elite of society, and those men with technical knowledge educated as engineers, especially at West Point, were considered even more

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<sup>92</sup> Pay Roll of sundry persons employed by the Commonwealth of Virginia for Coast, Harbor, and River defenses, and on the defensive works at Richmond, Index to Material Book of Engineer Department of Virginia 1861, The Library of Virginia, Richmond (hereafter cited as Pay Roll, The Library of Virginia). Engineer Department, Slave Rolls, July, August, September 1861 for Richmond, accession number 36887, folder 9, box 8, The Library of Virginia, Richmond (hereafter cited as Slave Rolls, The Library of Virginia).

<sup>93</sup> Pay Roll, The Library of Virginia and Slave Rolls, The Library of Virginia.

<sup>94</sup> Letters Received and Sent, The Library of Virginia, number 387.



uniquely educated than most. The paradox here was that most of society's wealthy made their fortune from the land, and watched carefully that engineering and manufacturing did not interfere with the enormous wealth generated by plantation farming. Engineers were valued, yet there was limited incentive to become one. In Robert E. L. Krick's book *Staff Officers in Gray: A Biographical Register of the Staff Officers in the Army of Northern Virginia*, the author pointed out that of the 1,149 men that served as staff officers under Joseph E. Johnston and Robert E. Lee (both West Point trained engineers) only eighty-seven were engineers before the war. Of those eighty-seven men, three were machinists, three were ironworkers, and four were carpenters.<sup>95</sup>

Out West in 1861 Confederate engineering operations were as problematic as they were in the East. General Albert Sidney Johnston's Army of Tennessee was not just establishing a defensive line to prevent Federal forces from invading the South west of the Appalachian Mountains, but the army was also protecting the Confederacy's largest producer of pig iron, and bar, sheet, and railroad iron in the region.<sup>96</sup> There were more than seventy-five furnaces and forges between the "fifty-mile-wide belt" of the Cumberland and Tennessee Rivers, where several hundred white laborers and thousands of slaves manned the operations.<sup>97</sup> Yet, interference from the Tennessee governor, poor engineering decisions, and a lack of interest in white laborers to build defenses would cost the Confederacy the entire region, and help make the first northern hero of the war, Ulysses S. Grant. His reputation established, he would go on to defeat Confederate armies both in the West and East, and in doing so would put his own engineers and manpower to brilliant use.

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<sup>95</sup> Krick, 40.

<sup>96</sup> Thomas Lawrence Connelly, *Army of the Heartland: The Army of Tennessee, 1861-1862* (Baton Rouge: Louisiana State University Press, 1967), 8.

<sup>97</sup> Connelly, 9.

The governor of Tennessee, Isham Harris, was both a remarkable help and hindrance to the Confederacy in the summer and fall of 1861. The governor worked endlessly and with considerable success to raise a fighting force, which boasted of twenty-four infantry regiments, ten artillery batteries, and Engineer Corps, Quartermaster and Ordnance departments, and an Ordnance Bureau.<sup>98</sup> He turned all of this over to the Confederacy and General Johnston. Like many politicians especially in the South, Harris also believed in his unfeigned ability to understand and execute military strategy, and it was this characteristic of his that unlocked the monster within. Alexis de Tocqueville said of southerners, "The citizen of the Southern states becomes a sort of domestic dictator from infancy; the first notion he acquires in life is that he was born to command, and the first habit he contracts is that of ruling without resistance."<sup>99</sup>

Harris believed in his ability to command, and he believed his efforts in recruiting soldiers earned him that right. Placing great trust in General Gideon Pillow's assessment that because of Kentucky neutrality, Union forces would strike south from western Tennessee, Harris concentrated forces along the Mississippi at forts under construction, leaving middle and eastern Tennessee vulnerable, and defenses along the Cumberland and Tennessee Rivers neglected. This was a serious blunder.<sup>100</sup>

In the spring, before Tennessee adopted its Ordinance of Secession, Harris had requested two civil engineers, Adna Anderson and Wilbur R. Foster, to identify sites for fortifications along the rivers. Anderson had served as an engineer for railroads in Connecticut, and New Hampshire, was chief engineer of the Tennessee & Alabama, and superintendent of the Edgefield & Kentucky. Eventually, when the State of Tennessee voted to approve secession on June 8, 1861, Anderson offered his services to the Federal government and would soon

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<sup>98</sup> Connelly, 25.

<sup>99</sup> David Donald, *Lincoln Reconsidered* (New York: Vintage Books, 1961), 223.

<sup>100</sup> Forts Harris, Wright, and Pillow, and defenses at Memphis were being built. See Connelly, 39.

become assistant engineer and chief of the Military Railroad Bureau's construction corps in Virginia. He would serve the United States government with distinction throughout the war. Foster would go on to serve in the Confederacy's corps of engineers.

So when working for the state of Tennessee before secession, Anderson selected a site on a steep hillside near the town of Dover. The fort, protected by deep gullies, was started immediately with earthworks dug by slaves from the Cumberland Rolling Mills. Foster wrote that after a "careful examination and study of all the topographical details, the first, or water battery at Fort Donelson was located by Mr. Anderson."<sup>101</sup> Anderson and his party then crossed the river, and moving west, paid studious attention to the flatlands between the Cumberland and Tennessee. Accessing the high-water mark along the flood plain was crucial to identifying the most feasible location for the second fort.<sup>102</sup>

Anderson selected a site "shortly below the mouth of Standing Stone [Rock] Creek and nearly opposite the mouth of the Sandy [river]."<sup>103</sup> The engineer lacked a labor force so he returned to Nashville and presented his recommendations to Governor Harris. As it turned out it was an excellent location for a fort, but perhaps the governor started to question Anderson's loyalty. Harris wanted a second opinion so he sent a West Pointer (class of 1825 who resigned his commission in 1826) Brigadier General Daniel S. Donelson, to investigate the situation and report back to the governor. Donelson's qualifications for this mission included several years in the state legislature, running a large plantation, and serving as brigadier general in the state militia. A comedy of errors ensued. Donelson disliked Anderson's choice and instead found an

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<sup>101</sup> Bromfield L. Ridley, *Battles and Sketches, Army of Tennessee 1861-1865* (Mexico, 1906), 63-66.

<sup>102</sup> Benjamin Franklin Cooling, *Forts Henry and Donelson: The Key to the Confederate Heartland* (Knoxville: The University of Tennessee Press, 1987), 46.

<sup>103</sup> Cooling, 46.

alternative site—Kirkman’s Old Landing, twelve miles due west of the fort being built at Dover. A third site also attracted Donelson’s attention across the river at Pine Bluff, Kentucky.<sup>104</sup>

The final position for what was to become Fort Henry was determined in June 1861 when Colonel Bushrod Rust Johnson, a recently commissioned Confederate engineer, confirmed that Donelson’s site at Kirkman’s Old Landing was the spot to construct the fort. Johnson was a 1840 graduate of West Point, had served in the army during the Seminole War and in the Mexican War as an infantry officer before he was dismissed on charges that he was operating an illegal contraband business through the commissary department. He then taught at the Western Military Institute in Kentucky as a chemistry professor, and when it merged with the University of Nashville, he became the superintendent of the school as well as a professor of civil engineering. There was no evidence suggesting he had any practical civil engineering experience. Whether or not he had engineering experience, Johnson selected a bad location to build a fort.

There were several problems. First, because of Kentucky’s neutrality the fort was built on the east bank of the Tennessee River. This meant that the fort was vulnerable to attack from the north and west bank of the river. Furthermore, construction was in its early stages when bishop turned Confederate Major General Leonidas Polk, moved into Columbus, Kentucky, violating the state’s neutrality. If Confederate strategists had paid close attention and had understood the basic topography, the fort could have been shifted to the west bank or Kentucky side of the river. This would mean the river would block land forces coming from the east.

Next, a range of hills sat on the west bank, which would allow enemy guns to command the fort’s parapet. In addition, the guns of the fort all faced downstream. Johnson reported that Fort Henry comprised a “good, inclosed [sic] work, with Bastion fronts, mounting six 32-

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<sup>104</sup> Cooling, 47.

pounders and two 12-pounders.”<sup>105</sup> Once Federal gunboats ran under the guns, the fort was helpless.<sup>106</sup> Colonel Adolphus Heiman of the 10<sup>th</sup> Tennessee Infantry, who was to garrison the fort, sounded the alarm about the problems at Fort Henry. Attached to his garrison troops was Captain Jesse Taylor’s Company H, Fixed Artillery from the state artillery corps. Taylor discovered the final and most disturbing fact about the fort.<sup>107</sup>

He discovered that in the ordinary February rise of the Tennessee River “the highest point in the fort would be under two feet of water and the lower river batteries nine feet of water.”<sup>108</sup> Taylor expressed his concerns up the chain of command, which at the time was confusing. General Johnston, in overall command, asked his staff engineer, Lieutenant Joseph Dixon to report on the progress of the two forts. The construction was moving at a snail’s pace because there were not enough laborers to complete the defenses along the river. “None of the slave owners wished to lose harvests by renting slaves to the government...and an additional 2,000 were required for the twin river forts.”<sup>109</sup>

Dixon reported that neither fort was in an ideal location, but the work should continue. Heimen, in the meantime wrote to state provisional army engineer, Lieutenant F. R. R. Smith. Smith suggested obstructing the navigable streams and the two rivers with cable chains and anchors, which Heiman considered useless. He wrote regarding the obstructions, “This will be a fruitless operation in a river which rises from low-water mark at least 57 feet, and which I myself have often known to rise at least 10 feet in 24 hours.”<sup>110</sup> Polk, the district commander, paid little

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<sup>105</sup> Cooling, 49.

<sup>106</sup> Connelly, 19.

<sup>107</sup> Captain Jesse Taylor, “Defense of Fort Henry,” in Robert U. Johnson and Clarence C. Buel, eds., *Battles and Leaders of the Civil War*, 2<sup>nd</sup> ed., vol. 1 (New York: The Century Company, 1956), 368-69.

<sup>108</sup> Connelly, 19.

<sup>109</sup> Connelly, 56.

<sup>110</sup> Cooling, 53.

attention to Heiman's complaints. The bishop was focused on his defenses at Columbus so he wrote Heiman a dismissive note, "Your report of dispositions for defense of Forts Donelson and Henry are satisfactory and I hope you will not relax your vigilance."<sup>111</sup>

On October 17<sup>th</sup> Johnston told Polk to "hasten the armament of the works at Fort Donelson and the obstructions below the place at which a post was intended."<sup>112</sup> Coinciding with the order came the arrival of Major Jeremy Gilmer, a former engineer in the United States Army, who was now responsible for the twin forts, superseding Dixon as chief engineer, and for establishing a second line of defense on the Cumberland River near Clarksville. Gilmer specialized in map making, surveying, and constructing fortifications including a fort in San Francisco, California.

Inspecting the twin forts with Dixon, Gilmer made five critical decisions. First, he agreed with Senator Gustavus Henry (the fort's namesake) that with Heiman's garrison at Fort Henry, it was "in fine condition for defense."<sup>113</sup> Next Gilmer agreed with Dixon that Fort Donelson would have been better located at Lineport, fifteen miles north, but "as the works at Fort Donelson were "partly built"...he advised Dixon to complete the position."<sup>114</sup> Third, Gilmer believed the guns at Fort Donelson inadequate, and he ordered two naval guns, four additional 32-pounders and "two 8-inch Colombiads or long range Parrott guns, all with garrison charges," to defend against Union gunboats.<sup>115</sup> Fourth, he planned for river obstructions placed beneath the batteries at Fort Donelson. Finally, he moved south to Clarksville where he laid out plans to build a second line of defense as General Johnston requested, but whether he wanted to take in planter hospitality in Nashville, or he had supreme confidence in his assistants, Gilmer did not

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<sup>111</sup> *O. R.*, ser. 1, vol. IV, 463 and 488.

<sup>112</sup> *O. R.*, ser. 1, vol. IV, 456, 463-469. See also Nichols, 43 and 44.

<sup>113</sup> Cooling, 54.

<sup>114</sup> Nichols, 44.

<sup>115</sup> *O. R.*, ser. 1, vol. IV, 496-497, 506, and 514.

personally supervise the construction at the forts so he was unaware that a lack of slave labor, “the reluctance of troop commanders to employ their soldiers on such work,” and illness among the men already on garrison duty slowed the construction to a crawl.<sup>116</sup>

Manpower was a problem at the forts so Johnston asked Polk if he could send 5,000 from his command at Columbus, but the latter responded that he could not because it would weaken his defenses. Johnston, who also had never inspected the twin forts and was operating in the dark decided in mid-November to send Brigadier General Lloyd Tilghman to supervise the construction efforts on the two rivers. Graduating near the bottom of his West Point class of 1836, Tilghman had entered the dragoons and after resigning from the army he had worked as a civil engineer on several railroad developments. Johnston was delighted to have Tilghman on board, and the first thing he did was to stop the construction of the timber obstructions Gilmer had ordered built under the guns at Fort Donelson. Gilmer was enraged about Tilghman’s meddling, and so Gilmer told the local civil engineer in charge of building the obstructions to ignore Tilghman’s order, which the civilian engineer did.

Then on November 20<sup>th</sup> Gideon Pillow, who had temporarily replaced the injured Polk at Columbus, ordered Dixon to move from Fort Donelson to Fort Henry, and supervise the construction of a fort on the west bank of the Tennessee River.<sup>117</sup> When Gilmer learned this and that Alabama slaves and whites “would work together on construction gangs,” he issued a formal complaint to Johnston, and Dixon was returned to Donelson.<sup>118</sup> When the year finally

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<sup>116</sup> Cooling, 56.

<sup>117</sup> Cooling, 59.

<sup>118</sup> *O. R.* ser. 1, vol. VII, 685, 692-700, 703-704, 709, 719, 723-724, and 733-735. See also Connelly, 104-105. Pillow was scheming. By late November he started to report an increase in enemy forces in front of him. The numbers went from 25,000 to 100,000 Union soldiers. Pillow was attempting to get reinforced so he could launch a winter offensive in the vicinity of Cairo, Illinois. Unfortunately, Pillow’s alarming reports focused attention on him (part of his plan) and away from the twin forts.

ended, the forts remained vulnerable and incomplete. Confusion was ubiquitous. The chain of command was broken. Johnston, Polk, Pillow, Tilghman, Harris, and Gilmer all worked at cross-purposes. There were no laborers available to work on building the fortifications because, for the most part, slaves were the only southerners who dug and moved dirt. White men joined the army to handle a rifle, not a shovel. Finally, the engineers had made several unfortunate decisions.

December 31, 1861 marked the final day of the war's first year. Since April two battles had been fought, one at Manassas Junction, Virginia and the other at Wilson's Creek, Missouri. Considering what was about to come, the death toll at both battles was low. Nonetheless, wives had lost their husbands, children their fathers, parents their sons. Now, the new year would bring unmerciful suffering as the fighting, killing, and dying started in earnest. Both armies had spent the fall and early winter of 1861 preparing, mustering, training, and organizing the men who would fight the war. The engineers, North and South, had played a supporting role in each side's mobilization efforts. Their limited activities did demonstrate a difference in how Union and Confederate leaders anticipated the use and need for engineers, and these early months revealed how the combatants would build an army that reflected different cultures and emphasis.

In the North the army had formed an Engineer Battalion, four volunteer engineer regiments, and two volunteer engineer companies.<sup>119</sup> These engineer officers and troops had started building pontoon trains, they had worked at making repairs to railroads and bridges, and they built fortification, some as small as in Somerset, Kentucky, and some large as the

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<sup>119</sup> Other engineer units were formed and served anywhere from three to thirteen months. These were the following: Chadwick's Engineers (August-October, 1861); Howland's Battle Creek Engineers (October-December, 1861); Wolster's Independent Company of Sappers and Miners (May-September, 1861); Balz's Company of Sappers and Miners (October 1861-February 1862); Gerster's Independent Company of Pioneers (August 1861-September 1862).



fortifications, which encircled Washington, DC. The officers of the volunteer regiments and companies were not West Pointers. These men were civil engineers, mechanics, railroad builders, and surveyors. The troops they led were made up of men from a variety of trades—mechanics, boat builders, carpenters, millwrights, masons, and farmers. Some were unskilled laborers, but none were averse to working with their hands, getting dirty, digging holes, and hauling equipment.

The Confederate Army had also organized an Engineer Bureau and a Corps of Engineers, although President Davis had yet to assign a permanent head to the department. The president required that all the officers be from West Point, but states enlisted the service of their own civilian engineers to help build coastal fortifications. There were no engineer troops. The labor being used to construct the fortification along the Virginia coast, at Richmond, Columbus, Kentucky, Forts Henry and Donelson, and along the Mississippi was predominantly African American slaves. Finally, because a West Point engineer was not available when it was time to consider laying out plans to construct forts on the Tennessee and Cumberland Rivers, a civilian was first sent. Adna Anderson was concerned about the flood plain in the region, and he reported this to the governor. The governor should have listened to him. Because Anderson was not a West Pointer, however, Major Bushrod Johnson was sent. He had little engineering experience to corroborate Anderson's work. He sited the fort in the flood plain.

Now with battles such as Forts Henry and Donelson, Island Number 10, Seven Days, Corinth, and Fredericksburg on the horizon and with railroad bridges to build and repair, and maps to make, the engineers prepared to march.

## CHAPTER 5

### Trial and Error

**That man Haupt has built a bridge across Potomac Creek, about 400 feet long and nearly 100 feet high, over which loaded trains are running every hour, and, upon my word, gentlemen, there is nothing in it but beanpoles and corn stalks.**

**Abraham Lincoln as told to Herman Haupt, May 1862**

**Our canal has been a gigantic work.... Six miles, through a great forest of immense trees, which had to be sawed off 4 feet under water, and then through cypress swamp thickly studded with cypress knees, have furnished us with an amount of labor surpassing any one's belief who has not seen it. We have now a canal 50 feet wide, 4 feet deep, and 6 miles long, through which large steamers can pass and all our supplies be delivered to us.**

**Major General John Pope, commanding Union forces at New Madrid to Major General Henry Halleck, April 2, 1862**

Beginning in 1862 with the Union campaign to capture Island No. 10 and the development of the United States Military Railroad, the Federal army used ingenuity and innovation to move and supply a massive number of men, horses, and equipment into the Confederate heartland. These logistical efforts struck hard at the Confederacy and weakened the South's ability to take advantage of her major strengths—internal lines of communication, and a complex geography, which should have made it extremely difficult for Union armies to operate inside the Confederacy.

It is equally critical to understand the Confederacy's inability to sustain a strong engineering presence during the war, and this also began early in 1862. Fort Henry, Fort Donelson, and Island No. 10 guarded the all important Cumberland, Tennessee, and Mississippi Rivers and Union army control of these vital arteries into the South. The extraordinary story of the site selection and subsequent loss of Fort Henry in February 1862 served as foreshadowing of what was, with some exceptions, to come for Confederate engineering operations. In addition, the inability of the Confederate government to nationalize the railroads or even to

develop policies to manage and keep them in repair demonstrated a lack of understanding of the management effort it would take to win a protracted war.

The first year of significant fighting began with the Battle of Mill Springs fought in southeastern Kentucky on January 19, 1862.<sup>120</sup> By Civil War standards, the battle itself was no more than a skirmish. Union and Confederate casualties combined were estimated at six hundred soldiers, including the death of Confederate general Felix Zollicoffer. The minor Union victory, however, had major implications for each side's strategic objectives, tactical maneuvers, and naval operations on the rivers. These objectives, maneuvers, and operations in turn, would be successful only if Northern and Southern engineers could do their jobs with skill and imagination. Eighty-four years after Mill Springs, British Field Marshal Archibald Wavell wrote, "The more I see of war, the more I realize how it all depends on administration and transportation.... It takes little skill or imagination to see where you would like your army to be and when; it takes much knowledge and hard work to know where you can place your forces and whether you can maintain them there."<sup>121</sup>

Mill Springs left the Union Army in control of the Cumberland River to Carthage, Tennessee (about sixty miles from Nashville) and on the flank of Southern forces in Bowling Green. As a result of the Union army's position, Confederate General Albert Sidney Johnston shifted his western line of defense abandoning all of southeastern Kentucky. He anchored his right flank at Bowling Green and his left flank at Columbus, Kentucky, with the center of his line at Forts Henry and Donelson. Johnston's ability to "know where he could place his forces and whether he could maintain them there," required four elements: solid intelligence of enemy

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<sup>120</sup> The battle was also known as Logan's Cross Roads, Fishing Creek, Somerset, and Beech Grove.

<sup>121</sup> Martin Van Creveld, *Supplying War: Logistics from Wallenstein to Patton* (Cambridge: Cambridge University Press, 1977), 231-232.

movements, maintenance of the railroad so he could move men and supplies quickly to the point of the Union attack, strong fortifications, and nerves of steel. His engineers were responsible for the forts and railroads. Unfortunately for the Confederacy all four elements would fail Johnston, and the warning signs after Mill Springs turned into a tidal wave of defeat that swept Southern forces out of Kentucky and away from the vital manufacturing center of Nashville, Tennessee.

It was true that the lack of intelligence reports from spies and partisans in Paducah prevented Brigadier General Lloyd Tilghman and his Confederate defenders at Fort Henry from catching Grant's men unawares as they disembarked from their river boats at Bailey's Ferry on the west bank of the Tennessee River approximately three miles north of the fort. Three days before Grant's attack on Fort Henry, Tilghman and Major Gilmer of the engineers left the fort to inspect the defenses of Donelson and only returned to Fort Henry after receiving word from a courier that Fort Henry was under attack. Tilghman wrote that upon his arrival, "I soon became satisfied that the enemy were really in strong force at Bailey's Ferry, with every indication of reinforcements arriving constantly."<sup>122</sup>

Tilghman was in trouble. The fort was poorly sited, poorly planned, and poorly made. And he knew it. With this in mind, did he stay and fight buying time so that further preparations could be made to strengthen Fort Donelson? Or did he evacuate immediately and march his small garrison to Donelson? A third possibility was to move to Clarksville, eighteen miles east of Fort Donelson on the Cumberland River and re-enforce this critical supply depot which was also the final fort along the Cumberland before Nashville. With Federal gunboats within range of his position, he decided to stay and fight. It was an honorable choice ... and a bad one.

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<sup>122</sup> *O. R.* ser. 1, vol. VII, 137.

In his book, *Unconditional Surrender: The Capture of Forts Henry and Donelson*, historian Spencer C. Tucker wrote: "The fort covered three acres of ground with a five-sided earthwork parapet about eight feet high. Rifle pits extended to the river and along the water and from outside of Fort Henry's perimeter some two miles east toward Dover and Fort Donelson."<sup>123</sup> When Tilghman arrived in January 1862, one of his responsibilities was to finish building an additional fortification directly across the river opposite Fort Henry on the high ground overlooking the surrounding area. This was never accomplished. Yet, according to the chief engineer of the Western Department, Jeremy Gilmer, his boss was not to blame. When Gilmer arrived on January 31<sup>st</sup> "by the exertions of the commanding general, aided by Lieutenant Joseph Dixon, his engineer officer, the main fort...had been put in a good condition for defense, and seventeen guns mounted on substantial platforms, twelve of which were so placed as to bear well on the river."<sup>124</sup> Furthermore, it was Dixon who had been assigned the task back in late November of building the additional fort on the west bank of the river, and he was promised that a large force of slaves from Alabama, with the troops to guard them, would arrive soon to work. This was not what white soldiers were paid to do. Yet, "by some unforeseen cause the negroes were not sent until after the 1<sup>st</sup> of January last. Much valuable time was lost...."<sup>125</sup> Gilmer finally reported that on February 1<sup>st</sup> the new works, Fort Heiman, was only a few days away from completion.

When Grant and Foote's attack came on February 6<sup>th</sup> the fort, contrary to Gilmer's report, was not in good condition. The Federals opened fire at 11:45am and the battle was over just two hours later. The upper Tennessee River was lost to the Confederacy for the remainder

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<sup>123</sup> Spencer C. Tucker, *Unconditional Surrender: The Capture of Forts Henry and Donelson* (Abilene, TX: McWhiney Foundation Press, 2001), 48.

<sup>124</sup> *O. R. ser. 1*, vol. VII, 131-132.

<sup>125</sup> *O. R. ser. 1*, vol. VII, 132.

of the war and Tilghman, Gilmer, Colonel Heiman, and Lieutenant Colonel Milton A. Hayes, commander of Fort Henry's artillery all agreed as to why. "The fault was in its location, not in its defenders."<sup>126</sup>

The predictions made by some engineers in the late autumn of 1861 that a rising river would doom the fort were prescient. In fact, as the Tennessee River crested thirty feet above normal, Union ironclads, whose cannon elevation was limited, now found they were at eye level with the fort, making their fire very accurate. The ships moved in rapidly, floating over the mines, which had been anchored to the bottom of the river when it was at a normal level. Confederate engineers had not considered adjusting the anchor cables as the river rose.<sup>127</sup>

Tilghman made it perfectly clear when he filed his official report of the bombardment of Fort Henry that "the wretched military position of Fort Henry and the small force at my disposal did not permit me to avail myself of the advantages to be derived from the system of outwork built with the hope of being re-enforced.... The entire fort...is enfiladed from three or four points on the opposite shore, while three points on the eastern bank completely command them both, all at easy cannon range."<sup>128</sup>

The general made little notice, however, in his reports to Adjutant General Samuel Cooper of the rising river water, which threatened to "eat away the earth and mud walls of the fort," although he did declare with hubris that, "The history of military engineering records no parallel case," to match what he had to endure in trying to defend such a poorly sited fort.<sup>129</sup> Colonel Heiman was less bashful. He wrote that additional torpedoes were sunk in the river, but

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<sup>126</sup> *O. R.* ser. 1, vol. VII, 147.

<sup>127</sup> Cooling, 88.

<sup>128</sup> *O. R.* ser. 1, vol. VII, 139.

<sup>129</sup> Nichols, 46 and *O. R.* ser. 1, vol. VII, 139.

“were rendered utterly useless by the heavy rise of water.”<sup>130</sup> In addition a “large force” tried to keep the water out of the fort. “The lower magazine had already 2 feet of water in it, and the ammunition had been removed to a temporary magazine above ground, which had but very little protection, but we had been at work day and night for the last week to cover it with sand bags and to protect it by a traverse.”<sup>131</sup>

So with Fort Henry in Federal hands Grant and Foote moved in a combined operation to capture Fort Donelson on the Cumberland River. Donelson was constructed on the west bank of the river near the town of Dover on high formidable ground. This citadel was strong and had none of Fort Henry’s flaws. It would take a two-day siege to capture the fort and most of its garrison opening the Cumberland for a Union advance on the undefended Nashville.

The fall of Henry and Donelson was a serious blow to the Confederacy. Historian Richard D. Goff wrote, “The consequences that followed the loss of Forts Henry and Donelson may well have been the greatest single disaster of the war.”<sup>132</sup> A. S. Johnston had formed his western defensive corridor based on Jomini’s principle of operating forces on internal lines of communication. The theory was simple: place your soldiers in geographic locations where men and supplies could be quickly moved from one point on the line to another, in order that the commanding general may at once concentrate his forces to exploit a weakness in the enemy’s line or concentrate forces to withstand an enemy attack. Johnston’s defensive position, from Bowling Green to Columbus, was on just such a line linked by three railroads.<sup>133</sup>

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<sup>130</sup> O. R. ser. 1, vol. VII, 149.

<sup>131</sup> O. R. ser. 1, vol. VII, 149.

<sup>132</sup> Richard D. Goff, *Confederate Supply* (Durham: Duke University Press, 1969), 56.

<sup>133</sup> Robert C. Black, III, *The Railroads of the Confederacy* (Chapel Hill: The University of North Carolina Press, 1998), xxiii-xxix. The Cumberland River acted as a thirty-one mile highway between the train station at Clarksville and Fort Donelson. It was sixty-three miles between Paris and Clarksville and forty-nine miles between Clarksville and Nashville. These were short distances by train. Ten miles separated the two forts connected by the Telegraph Road and just

The effective use of the railroads might have allowed Johnston to shift men from one point along his defensive line to another, matching Grant's attacking army in manpower, maneuverability, and supply. Unfortunately, the railroad lines were severely taxed, and although some men recognized the management challenge in moving men and materials, no one took charge of the situation. This only exacerbated the problem. The superintendent of the Louisville & Nashville, George B. Fleece, told Johnston's quartermaster on 2 January 1862 "at every station there is a large accumulation of freight, consisting of hogs, corn, flour, &c. The passenger travel (civilian) is also large. In addition to all, troops move in great numbers. In a word, the entire road is crowded with business to an extent unprecedented in the history of any branch of it."<sup>134</sup> In addition, with only ten engines, 120 box cars, and 55 flat cars in operation, this was less than half the number needed, Fleece estimated, to cover the entire 225 miles of rail lines. Under these circumstances the maximum capacity of the road from Paris to Bowling Green each day was twelve freight cars.<sup>135</sup>

Fleece, hoping to do "justice to the army, the stockholders, or myself" proposed he be granted permission to establish a new schedule "best adapted for the speedy, safe, and certain final accomplishment of all work," and that he be allowed to requisition engines and rolling stock from other roads with the promise that the Confederate government would pay for the inconvenience and the use of the "...machinery required."<sup>136</sup>

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south of this footpath, Bottom Road. There was no direct road from Paris to Fort Heiman. All the railroads were on five-foot gauges. From Bowling Green running due south was the Louisville & Nashville Railroad. From Bowling Green moving southwest was the Memphis, Clarksville & Louisville, which actually ended at Paris, Tennessee. This line then became the Memphis & Ohio, which connected Memphis, Humboldt, and Johnsonville, Tennessee, to Paris. The Mobile & Ohio Railroad, in its northern section, connected General Polk's army in Columbus, Kentucky, with Union City and Humboldt on a north/south axis

<sup>134</sup> *O. R. ser. 1, vol. 7, 818-819.*

<sup>135</sup> *O. R. ser. 1, vol. 7, 818-819.*

<sup>136</sup> *O. R. ser. 1, vol. 7, 819.*



Yet, any attempt to alter train schedules or procure additional engines would require voluntary cooperation from the civilian railroad superintendents, the general public, merchants, and army commanders. All these groups had different expectations and selfish needs. Superintendents were responsible for operating the railroads efficiently and for making money. Money in the winter of 1862 was a problem. All railroads were disinclined to take Confederate currency because it was difficult to determine the papers' value. In January the value of the currency fell as a result of discounting by Confederate purchasing agents, and consequently, the railroads were reluctant to substitute government business for private business. Next, the general public expected it would move freely and in a timely fashion along the lines, just as merchants expected their freight to be delivered to the place the railroad promised to deliver it, and not left rotting on a station platform because the army commandeered the trains. Army commanders would also argue over whose re-enforcements and supplies should take precedence over what trains.<sup>137</sup>

This situation was a nightmare. All Johnston did, or perhaps all he could do was to write Adjutant General Cooper January 8<sup>th</sup> requesting Cooper send him "a full corps of competent Engineers and Machinists" from Captain John S. Butler's "Railroad Boys" with the 1<sup>st</sup> Tennessee Infantry stationed in Winchester, Virginia.<sup>138</sup> Richmond did not answer Johnston's request, which left Johnston no choice but to ask for re-enforcements from all quarters. Prepared for the Union offensive, Polk at Columbus, Tilghman at Fort Henry, and Buckner, Floyd, and Pillow at Fort Donelson sent no one to Johnston.

Robert C. Black, III, in his book *The Railroads of the Confederacy*, argued the Confederate military and government faced a major obstacle in fixing the dismal state of

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<sup>137</sup> See A. S. Johnston's letter to Secretary of War J. P. Benjamin, January 5, 1862 in *O. R.* ser. 1, vol. 7, 820-822.

<sup>138</sup> Cooling, 84.

railroad transportation characterized by General Johnston's dilemma during the winter of 1862. How was the government to manage the task of creating a network of transportation links essential to moving supplies and men efficiently to counter Federal incursions into the South? How could they support Confederate armies in the field, and at the same time allow individual railroad companies their "rights" to operate freely, moving private freight and the general public along the same lines?

Black wrote that the Southern attempt to solve this problem was "hesitant, spasmodic, and largely ineffective."<sup>139</sup> The Provisional Congress did offer a radical solution: nationalize the railroads that ran through Richmond, Nashville, Memphis, and Atlanta.<sup>140</sup> The committee assigned to investigate railroad transportation continued, "Great delay, inconvenience, and expense is caused by the numerous unconnected track, which, if joined by links, short in distance, would not only increase the facilities for transportation and the capacity of the roads, but would save much time, labor, and expense in transferring troops and freight."<sup>141</sup>

The committee's recommendation was both outside the comfort zone of the states' rights Confederacy and it was farsighted. Two questions remained: First, would the Confederate congress and president actually embrace the committee's idea, as it represented the antithesis of the South's founding principles? Second, would the Confederacy actually have the men with management skills to execute such a plan? Most Southern lines seldom exceeded 200 miles in length, which meant that superintendents managed a centralized operation including ticketing locations, repair facilities, refueling and water stations, and track maintenance. The chain of command was compact with the man at the top able to watch over every facet of the business. Now the Provisional Congress (soon to give way to a permanent one) was asking for "proper

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<sup>139</sup> Black, III, 95-96.

<sup>140</sup> Black, III, 96.

<sup>141</sup> *O. R.*, series 4, vol. I, 884.

management” to oversee the increase in the number of trains run each day and to increase the speed which they travelled.<sup>142</sup>

To nationalize the railroad required a management team with the ability to establish a decentralized chain of command because track and engine repairs, civilian and military schedules, and emergency operational adjustments, would be spread over great distances and need a structure similar to the one developed by the Pennsylvania Railroad before the war. The president, secretary of war, quartermaster, ordnance, medical, and commissary departments, along with general officers in the field, would have to accept the central authority of the railroad head in order for the system to work. Finally, engineers and laborers would be needed to repair engines, build rolling stock, and properly maintain the track. The South had too few of these men, except African American slave laborers, before the war to meet the rising demand during the war.

The railroads did not serve General Johnston well as he attempted to defend, in early 1862, his extensive western front. More serious still were the disastrous results of the evacuation of Nashville. A manufacturing center and supply hub for Johnston’s Confederate forces, the city began to move war material south to the interior of the country at the time of Fort Henry’s capture. Johnston whose direct contact with Polk’s 17,000 men in Columbus, Kentucky, was now broken had abandoned Bowling Green and ordered 15,000 men of Major General William Hardee’s command to Fort Donelson, marching the remaining 7,000 men and supplies to Nashville.<sup>143</sup> If Fort Donelson was captured, Johnston believed he could not withstand a Union attack on the Tennessee capital. This was his reason for quietly shifting his major supply base from Nashville south.

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<sup>142</sup> *O. R.*, series 4, vol. I, 884.

<sup>143</sup> *O. R.*, series 1, vol. VII, 895.

The governor of Georgia, Joseph E. Brown, understood the importance of keeping precious Confederate supplies out of Union hands, and consequently, he loaned a number of locomotives and rolling stock from the Western & Atlantic Railroad to the Nashville & Chattanooga Railroad.<sup>144</sup> Unfortunately the Nashville track “contained no less than 1,200 broken rails,” so when Fort Donelson fell on February 16<sup>th</sup>, Nashville citizens panicked. People pushed their neighbors off passenger cars, merchants demanded to load their goods onto freight cars, and quartermasters tried to move massive amounts of ammunition, clothing, medical supplies, and food from army warehouses to the trains. Wealthy citizens and high- ranking military officers demanded to board trains with personal belongings and their slaves. No one saw the president of the Nashville & Chattanooga and the person responsible for the military stores in the city, Major V. K. Stevenson, during the eight-day evacuation.<sup>145</sup> The lack of proper management and the failure to plan for the army’s mass departure from Nashville cost the Confederacy vital war material that became increasingly difficult to procure or replace.

With a dysfunctional railroad system in place that injured Confederate western operations early in the war, Texas Congressman Peter W. Gray, introduced a resolution that the House Committee on Military Affairs “inquire whether further legislation is necessary to give increased efficiency to our interior lines of railroads.”<sup>146</sup> Finally, on March 27, 1862, members of the committee presented a railroad bill to the House. The bill offered an effective organizational scheme to manage Southern railroads. The president would appoint a “military chief of railroad

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<sup>144</sup> Black, III, 138.

<sup>145</sup> In an undated response to a congressional inquiry regarding the Nashville evacuation, Colonel Nathan B. Forrest reported that only a portion of the stores were removed before the city surrendered. Furthermore, because the army could not remove all the supplies, Forrest noted, “The quartermaster’s stores were open, and the citizens were invited to come and help themselves, which they did in larger crowds, if possible, than at the other department [commissary].” See *O. R.* ser. 1, vol. VII, 429-430.

<sup>146</sup> Black, III, 97.

transportation.”<sup>147</sup> District superintendents reported to the transportation chief, and these district managers had complete control of their own sections. In most ways the House bill was modeled on the management systems developed by a number of Northern railroad companies before the war. The bill, however, proscribed that everyone involved in military transportation be given “military rank and military responsibilities.”<sup>148</sup> This was designed to provide gravitas to railroad personnel especially when wrangling with civilian operators. The bill was a positive first step toward nationalizing the Confederacy’s railroads and addressing critical strategic, tactical, and logistic needs of the Southern high command. For some politicians, especially the fireaters, placing such control in the hands of the central government was an ideological abomination. Their goal was to prevent the bill from becoming law. They succeeded.<sup>149</sup>

Forthcoming was a storm of obstructions and amendments ultimately drowning the bill so by April 21<sup>st</sup> when the Senate Committee on Military Affairs “reported it without amendment” the lack of interest in the bill’s outcome resulted in its death.<sup>150</sup> The House struck out all the provisions of the original bill and then drafted a measure that required the Secretary of War to consult with civilian railroad officials regarding military operations. Yet, even at that Augustus R. Wright of Georgia, and Thomas J. Foster, filed a protest: “We believe that this act...would be subversive of, and in direct contravention to, the great and fundamental principles of State sovereignty....”<sup>151</sup> The authors went on to claim that railroad superintendents were most cooperative with military officials in moving materials and these same local managers were “more conversant with all the minute and complicated details of their

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<sup>147</sup> Black, III, 98.

<sup>148</sup> Black, III, 98.

<sup>149</sup> Black, III, 98.

<sup>150</sup> Black, III, 98-99. See *The Journal of the House of Representatives of the First Congress of the Confederate States of America*, vol. V, 152, 188, 215, 253-254, 269.

<sup>151</sup> *Journal*, vol. V, 269.

roads...than the Executive or his military subordinates could possibly be.”<sup>152</sup> The army’s experience in defending their western defensive line in the winter of 1862 suggested otherwise.

President Jefferson Davis displayed little leadership when it came to the railroads, vacillating between the suggestion that Congress provide the capital to construct government facilities for re-rolling rails, building locomotives, and leaving everything status quo. In a message printed in the *Wilmington Journal* written just after the fall of Fort Donelson, Davis said that Congress could appropriate the money to create government railroad facilities, but it is “equally clear, that when the military necessity ceases, the right to make such appropriations no longer exists. To exercise this power when it exists, and to *confine it within the proper limits*, is a matter for the just discretion of Congress....”<sup>153</sup>

The legacy of the Kentucky and Tennessee campaigns during the winter of 1862 revealed the problems to come for the Confederacy over the next three years of war. Few soldiers embraced the tedium of staff work that included the careful planning of logistics to support armies in the field. The Confederate Congress and the President believed that civilian railroad managers would place patriotic duty ahead of company profits, and that the army would not have to waste valuable manpower resources operating the railroads. Furthermore, even if local railroad agents placed patriotism ahead of profits, most had only managed small companies and had no training or experience in operating in a larger system.

Finally, the Confederacy lacked competent engineers. Certainly some men in this capacity would serve the South well, but efforts such as the shoddy work done at Fort Henry or the lack of follow through in Clarksville would persist throughout the war and it would be costly. The lack of mechanics, machinists, carpenters, ship builders, and railroad workers in the ranks

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<sup>152</sup> *Journal*, vol. V, 269.

<sup>153</sup> Message of President Davis on Railroads, *Wilmington Journal*, February 17, 1862, at [www.csa-railroads.com/Essays/Confederate\\_Railroads\\_Original\\_Documents.htm](http://www.csa-railroads.com/Essays/Confederate_Railroads_Original_Documents.htm).

harmful engineering operations. Southern engineers relied chiefly on slaves to make up their labor force, and white soldiers carried with them the Southern cultural attitude that it was beneath them to dig ditches.

Union engineering efforts and the creation of efficient railroad operations in the western theater of operations stood in stark contrast to that of the Confederacy's difficulties. In the aftermath of Forts Henry and Donelson, and Federal control of the Cumberland and Tennessee Rivers, Union General Henry Halleck's western army now set its sights on the Mississippi River and one of the Confederacy's major river blocks, Island No. 10.<sup>154</sup>

At the start of the war Confederate construction began on a series of forts along the Mississippi covering approximately twenty-two miles and running from just east of Osceola, Arkansas, (Fort Pillow) to Fort Pickering at Memphis.<sup>155</sup> Moving north, Brigadier General Gideon Pillow had devised an invasion plan to march an army to New Madrid, Missouri, where he would continue overland on the old King's Highway to Cape Girardeau, Missouri, link up with another Confederate force and then swiftly attack and capture St. Louis. Events moved quickly. Rumors spread that Federal gunboats were arriving at Cairo, Illinois, and Cape Girardeau, and so Pillow pressed his commanding officer, Major General Polk, to consider an alternate plan. Polk made two decisions. At Pillow's urging, Polk would march to Columbus, Kentucky, and fortify the area. This had several advantages. First, Columbus perched comfortably above the flood plain of the

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<sup>154</sup> At the time of the Forts Henry and Donelson campaigns the western command was divided between Halleck (Department of Missouri), headquartered in St. Louis and then Brigadier General Don Carlos Buell (Department of the Ohio), headquartered in Louisville. On March 11, 1862, Halleck was promoted to command the newly created Department of the Mississippi, giving him unified command of western forces.

<sup>155</sup> The locations were selected with some care. The series of forts built, Pillow, Wright, Harris, and Pickering were constructed on the only high ground along a 115-mile stretch to Island No. 10. (Moving south to north, the hills were identified as the third, second, and first Chickasaw Bluffs). Also, the forts were built in these locations because Confederate strategic planner, General Pillow and Governor Harris believed that as a result of Kentucky neutrality in 1861, the Union offensive along the Mississippi would come through southern Missouri.

Mississippi. Second, a fort at Columbus could prevent a Northern water invasion into western Tennessee. Third, Columbus was on the Memphis & Ohio Railroad. The one problem with the Polk/Pillow plan was that Confederate occupation of Columbus violated Kentucky neutrality.<sup>156</sup>

The second decision was to send topographical engineer, Asa Gray, to New Madrid to ascertain if the area had merit for establishing a line of defense below Columbus along the Mississippi. Gray discovered that just ten miles south of New Madrid, at the base of a “U” bend in the river, sat Island No. 10. As the river extended up the left arm of the “U” it bent again left “Ω” and then continued south. New Madrid was located at the top of the upside down “U.” Gray reported that the island had “no superior, in my judgment, above Memphis.”<sup>157</sup> The island was the tenth one south of where the Ohio River met the Mississippi, and it was one mile long and 450 yards wide. It was positioned in the middle of the channel near the borders of Kentucky to the northeast, Missouri to the north, and Tennessee to the east.<sup>158</sup> The batteries on the island and on the eastern Tennessee shore presented a vexing problem for Union gunboats attempting to pass. At New Madrid two forts, Thompson west of the city and Bankhead east of it also commanded the river. The Mississippi would be also at flood stage in February and March, inundating the land due north of the island, and consequently serving as a barrier to prevent Union soldiers from placing artillery near the island. The flooded area leaked into bayous and swamps. Four feet of water covered the base of tall trees and decayed stumps with jagged tops. The Yankees might consider floating barges through this mess to surround the island, but it was not going to happen.

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<sup>156</sup> Rowena Reed, *Combined Operations in the Civil War* (Annapolis, MD: Naval Institute Press, 1978), 207.

<sup>157</sup> *O. R.*, ser. 1, vol. III, 617-619, 654.

<sup>158</sup> Larry J. Daniel and Lynn N. Bock, *Island No. 10: Struggle for the Mississippi Valley* (Tuscaloosa: The University of Alabama Press, 1996), 6. There were woods between where the river turned north toward New Madrid and when it turned south. This parcel of land west of Island No. 10 was in Tennessee.



Island No. 10 was secure. General Polk's garrison in Columbus, Kentucky, was not. After the Confederate evacuation of upper Tennessee, General Halleck saw an opportunity to capture all of Polk's men by cutting off the Bishop's only escape route. Halleck's goal then was to occupy New Madrid. The man Halleck assigned to lead the operation was forty-year-old Brigadier General John Pope. A West Point graduate, class of 1842, Pope had served as a topographical engineer in the Regular Army and fought in Mexico. Hiding his movements from Polk, Pope began his operation from Commerce, Missouri, northwest of Cairo and eventually would move along the Sikeston Road south to New Madrid. Speed would win the campaign, which meant that a wagon train of two hundred teams filled with supplies had to keep pace with the advancing army.<sup>159</sup>

Colonel Josiah Bissell and his Missouri engineers were responsible for repairing the Sikeston road, and from the onset of the army's march weather conditions and geographical features forced the engineers to work at an incessant pace. The banks of the Mississippi were overflowed, and the river spread out on both sides for miles. To make matters worse, the area the army moved through was known as the Great Mingo Swamp. Pope wrote, it was "dismal and almost impassable...."<sup>160</sup> In some places the water was ten feet deep, and it was never less than one foot deep. Walking through the swampy backwater was like attempting to pass through quicksand. A correspondent with the troops said the men "waded in mud, ate mud, slept in it, were surrounded by it."<sup>161</sup>

The weather was cold and wet, and drizzling rain and snow was the soldier's constant companion. Pope reported, "An old embankment upon which a corduroy road had been built, extended part of the way to New Madrid, but the road had not been repaired for years, and was

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<sup>159</sup> Daniel and Bock, 43.

<sup>160</sup> *O. R.* ser. 1, vol. VIII, 80. The swamp was approximately thirty miles wide.

<sup>161</sup> Daniel and Bock, 43. See *Cincinnati Commercial*, March 10 and March 17, 1862.

in a very bad condition, and in many places entirely impassable.”<sup>162</sup> Bissell and his men gathered every piece of scrap wood they could find and every fence rail for almost eighteen miles.<sup>163</sup> The engineers built bridges out of fallen trees, ropes and vines, and in some cases before they could rebuild roads and bridges they had to remove debris placed in their way by retreating Confederates. At one point along the march route, felled trees and burned bridges forced the entire column to halt. Close to dusk, the men bivouacked for the night, and the engineers went to work by torchlight to open the road. Fifteen hours later the work was finished, and the march resumed with the engineers in tow.<sup>164</sup>

Bissell’s Engineers were detached by companies and assigned other tasks throughout Pope’s campaign on New Madrid. After removing “the obstructions thrown in the way by Rebel guerrilla chief [Meriwether] Jefferson Thompson,” companies A and B, under Major Montague S. Hasie, proceeded to Point Pleasant, ten miles south of New Madrid, on the western bank of the Mississippi, and constructed earthworks on the river bank.<sup>165</sup> Company C, D, and K worked on repairing the Cairo and Fulton Railroad running east to west from Bird’s Point, just south of Cairo to Sikeston. Company G worked on the same railroad doing bridge repair. It was joined by Company H, which built a depot platform in Sikeston with lumber produced by Company F, which spent all of November and December 1861, operating a lumber mill.<sup>166</sup>

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<sup>162</sup> *O. R.*, ser. 1, vol. VIII, 80. A corduroy road was built of felled trees or logs to aid travelers over impassable muddy roads. Logs were first laid parallel along each side of the roadway. Then logs were placed in a perpendicular fashion and fastened at each end to the logs that were laid parallel, thus providing for an elevated surface making it easier for traffic to pass over.

<sup>163</sup> Daniel and Bock, 44.

<sup>164</sup> Daniel and Bock, 41.

<sup>165</sup> Janet B. Hewett, ed., *Supplement to the Official Records of the Union and Confederate Armies*, part II, vol. 36 (Wilmington, NC: Broadfoot Publishing Company, 1996), 199, 220. Hereafter cited *S. O. R.*.

<sup>166</sup> *S. O. R.*, part II, vol. 36, 225, 226, 229, 233, 240.

On March 14<sup>th</sup>, the day Confederate forces evacuated New Madrid, Pope reported his operations to the War Department. He included reports of division and brigade commanders, but of the engineers he wrote, "Col. J. W. Bissell, Engineers, has been too incessantly occupied to make a written report, but desires to mention the following officers of his regiment who displayed unusual gallantry: Lieutenant-Colonel Adams, Captains Dean, Hill, and Tweeddale, and Lieutenants Odenbaugh, Randolph, and Besier."<sup>167</sup>

Pope's plan to cut off any escape route for 17,000 Confederate soldiers garrisoned in Columbus, Kentucky, did not come to fruition. General Polk sensed the trap and starting on February 26<sup>th</sup> he pulled his men out from the city's fortification and moved south along the Mississippi to link up with Brigadier General John P. McCown's 2,000 men in New Madrid. When Pope's men attacked New Madrid, McCown determined his position untenable, and he evacuated across the river. This was a costly mistake, but not a mortal blow. Supplies for Island No. 10 would "now have to be hauled overland from Tiptonville," but the island remained unassailable from everywhere except on the river south of Island No. 8.<sup>168</sup> The Federal Army at New Madrid had no means of crossing the river, and if they attempted to build small barges an eight ship Confederate flotilla under the command of George N. Hollins would make quick work of any Union effort. Island No. Ten commanded all river traffic south, and with a supply line open, the men operating the island's fifteen guns could hold out for a considerable length of time.

Pope had two options, and both required naval cooperation. First, he could order Flag Officer Andrew H. Foote's squadron of gunboats, steamboats, and mortars to bombard the island and shore batteries making it possible for an amphibious assault. Second, Foote could run

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<sup>167</sup> *O. R.*, ser. 1, vol. VIII, 84.

<sup>168</sup> Daniel and Bock, 65.

several ships past the Rebel stronghold and transport soldiers from New Madrid across the river and then attack the island from both sides.

There was a third option—or at least a suggestion—but it was not entirely clear how this suggestion came about. In Pope’s report of the operations which led to the capture of Island No. 10 dated May 2, 1862, the general wrote that on March 16<sup>th</sup> he received a dispatch from General Halleck “directing me (Pope) if possible to construct a road through the swamps to a point on the Missouri shore opposite Island No. 10.”<sup>169</sup> Although no record of the conversation exists, it was possible that at the same time Halleck was encouraging Pope to find an opening through the wetlands, one of Pope’s division commanders, Brigadier General Schuyler proposed the idea of cutting a canal across the peninsula in order to attack Island No. 10 from the rear.<sup>170</sup> In Pope’s report to Halleck on April 9<sup>th</sup> Pope wrote, “The canal across the peninsula opposite Island No. 10, and for the idea of which I am indebted to General Schuyler Hamilton, was completed by Colonel Bissell’s Engineer Regiment....” Then on May 2<sup>nd</sup> Pope wrote, “The idea of the canal was suggested to me by General Schuyler Hamilton.”<sup>171</sup>

Between Halleck’s suggestion of attempting to cut a road south from New Madrid to the northern bank of the Mississippi opposite Island No. 10, to Hamilton’s rudimentary idea of a canal, to Pope’s plan to run Foote’s gunboats between the island and shore batteries, it made perfect sense to send Colonel Bissell across the peninsula. He could assist Foote in preparing the gunboats with additional protection to run the Confederate batteries, and he could reconnoiter the area to determine if it was practicable to cut a road or dig a canal.

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<sup>169</sup> *O. R. ser. 1, vol. VIII, 86.*

<sup>170</sup> *O. R. ser. 1, vol. VIII, 86.*

<sup>171</sup> *O. R. ser. 1, vol. VIII, 78 and 86.*

Pope was confident Foote's gunboats would succeed in passing the island.<sup>172</sup> Foote was not. For days his squadron had opened a ferocious cannonade that had little effect on the island, yet Confederate return fire damaged several of his ships and killed or wounded at least a dozen of his sailors. Foote was, therefore, prepared for a long siege because he feared sending any of his gunboats to run the gauntlet between the island and the shore batteries. A gunboat might be sunk or worse, fall into the hands of the Confederates and be used against the Union flotilla.<sup>173</sup>

General Pope was furious to learn that Foote would not run his gunboats past Island No. 10. Bissell, for his part, was also frustrated because on March 19<sup>th</sup> he figured out that both a road and canal were not possible. Regarding the latter, he had explored the possibility that St. James Bayou, which entered the Mississippi River seven miles north of Island No. 8, was connected to St. John's Bayou, which emptied into the Mississippi at New Madrid. It did not. Consequently, Bissell would return to Pope's headquarters the following day with disappointing news.<sup>174</sup>

The following morning, while standing on the levee along side the Mississippi waiting for the dug-out (canoe) and guide to arrive, which would take him back to Pope's headquarters, Bissell noticed that opposite him and directly across the submerged peninsula, stood an opening between large trees which appeared like a path through the woods. Bissell wrote: "This proved to be an old wagon road extending half a mile into the woods; beyond and around was a dense

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<sup>172</sup> James Buchanan Eads built Foote's gunboats in St. Louis, Missouri. Known as City-class ironclads, each vessel had 251 officers and men. The vessels' weighed approximately 75 tons and carried thirteen guns—six 32-pounder, three 8-inch Dahlgren smoothbore guns, and four 42-pounder rifled guns. Three gunports faced forward, there were four on each side, and two guns were aft.

<sup>173</sup> James M. Powles, "Steaming Through the Trees," *American Civil War*, March 2005, 34.

<sup>174</sup> J. W. Bissell, "Sawing Out the Channel Above Island Number Ten," in *Battles and Leaders of the Civil War: From Sumter to Shiloh*, vol. 1 (New York: Thomas Yoseloff, Inc., 1956), 460.

forest of heavy timber.”<sup>175</sup> The guide determined that it was approximately two miles from the end of the old wagon road to the nearest bayou. The guide made a sketch of the area in Bissell’s memorandum book, and the two men examined the wetlands until nightfall then returned to Pope’s headquarters.

What happened next remains a mystery. Bissell claimed that General Pope and his staff had just finished supper when “someone said something about a canal.” According to Bissell, Pope joked about the idea stating that the entire countryside was under ten feet of water. Bissell then pulled out the map and announced that he “would have the boats through in fourteen days.”<sup>176</sup> Pope was not impressed by Bissell’s bravado, so the general took him aside and asked the engineer if he meant what he said. The answer was an unequivocal, yes. After this briefing, Pope approved the project. General Schuyler Hamilton challenged Bissell’s account of what happened, and there was considerable post war bickering between the two men each claiming responsibility for the idea of a canal.<sup>177</sup>

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<sup>175</sup> Bissell, 460.

<sup>176</sup> W. A. Neal, *An Illustrated History of the Missouri Engineers and the Twenty-Fifth Infantry Regiment* (Chicago: Donohue and Henneper, 1889), 37, 42-43. Pope wrote to Halleck on March 19, 1862, “Have had the country examined between here [New Madrid] and Islands 8 and 10. Had to be done in skiffs, as the whole region is under water.... Am having an examination made, to see if by digging across one or two ridges I cannot connect Island No. 8 with the river below Island No. 10 by connecting two bayous.” Then on the same day Pope wrote Bissell, “I desire, you...to make an examination of the peninsula opposite Island No. 10, to ascertain whether a short canal, not to exceed 2 miles in length, cannot be dug, so that boats can enter above Island No. 10 and come out into the river below it.” *O. R. ser. 1*, vol. VIII, 625.

<sup>177</sup> *O. R. ser. 1*, vol. VIII, 104. See also “The Schuyler Hamilton Canal,” *New York Herald*, April 13, 1862; “Comment by General Schuyler Hamilton, Major General, U. S. V.,” in *Battles and Leaders*, vol. 1, 462. Alexander Hamilton’s grandson, General Schuyler Hamilton, took issue with Bissell’s account of what happened claiming responsibility for the idea of a canal. The evidence suggests that Hamilton most likely mentioned the idea of a canal to Pope sometime around March 17<sup>th</sup>, because Pope sent Bissell on a mission to explore just such a possibility. It is also probable that Pope believed a canal impossible and instead placed his faith in Foote’s gunboats. Finally, since Bissell actually found the submerged wagon road, formulated the plan, and according to Hamilton’s official report dated April 22<sup>nd</sup>, completed the “channel cut with enormous labor

Regardless of who came up with the idea, the canal itself was an incredible feat of Civil War engineering and recognized as such by General Pope. He wrote to Halleck on April 9<sup>th</sup>, "Of Colonel Bissell, Engineer Regiment, I can hardly say too much. Full resources, untiring and determined, he labored night and day, and completed work which will be a monument of enterprise and skill."<sup>178</sup> The assembly point for the canal operation was Island No. 8 where six hundred men, four steamboats, six coal barges, four pieces of heavy artillery, axes, saws, rope, carpenter tools and tackle, and two million feet of lumber were gathered on March 23<sup>rd</sup> to begin work.<sup>179</sup>

Bissell's men cut a break in the Mississippi River levee at Phillip's plantation to access the cornfield. Although the barges could get through, the four stern-wheel steamboats drew thirty-six inches of water, and consequently, the break proved too shallow for them to pass. So Bissell's men cut thirty more feet of levee and jumping into the cold waist deep water also removed stumps and logs while battling a swift current with a dangerous undertow. Within twenty-four hours one steamboat, the *W. B. Terry*, and two barges made it through the cornfield and the one-half mile long submerged wagon road, to the flooded forest where the channel narrowed making further passage impossible.<sup>180</sup> The task now assigned to Captain William Tweeddale was to widen the channel and remove the stumps so the Union's vessels could pass.

Tweeddale's process for carrying out his orders combined the delegation of tasks in the Northern mill system and the future assembly line. First, men on small rafts would wedge

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under" his (Bissell's) direction, it seemed clear the colonel was not about to let history give the credit for the remarkable canal to the man who mentioned the idea perhaps as a passing thought over whiskey and cigars one evening after supper.

<sup>178</sup> *O. R.* ser. 1, vol. VIII, 79.

<sup>179</sup> Bissell, "Sawing Out the Channel Above Island Number Ten," 461.

<sup>180</sup> Daniel and Bock, 106.

springboards on which to stand, into trees and proceed to cut them about eight feet above the water. Another set of soldiers on rafts tied a line around the downed tree, and hauled it away with the use of a snatch block and a steam capstan aboard the *W. B. Terry*.<sup>181</sup> Next a trailing raft was lashed to the stump and an upright plank was also fastened to the stump. The upright plank had a frame shaped like an isosceles trapezoid attached to it with a pivot pin so the frame could swing like a pendulum. A saw blade was connected to the legs of the trapezoid and with two men pulling on ropes, the blade could move back and forth cutting through the stump below the surface of the water leaving a stump four and one half feet below the surface. Trees stumps less than two feet in diameter offered no problems, but larger trees such as elms “which spread out so much at the bottom” proved to be a challenge.<sup>182</sup> In addition, since the water was muddy and murky, it was often difficult to determine what was interfering with the saw.

The thicker trunks often pinched the saw and then it required tackle to be attached to the top of the trunk and pulled so as to relieve the trapped saw. It could take as long as three hours to remove some trunks and working twenty-four hours a day it took the engineers eight days to clear a channel fifty feet wide and two miles long.<sup>183</sup> This channel entered the first of three bayous, all of which were narrow and overgrown with trees. Now as the engineers started through the bayou, Bissell spoke solemnly of the new danger awaiting the engineers: “The river had begun to fall, and the water was running rapidly.”<sup>184</sup> As a result, men wore lifelines attached to their waists as they climbed out onto slippery logs to secure cables so these downed obstructions could be pulled away. Some trees had to be sawed and axed into sections before

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<sup>181</sup> Bissell, “Sawing Out the Channel Above Island Number Ten,” 461. A snatch block is a pulley inside a casing used to assist with winching duties.

<sup>182</sup> Bissell, “Sawing Out the Channel Above Island Number Ten,” 461.

<sup>183</sup> Daniel and Bock, 108.

<sup>184</sup> Bissell, 461.



they were moved, underbrush had to be cut and pulled to the embankments, and as the water dropped, stumps originally four feet under the water had to be re-cut.<sup>185</sup>

The exhausting work continued until April 6<sup>th</sup> when the six mile long channel opened to traffic. Once the engineers entered Wilson's Bayou, they eventually linked up with East Bayou and finally St. John's Bayou, which emptied into the Mississippi at New Madrid. As the water continued to recede only flat-bottom transports could navigate the canal, but some of Bissell's men had installed these vessels with heavy artillery to create improvised gunboats.

General Pope had attempted to keep the canal a secret, but Confederate scouts detected the break in the levee opposite Island No. 8 as early as March 29<sup>th</sup>. With a rapid drop in the water level, however, the Southern command did not believe the canal would be successfully completed. Some officers reported to a journalist that it "is believed utterly impracticable for the enemy to cut a canal from New Madrid across the bend to a point above the island." Another officer continued, "The trees in the Mississippi bottoms...are very large and grow together, and sent their roots deep into the soil. This growth of our swamps and bayous presents an impenetrable barrier to any such undertaking as that spoken of."<sup>186</sup> In Confederate commander Brigadier General William W. Mackall's final report of the operations around Island No. 10, he noted that he was told the enemy "were endeavoring to cut a canal across the opposite peninsula for the passage of transports, in order to land below the bend; that they would fail, and that the position was safe until the river fell and no longer."<sup>187</sup>

The canal itself did not prove to be the decisive factor in the capture of Island No. 10. Yet, what Pope was able to do was to transport men and material to the eastern bank of the Mississippi where he was able to block the only escape route the Confederates had—the road to

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<sup>185</sup> Powles, 36; Daniel and Bock, 108; Bissell, 461.

<sup>186</sup> Daniel and Bock, 114.

<sup>187</sup> *O. R.* ser. 1, vol. VIII, 132.

Tiptonville. On April 4<sup>th</sup> the ironclad gunboat *Carondelet* ran past the Confederate batteries, and two nights later the *Pittsburgh* successfully did the same. Now, with gunboats attacking the island from front and rear, and the major road to and from the island blocked, Mackall's only recourse was to surrender. He did so on April 7<sup>th</sup> and the Mississippi was now open to Fort Pillow.

The canal and channel Bissell and the Missouri engineers cut and dredged represented the ingenuity, confidence, and culture of Pope's army. When Bissell stood atop the Mississippi levee and spotted a flooded cornfield and old wagon road carved between the trees, he saw possibility not impossibility. When trees sprang up from six feet below the waterline, a system was developed with the help of makeshift saw, to cut them away. All the men in Bissell's Engineers were carpenters, mechanics, or builders and in a former life, had had to improvise to solve problems as they worked on machines, steamboats, or the railroads. Finally, both Pope and Hamilton had engineering backgrounds and consequently were open to the possibility of opening a canal. Although never discussed in histories of the New Madrid campaign, Pope could have said "no" to Bissell's plan. Although we can only speculate as to why Pope said, "yes" to the plan, two factors had to include his own background, and his belief that Bissell's plan would work. Chances were that in his twenty years before the war as a surveyor in Florida, New Mexico, and Minnesota, and as the surveyor for possible southern routes for the first transcontinental railroad, he considered creative possibilities to conquer challenging geography.

The canal and channel to by-pass Island No. 10 would turn out to be one of the most demanding engineering feats of the war. There was no doubt the canal scored psychological points for the North, as well. The Northern press celebrated the victory with headlines such as "How Colonel Bissell's Engineers Fores [Force] Their Way to General Pope," and "The Great

Western Stump Cutter.”<sup>188</sup> Even Southern newspapers marveled at the accomplishment. An article appeared in the *Macon Telegraph* that reported on the Yankee engineers’ work: “The exploit is unparalleled, at least in this country, and is one of the most novel and marvelous which has been performed during the War.”<sup>189</sup>

Bissell’s regiment, however, was not the only group of volunteer engineers engaged in a critical assignment in the spring of 1862. The First Michigan Engineers and Mechanics, encamped with Buell’s army in Nashville, would be assigned the herculean task of repairing turnpike and railroad bridges destroyed by retreating Confederates south of the city as far as Murfreesboro. The Union Army had to take the war into the deep South, but could only do so if critical supply lines could remain open and maintained. Every time several hundred partisans, or Confederate cavalry, burned a railroad bridge, or destroyed rolling stock, thirty to fifty thousand Union soldiers on the march would stumble to a halt. No supplies meant no movement. Moreover, Civil War armies, because of their size, needed to divide into smaller units (15,000 to 20,000 men, artillery, and wagons) and move on parallel roads to reduce congestion. A line of soldiers composed of 50,000 men, horses, artillery, and wagons long, from head to tail, would take seventy-two hours to pass one spot. To adjust from columns of march to lines of battle (going on line) would be a nightmare. For the engineers this meant keeping multiple roads open so the entire army arrived at the same place at the same time. If one group arrived and the others were stalled, the lone unit in advance of the others could be destroyed by a larger enemy

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<sup>188</sup> “How Colonel Bissell’s Engineers Fores [Force] Their Way to General Pope,” *Philadelphia Inquirer*, April 11, 1862. “The Great Western Stump Cutter,” *Philadelphia Inquirer*, April 16, 1862.

<sup>189</sup> “Great Exploit of the Engineers,” *Macon Telegraph*, April 24, 1862.

force. Generals knew this to be a real fear, and it added additional pressure to the work of the engineers.<sup>190</sup>

In the early spring of 1862 Halleck's Department of the Mississippi was divided into three major components: Pope's army on the Mississippi, Buell's army in Nashville, and Grant's in Savannah, Tennessee, northeast of Corinth, Mississippi, on the eastern bank of the Tennessee River. Halleck's slowly evolving plan was to have Pope's forces continue to slug their way south along the Mississippi toward Memphis, while Buell and Grant, under Grant's command, were to rendezvous at a place called Pittsburgh Landing and then strike Sydney Johnston's army at the important railroad junction at Corinth.

Johnston's forces were spread out over four states, and the general had to decide where to concentrate his armies. He could not defend both middle Tennessee and the line along the Mississippi River. Johnston chose the Mississippi defense and selected Corinth as the concentration point because of the railroads. The war was less than one year old and the fighting in the western theater three months old, yet both Union and Confederate armies understood the critical importance of the railroads. The quick concentration of troops, the movement of supplies and reinforcements over great distances, the ability to flank an enemy or block their retreat, and the ability to block an advance or better yet, cut-off an advancing an army from its supply base, made the iron horse a new factor in American warfare. The degree to which the railroads would play in strategic and tactical decision-making was unanticipated.

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<sup>190</sup> There is an excellent discussion and explanation of logistical problems in Edward Hagerman, *The American Civil War and the Origins of Modern Warfare* (Bloomington: Indiana University Press, 1992), 58-64. The accidental discovery of Robert E. Lee's Special Order No. 191 during his Maryland Campaign of 1862 demonstrated the potential problem of dividing forces when on the move. The order found by Union soldiers in a farmer's field indicated the exact whereabouts about Lee's four divided forces. General McClellan believed he could strike each one "in detail" and destroy Lee's invading army. McClellan's delay in moving allowed Lee time to bring his forces together at the small town of Sharpsburg, Maryland. On September 17, 1862 Union and Confederate armies slaughtered each other at the Battle of Antietam.

There was no reason to believe it should have been otherwise. Therefore, since armies did not carry with them trained experts on railroad warfare, both sides had to improvise. Ill-trained and ill-prepared generals and their staffs would be required to manage and support operations over vast areas.

When Halleck ordered Buell to join forces with Grant in Savannah, Buell decided to move southwest from Nashville to Columbia along the Tennessee and Alabama Railroad, and from there move over a dismal road southwest to Savannah. On March 15<sup>th</sup> Buell sent multiple orders to the Michigan engineers. Colonel Innes was to take three companies north to Paducah, Kentucky, then travel south on the Tennessee River to a spot called Lucas Landing where they were to take possession of an abandoned railroad engine, six platform cars, and one boxcar. Innes and his men were to load these on barges and bring them back to Nashville.<sup>191</sup> Captain John B. Yates was ordered southeast from Nashville, along the Nashville and Chattanooga Railroad, to repair both the turnpike and railroad bridge at Stones River just north of Murfreesboro.<sup>192</sup> Finally, Captain Perrin V. Fox, marching with Buell's army to the southwest, was called upon to repair a major railroad crossing at Franklin, Tennessee. Retreating Confederate cavalry destroyed the bridge, which was a vital link in Buell's supply chain.

Buell and his staff were not ready to manage the multiple tasks assigned to the engineers, and consequently the work was helter-skelter. Slow to repair the bridges, the engineers completed the work, but their operations were not well coordinated. As historian Mark Hoffman author of *"My Brave Mechanics": The First Michigan Engineers and Their Civil*

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<sup>191</sup> Frank J. Welcher, *The Union Army 1861-1865: Organization and Operations*, vol. 2 (Bloomington: Indiana University Press, 1993), 82. See also Mark Hoffman, *"My Brave Mechanics": The First Michigan Engineers and Their Civil War* (Detroit: Wayne State University Press, 2007), 58.

<sup>192</sup> Hoffman, 59. See also F. A. Mitchell, *Ormsby MacKnight Mitchell, Astronomer and General: A Biographical Narrative* (New York: Houghton, Mifflin, 1887), 267-272.

*War* assiduously noted, "The conquering Union commanders were forced to operate the railroad as best they could, detailing officers with railroad backgrounds to provide the day-to-day management."<sup>193</sup> Buell had appointed John Byers Anderson, a civilian and former Superintendent of Transportation for the Louisville and Nashville Railroad, to manage operations north of Nashville. By March 1862, the Federal government had established the United States Military Railroad Bureau, yet this embryonic organization focused most of its attention in the eastern theater, and consequently Anderson received little guidance from the new bureau.<sup>194</sup> Buell preferred it this way.

South of Nashville, Confederate forces destroyed the two major lines from the city, both of which tied into the east-west running Memphis & Charleston Railroad. For repair to these railroads, Buell tapped the colonel of the Thirteenth Ohio Infantry, William Sooy Smith. Smith was an 1853 graduate of West Point, worked for the Illinois Central Railroad and in 1857 opened his own civil engineering company, Parkinson & Smith. In addition to repairing track and bridges, Smith had to acquire locomotives and cars.<sup>195</sup>

Now as Buell marched his men toward Pittsburg Landing, he left behind Brigadier General Ormsby M. Mitchell to guard Middle Tennessee. Mitchell had been a surveyor and

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<sup>193</sup> Hoffman, 56.

<sup>194</sup> Hoffman, 56.

<sup>195</sup> Hoffman, 58. Running southeast from Nashville was the Nashville & Chattanooga Railroad. Stops included Murfreesboro, Tullahoma, and finally Stevenson, Alabama. There it met the Memphis & Charleston, which ran east to Bridgeport, Alabama, and beyond Bridgeport forked northeast to Chattanooga and continued to Richmond, Virginia. The southeast/south fork went through Dalton and Atlanta, Georgia, terminating in Charleston, South Carolina. Running southwest from Nashville, three railroads, the Tennessee & Alabama to Columbia, the Central Southern to the state line, and the Tennessee & Central Alabama to Decatur completed the line to the Memphis & Charleston. West from Decatur the railroad ran to Corinth and ended at Memphis. In order for Confederate armies to take advantage of internal lines of operation these roads were a critical transportation and supply network. In order for Union armies to take the war into the Confederate heartland and defeat the South these were a critical transportation and supply network.

astronomer before the war. For three months in the fall of 1861 he had command of the Department of the Ohio, and was aggressive and ambitious. Without orders from Buell, Mitchell moved south to Murfreesboro where with three companies of Michigan engineers and several infantry regiments he supervised the re-building of "three bridges totaling some 920 feet in length...two railroad bridges and one on the pike."<sup>196</sup> North of Mitchell's efforts, engineers were building a railroad bridge that had been washed out by high water at Mill Creek No. 2 southwest of Nashville at Franklin. Michigan engineers, with the help of a civilian work crew from the McCallum Bridge Company of Cincinnati, the Thirty-Eighth Indiana Infantry, and an engineer company who operated a sawmill, built a temporary truss 110 feet long over the Big Harpeth River.<sup>197</sup>

Buell's major detachment heading for Pittsburg Landing also met up with a bridge problem. In Columbia his columns came to an abrupt halt when it was discovered that the Duck River Bridge was destroyed and the river at flood stage. Their problem was exacerbated by the fact that there were no more engineer troops available to work on the crossing. The engineers were scattered to the four winds, and all functioning under a confusing command structure. Anderson, with no military rank, had no military authority. Colonel Smith, responsible for bridge repair and finding locomotives, had sent Colonel Innes, commander of the Michigan Engineers, north to bring engines and cars back to Nashville. Smith also assigned Captain Yates to rebuild the bridge at Mill Creek, but some of Yates's men were taking orders from General Mitchell at Murfreesboro.

Colonel Jacob Ammen's March 20<sup>th</sup> entry in his "diary of the march to and battle at Pittsburg Landing" read, "Bridge over the Duck River at Columbia burned by rebels; river high;

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<sup>196</sup> Hoffman, 59.

<sup>197</sup> Hoffman, 59.

no boats. General McCook's division in advance, repairing bridge."<sup>198</sup> Alexander McCook's infantry actually worked on the bridge until the 27<sup>th</sup> when second division commander, Brigadier General William Nelson, told one of his brigade commanders, Ammen, that the river was falling and Ammen's needed to find a "damn ford" before the 29<sup>th</sup>, because Nelson wanted his division to cross first and then have the honor of being the lead unit on the march to Pittsburg Landing. On March 29<sup>th</sup> Ammen wrote, "At 3am men wade [sic] stream. Cavalry in river to point out ford, break force of current, and protect infantry. Cold and disagreeable day. Bridge not completed."<sup>199</sup> Among all the confusion Buell finally ordered some engineers, who were working on the bridge at Big Harpeth forward to the Duck River. When they arrived on April 1<sup>st</sup>, the bridge was near completion.

Buell's arrival at Pittsburg Landing came none too soon. After the first day of fighting at Shiloh, Confederate forces had surged forward almost driving Grant's army into the Tennessee River. Buell's arrival and Grant's audacity reversed Yankee fortunes on April 7<sup>th</sup> with a Northern victory. Now the Union Army set its sights on the critical railroad junction at Corinth. The defending Southerners evacuated the city on May 30<sup>th</sup> because they feared being trapped by a much larger Union force.

In his still highly regarded, classic study of railroads in the Civil War, George Edgar Turner described the end of May 1862 as a significant time early in the war when Union forces held "a vital part of the Confederates' one line of railroad between Virginia and the Mississippi River."<sup>200</sup> They held the Nashville & Chattanooga as far as Stevenson, the three lines from Nashville to Decatur, the Mobile & Ohio from Columbus, Kentucky to Corinth, and a direct line

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<sup>198</sup> O. R. ser. 1, vol. 10, part I, 329.

<sup>199</sup> O. R. ser. 1, vol. 10, part I, 329.

<sup>200</sup> George Edgar Turner, *Victory Rode the Rails: The Strategic Place of Railroads in the Civil War* (Indianapolis: Bobbs-Merrill Company, Inc., 1953), 125.



from Louisville to Memphis. On May 31<sup>st</sup> Halleck instructed the First Michigan to begin the all important repair work along the Memphis & Charleston, between Corinth to Decatur, Alabama. Turner no doubt agreed with historian Russell F. Weigley's later assessment of the railroad's importance in bringing about Union victory. He argued that the Union's war-making capacity at the start of the war only existed on paper. Converting those potential assets into superior resources was one of the major roles of the railroads.<sup>201</sup> Historian John E. Clark, Jr. also emphasized the value of the railroads: "The Union's successful use of the railroads neutralized a determined Confederacy's vast land mass. They changed the nature of warfare by enabling the Union to shrink the Confederacy to a manageable—and vulnerable—size."<sup>202</sup> Clark continued, "The modern management principles and procedures developed by antebellum northern railroads produced outstanding managers whose ability and experience proved invaluable to the Union war effort."<sup>203</sup>

Turner, Weigley, and Clark were correct in their views about the virtues of the railroad during the war. Yet, Buell's difficulty in finding solutions to problems, finding the right managers, establishing a proper chain of command, recognizing the value of the work force, creating an effective and an authoritative civilian organization, and curbing the massive egos of many a general, were not givens in June 1862. The Civil War was to require a new type of manager and new type of management system, one where both boss and employee had to overcome unforeseen, challenging, and changing circumstances. In June 1862, in the western theater, there were at least two problems festering.

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<sup>201</sup> Russell F. Weigley, *Quartermaster General of the Union Army: A Biography of M. C. Meigs* (New York: Columbia University Press, 1959), 5.

<sup>202</sup> John E. Clark, Jr. *Railroads in the Civil War: The Impact of Management on Victory and Defeat* (Baton Rouge: Louisiana State University Press, 2001), 22-23.

<sup>203</sup> Clark, Jr., 22-23.

The first one was a management issue. There was no system in place to control the resources of Buell's newly organized Army of the Ohio, and no railroad/engineer/management expert who had the authority to synchronize logistical operations at both the strategic and tactical level. Buell, his corps, and his division commander all had a chief engineer on staff. Most were West Pointers. These engineers reported to both their commanding officers and the Engineer Bureau in Washington, D. C. Then there were civilian railroad men such as John Byers Anderson, and civilian workers. The First Michigan Engineers and Mechanics and Bissell's Engineers each had their own commanding officer. What if a corps commander wanted to order a detail of engineers working on bridge repair, to work on a different project that suited the general, but not the army's overall efforts? Could they disobey the order? The answer was yes, but only if they were prepared to be called up on charges. Civil War historian Phillip Shiman wrote: "Buell's troops scattered across Middle Tennessee, engaged in either repairing the railroad or defending it against the raids of Confederate cavalry, partisans, and guerrillas.... Most of Buell's failure had been attributable to the army's inadequate engineer organization and preparations."<sup>204</sup> By June 1862, Buell's engineers were sprinkled about Middle Tennessee, and northern Mississippi and Alabama. Two companies of engineers were with General Mitchell in Decatur building bridges while Halleck ordered Buell to move his 50,000 soldiers and their supplies east from Corinth along the railroad toward Chattanooga. Preparations for the move were fair at best, and the Army of the Ohio would soon find itself, and its supply line, dangerously extended.

The second problem was a potential mutiny. At the time of their enlistments the soldiers of the Michigan engineers had been promised the pay rate of regular army engineer

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<sup>204</sup> The Civil War Group, "The Pioneer Brigade," <http://www.thecivilwargroup.com/pioneer.html> (accessed May 27, 2013).

troops, seventeen dollars a month, as opposed to the standard thirteen dollars a month for infantry. Engineers' pay was not forthcoming. Since January, Colonel Innes had petitioned the War Department, Missouri congressman Francis P. Blair, Jr and congressman Francis W. Kellogg of Grand Rapids, requesting back pay at the seventeen-dollar rate. In February 1862, Blair introduced legislation that would retroactively pay the volunteer engineers the regular army rate. The bill was finally voted down sixty-six to fifty-seven.<sup>205</sup> Regular army engineer officers also did not support the bill, believing volunteer engineers were not as professionally trained, skillful or disciplined as the regulars. The snob factor ran high.

Discontent among the soldiers of the 1<sup>st</sup> Michigan continued to swell. At the time of Buell's movement toward Pittsburg Landing a number of men refused to march. Innes threatened arrest. Thirty noncommissioned officers were reduced in rank for their role in encouraging the men to stop working. The reduction was temporary for most.<sup>206</sup> Innes was finally able to quell the bad feelings and the men marched. Yet, by June pay for volunteer engineers was still the elephant in the room.

In the eastern theater during the first five months of 1862, the engineer organization, and the operation of the railroads, was taking on a more cohesive shape than that in the west. Four things accounted for this development. First, the War Department identified two pre-war railroad managers with business acumen and organization genius. Second, the theater of operation covered the Washington, DC, northern Virginia corridor that allowed for a more hands-on approach and direct supervision than did the vast expanse of the western theater. Third, Secretary of War Edwin Stanton took an active interest in railroad operation and his

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<sup>205</sup> *Congressional Globe*, 37<sup>th</sup> Congress, 2<sup>nd</sup> sess., 1862, 32:1022-30.

<sup>206</sup> Hoffman, fn. 29, 351. A sergeant in the regular army engineers received twenty-four dollars a month whereas infantry sergeants received seventeen dollars a month. Corporals were paid twenty dollars in the engineers and thirteen dollars in the infantry.

assistant secretary, Thomas Scott, was general superintendent of the Pennsylvania Railroad. Fourth, General George B. McClellan, a former railroad president and army engineer, understood the value of logistics and he had the ability to organize. Despite being jaundiced and mean spirited toward President Lincoln and his cabinet, despite his inability to take risks or command with strength in battle, and despite his habit of moving his army at a sluggish pace, McClellan valued his men and especially his engineers.

General McClellan spent considerable time trying to build an engineering organization that could meet the challenges of the army's logistical demands. These burdens required the coordination of troop movements and complex supply functions. As daunting a task as this was, McClellan faced several obstacles that made his efforts even more difficult. First, several West Point trained engineers opted, like McClellan himself, to accept field commissions in the volunteer army. Prestige, promotion, and pay, all limited in the antebellum army, were now waiting for the men who would lead the charge. Second, the advent of the railroad and telegraph in warfare siphoned engineers away from the field army and placed them in roles usually assigned to civilians. Third, regular army engineers balked at embracing volunteer engineers as equals, which created tension between the two groups. Fourth, the politicians in Washington saw war as a clash of arms, and consequently any attempt to raise troops for anything but infantry was viewed with suspicion.<sup>207</sup>

Historian Edward Hagerman wrote that "the Union army sent some engineer officers to maintain its extended system of fixed, mostly coastal, fortifications, while others continued their prewar civilian function in building bridges, running surveys, and other internal improvements." He continued: "Despite the increasing need for engineering personnel in the field, as many as

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<sup>207</sup> Edward Hagerman, *The American Civil War and the Origins of Modern Warfare: Ideas, Organization, and Field Command* (Bloomington: Indiana University Press, 1988), 234-235.

one-third of the officers in the Corps of Engineers remained assigned until the end of the war to coastal defense or to internal improvements.”<sup>208</sup>

Under the circumstances McClellan opted to continue to demand rigorous bridge-building training and on February 26<sup>th</sup> regular army engineers waded into a frigid Potomac River across from Harpers Ferry and began construction on an 840-foot long pontoon bridge. The water was 15 feet higher than at normal summer levels and the day was raw and windy. The engineers used ship anchors and chain cables to lash together sixty pontoons, and the bridge was completed in eight hours. McClellan was delighted with the successful operation. “The bridge was splendidly thrown by Captain Duane.... It was one of the most difficult operations of the kind ever performed.”<sup>209</sup>

Captain Duane, who literally wrote the book on “Ponton Drill” in a *Manual for Engineer Troops*, continued to express doubts about the usefulness of volunteer engineers, and especially the officers who lacked a West Point education.<sup>210</sup> It seems probable that Duane was caught in an unavoidable paradox: the recognition that West Point trained engineers were critical in the emerging modern war, but there were not enough of them to respond to the growing needs. For Duane, his doubts about the value of volunteer engineer officers were also personal. He had trained, studied, and earned his way into the most elite intellectual organization in the army,

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<sup>208</sup> Hagerman, 235. See also Samuel R. Bright, Jr., “Confederate Coast Defense” (Ph.D. diss., Duke University, 1961).

<sup>209</sup> Telegram from G. B. McClellan to E. M. Stanton, February 26, 1862 in Stephen W. Sears, ed., *The Civil War Papers of George B. McClellan: Selected Correspondence, 1860-1865* (New York: Ticknor & Fields, 1989), 191. See also Phillip M. Thienel, *Mr. Lincoln’s Bridge Builder: The Right Hand of American Genius* (Shippensburg, PA: White Mane Books, 2000), 31-32.

<sup>210</sup> Captain J. C. Duane, *Manual for Engineer Troops* (New York: D. Van Nostrand, 1862), 7-48. Duane’s spelling of “Ponton” (pon'-ton) is considered, by Mark M. Boatner, III author of *The Civil War Dictionary*, the correct modern military spelling and pronunciation. According to Boatner, Scott’s *Military Dictionary* (1862) used the form “pontoon” as did most Civil War literature. Boatner wrote, “Wilhelm’s *Military Dictionary* (1881) uses the form “ponton” which is the correct modern military usage.”

and perhaps, in the United States. The idea that men with no formal training could break the glass ceiling was both puzzling and threatening.

Even Brigadier General Joseph G. Totten, West Point class of 1805 and head of the Corps of Engineers since 1838, did not grasp the magnitude of change coming to the engineers, nor did he understand their expanding role in mobile warfare. In a letter he sent to Stanton just one day before Duane's engineers built their bridge from Sandy Hook, Maryland, to Harpers Ferry, the head of engineers insisted that twelve of his officers stationed in places like New Bedford, Massachusetts, Oswego, New York, the Kennebec River, Maine, and Alcatraz Island, San Francisco harbor, should not be pulled from the forts to serve in the field with the armies. "Officers of some experience are required for duty of this kind which involves large disbursements and business practice, control of men and acquired knowledge of construction, as well as theoretical attainments as Engineers of fortifications."<sup>211</sup>

In mid-March 1862 Totten wrote to McClellan requesting two engineers from McClellan's Army of the Potomac to be assigned to coastal fortification in the North. McClellan politely declined the request. With the Peninsula Campaign underway, McClellan reminded Totten that Little Mac's operations "will require the services of a number of Engineer officers.... If I can even keep them [engineers] until the question of Yorktown [a siege] is disposed of I shall feel better satisfied."<sup>212</sup>

McClellan kept his engineers and restructured the department within the Army of the Potomac, adding to the Engineer Battalion the Volunteer Engineer Brigade made up of the 15<sup>th</sup>

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<sup>211</sup> Communications to the Secretary of War and to Congress, No. 10, April 22, 1859 to January 12, 1863. RG 77 entry 8, Letters, Reports, and Statements sent to the Secretary of War, etc. Engineer Department, February 25, 1862, Totten to Stanton, Letter 347, National Archives, Washington, D. C.

<sup>212</sup> Unofficial & Private letter from Geo. B. McClellan to Joseph G. Totten, March 28, 1862 in Sears, ed., 218.

and 50<sup>th</sup> New York Volunteer Engineers. Congress did not, however, officially recognize these two regiments until July 17, 1862. The act accomplished what the mutinous Michigan engineers had hoped, the same “pay and emoluments, as the corps of engineers in the regular army.”<sup>213</sup> Lieutenant Colonel Alexander would continue to instruct the volunteers and serve on McClellan’s staff. Colonel Stewart was the regimental commander of the 50<sup>th</sup> New York and Colonel McLeod Murphy, former chief of the Brooklyn Naval Yard, commanded the 15<sup>th</sup> New York. Their commanding officer was Brigadier General Daniel Phineas Woodbury, West Point class of 1836. Both Woodbury and Duane reported to McClellan’s Chief Engineer John G. Barnard.<sup>214</sup>

The regular army engineers’ skepticism remained keen as the Army of the Potomac set sail for Fort Monroe and the opening of McClellan’s Peninsula Campaign. On April 4<sup>th</sup> the engineers arrived and began their march in fine spring weather toward Yorktown, situated on the York River. By mid-afternoon the rain began to fall and before the day ended torrents of rain had soaked soldiers, and their spirits waned. Roads turned to mud making the march difficult. During the siege of Yorktown the volunteer engineers began to earn the respect, albeit tempered, of the regular engineers. There were still signs of ambivalence. In Brigadier General Barnard’s report on engineer operations during the siege he wrote: “Captain Duane, with his command, and Lieutenants Comstock and McAlester, have superintended the siege works. All of

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<sup>213</sup> Ed Malles, ed., *Bridge Building in Wartime: Colonel Wesley Brainerd’s Memoir of the 50<sup>th</sup> New York Volunteer Engineers* (Knoxville: The University of Tennessee Press, 1997), fn. 9, 349. See also A Century of Lawmaking for a New Nation: U. S. Congressional Globe, “Appendix to the Congressional Globe, July 17, 1862” The Library of Congress/American Memory, <http://memory.loc.gov/ammen/amlaw/lwgc.html> (accessed May 30, 2013).

<sup>214</sup> In a Civil War peculiarity regular army engineers retained their regular army rank. When in command of volunteer troops they would also carry a volunteer rank. Thus, McClellan listed Woodbury as “Brigadier General D. P. Woodbury, Major U. S. Engineers. See George B. McClellan, *Report of the Organization and Campaigns of the Army of the Potomac: To which is added an account of the Campaign in Western Virginia with Plans of Battle-Fields* (1864; repr., Freeport, NY: Books for Libraries Press, 1970), 63.

these officers have exhibited great energy, industry, and courage....”<sup>215</sup> Conversely, he wrote this about the volunteers: “During the siege operations, General Woodbury, with his brigade, has been mainly engaged on the construction of roads and bridges, making gabions and fascines, and constructing Battery No. 4 (13-inch mortar).”<sup>216</sup> This was the proverbial understatement. Barnard’s journal of the siege was somewhat more specific. For April 24<sup>th</sup> he noted, “The northern approach to the upper pontoon bridge, 1,200 feet in length, is nearly finished, and will be completed probably tomorrow. Crib bridge, floating bridge, and middle pontoon bridge are all in working order.... The roads in the two branch ravines above dam, with the secondary roads leading up to the plateau, will...be completed to-day.”<sup>217</sup> The brigade corduroyed 5,000 yards of road and built two engineering depots while at Yorktown.<sup>218</sup>

Duane’s battalion deserved credit from Barnard for the monumental work they did, and would continue to do, throughout the campaign. Yet, so did Woodbury’s men. The siege ended on May 3<sup>rd</sup> when Confederate General Joseph Johnston’s army slipped out quietly and moved northwest toward Richmond. McClellan, excessively cautious, spent the entire month of April preparing the siege and accomplishing little. Johnston, on the other hand, had bought more time to prepare his army and the defenses around the Confederate capital for the coming fight, and he placed burgeoning demands on McClellan’s expanding supply lines.

With Yorktown abandoned, McClellan reneged on his promise to Secretary of War Stanton to keep General Irwin McDowell’s corps in Washington, and instead ordered McDowell’s men to move south toward Richmond. This forced President Lincoln to intervene. Demanding that a sizable force be left to defend the city, the President compromised with

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<sup>215</sup> *O. R.* ser. 1, vol. XI, part I, 320-321.

<sup>216</sup> *O. R.* ser. 1, vol. XI, part I, 320.

<sup>217</sup> *O. R.* ser. 1, vol. XI, part I, 327.

<sup>218</sup> Thienel, 36.



McClellan and sent Major General William B. Franklin's division of 11,000 soldiers to West Point, Virginia, a place where the Mattaponi and Pamunkey Rivers join to form the York River at its northwestern end. From there McClellan would move his giant army west along the Pamunkey to White House. The Richmond & York Railroad connected West Point at the head of the York River to White House, as well. From this new base Little Mac would orchestrate his operation against Richmond, which was approximately seventeen miles away.

A detachment of the 15<sup>th</sup> New York was assigned to assist in Franklin's landing operation. The challenge was to prevent the artillery pieces from getting weighed down on the muddy beach sand. To prevent this the engineers placed the guns on two canal barges lashed together, and floated them to shore where the barges were connected to boardwalks and then wheeled ashore. Pontoons were used to bring the men to the beach, and finally some barges were grounded into the beach while others were strung together to extend 220 feet into the river. The floating wharf preceded the one called Mulberry Harbor, used by the Allies during the Normandy invasion 81 years later.<sup>219</sup> In addition, the 50<sup>th</sup> New York was divided into four detachments to assist with the barges, prepare a pontoon train, construct trestle bridges, and repair a railroad bridge and a portion of track. Woodbury summarized the work done from May 19 to May 29: "One bridge, single span, 26 feet, at Black Creek; one bridge, two spans, 18 and 20 feet, respectively, roadway 12 feet, at Mill Creek...three bridges...beyond the White Church over streams 8 feet in width and 15 inches in depth, built with stringers laid on crib abutments; two trestle bridges 120 feet in length across the Chickahominy at Bottom's Bridge...."<sup>220</sup>

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<sup>219</sup> Phillip M. Thienel, "Engineers in the Union Army, 1861-1865: Part I, Engineer Organization," *The Military Engineer* XLVII, no. 315 (January-February 1955): 38.

<sup>220</sup> *O. R.* ser. 1, vol. XI, part I, 142-145. Woodbury's report also included work done by the Engineer Brigade on railroad bridges and roads.

On May 31<sup>st</sup> the Union Army fought the first major battle of the Peninsula Campaign at Fair Oaks (Seven Pines), Virginia. Since April 4<sup>th</sup> the engineers had worked ceaselessly to accomplish two tasks. First, they opened avenues of transportation through a scarcely populated southeast Virginia with many culverts and swamps, and few roads on which a city of men could move. Second, they maintained roads and bridges in order to meet logistical demands. Depots were needed to create from nothing an operational supply base. The engineers had to build roads, bridges, harbors, and warehouses to sustain over 100,000 soldiers and 30,000 horses and mules.<sup>221</sup> Most roads had to be widened. Until this happened two wagons travelling in opposite directions could not pass each other. "Some of the roads required three or four layers of corduroying before logs would stay above the surface of the mud."<sup>222</sup> The quartermasters complained that the log surfaces of the roads were, "exceedingly rough, and the consequence is that the wear and tear of our transportation has been very great," but with so many roads to attend to what else could be done.<sup>223</sup>

The traffic on the roads, the length of the supply line, and the rain and mud with which to contend, provided the engineers with remarkable on the job training. On May 28<sup>th</sup> Brigadier General Silas Casey's division of the IV corps alone reported 194 wagons in use, 84 of which were used by the 14 regiments of the division, 30 for infantry ammunition, 13 for forage for artillery animals, and 10 for artillery ammunition.<sup>224</sup> Supplies originated in New York, Philadelphia, and Baltimore, travelled by steamers to West Point, "then about another 45 miles up the tortuous Pamunkey. Once at White House, the supply line stretched inland 15 miles to

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<sup>221</sup> William J. Miller, "Scarcely any Parallel in History": Logistics, Friction and McClellan's Strategy for the Peninsula Campaign," in *The Peninsula Campaign of 1862: Yorktown to Seven Days*, ed. William J. Miller (Cambridge, MA: Da Capo Press, 1995), 2:137. The army estimated that horses ate 26 pounds of fodder per day, and mules ate 23 pounds.

<sup>222</sup> Miller, 144.

<sup>223</sup> Miller, 145.

<sup>224</sup> Miller, 157.

the Chicahominy and, eventually, across that stream to within six miles of Richmond.”<sup>225</sup> The month of April witnessed eighteen days of precipitation in the Tidewater Region, and in May, fifteen days.<sup>226</sup>

The Engineer Brigade and Battalion were not alone in facing considerable, and sometimes overwhelming, challenges in the spring of 1862. With supply lines critical to McClellan’s potential success, the railroads would be pressed into service. To operate efficiently, they would require sound management drawing on the resources available. Northern railroad operations would not be the problem, but the Union Army’s ability to use railroads abandoned by Virginia, and to cope with those forces that would militate that use was a challenge. In the prewar years the rapid expansion of the railroad produced men with skill sets necessary to build locomotives, construct bridges, manage men and material, and adapt to circumstances and problems. The decision was made by the Federal government early in the war to tap their manpower resources and to use the railroad as a war tool. Fortunately, for McClellan’s army on the peninsula and for the Union’s war effort in general the idea of nationalizing the railroads and establishing a bureau to coordinate civilian and military use developed just two weeks after the war started.

With the fall of Fort Sumter panic struck Washington. The Lincoln administration feared that with pro slave states Maryland and Virginia on Washington’s borders, the city was vulnerable to an invasion by Confederate forces. Furthermore, any attempt to send Northern troops to the capital by railroad meant they had to pass through Baltimore and thus could be blocked by fireeating Marylanders. This worry soon appeared prescient. As Brigadier General

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<sup>225</sup> Miller, 150.

<sup>226</sup> William J. Miller, “Weather Still Execrable”: Climatological Notes on the Peninsula Campaign March through August 1862,” in *The Peninsula Campaign of 1862: Yorktown to the Seven Days*, ed. William J. Miller (El Dorado Hills, CA: Savas Publishing Company, 1997), 3:191.

Benjamin Butler's soldiers arrived in Baltimore by train from Massachusetts and New York, mobs greeted them with rocks, garbage, and musket balls. The soldiers returned fire and at least a dozen locals were killed. The soldiers managed to work their way to the west end of the city where they boarded a train for Washington. Lincoln had some troops, but the pro southern faction in Baltimore held the city.<sup>227</sup>

Maryland's Governor Thomas Hicks wanted no trouble and suggested to Lincoln that troops from the North by-pass Baltimore and instead travel by boat to the capital. That option was too slow for Lincoln to even consider. Governor Hicks, therefore, in an effort to avoid a likely confrontation between Federal soldiers and southern sympathizers, blocked all the railroad bridges into the city. For Union troops there were two choices: force their way into the city (and loose Maryland to the Confederacy) or take regiments by steamer to Annapolis, take the train to Elkridge, Maryland, just south of Baltimore, and then reconnect with the Baltimore & Ohio. The problem was that pro-southern Marylanders had torn up the track and destroyed several locomotives.

What happened next was one of those points of contingency that Civil War historian James McPherson described as changing the course of the war. Congressman David Wilmot of Pennsylvania and Major General Robert Patterson, commanding Pennsylvania volunteer troops, suggested that the railroad between Baltimore and Havre de Grace be taken over by the Federal

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<sup>227</sup> A city ordinance in Baltimore prevented railroad lines from running through the city. Consequently, trains coming from Wilmington and Philadelphia had to stop at President's Street Station. The train was then coupled to a horse team, and on trolley lines, was pulled ten blocks west along Pratt Street to Camden Station. There the Baltimore & Ohio began. After the riots in which 4 soldiers and 12 civilians died Maryland Governor Thomas Hicks asked Lincoln to avoid sending troops through Baltimore. This was an untenable request. Hicks then asked the militia to block the railroad bridges entering the city.

government. Instead, General Butler took the initiative and took possession of the Annapolis & Elkridge Railroad.<sup>228</sup>

Just a short time later Assistant Secretary of War Thomas A. Scott took charge of the Annapolis & Elkridge Railroad and ostensibly inaugurated the United States Military Railroad Service, if in practice if not in name. As the former first vice president of all operations of the Pennsylvania Railroad, Scott was a triple threat: he had engineering skills, business acumen, and management capability. He saw the potential in rail transportation for the army, and he anticipated the problems the military would face if the government did not nationalize the railroads. In early January 1862, he prepared a report on the military's transportation needs anticipating an act of Congress passed on January 31, 1862 authorizing the President to take possession "of any and all the railroad lines in the United States," as well as all the telegraph lines in the country until "the suppression of this rebellion."<sup>229</sup>

Scott argued that although technically subject to military control, Northern railroads needed to remain under civilian management. Nonetheless, he made it clear to them that they were to act as "direct adjuncts" of the War Department or he would force them into doing so. He promised them that the latter was not in their best interests.<sup>230</sup> Scott, like his boss Secretary of War Edwin M. Stanton, made thoughtful and decisive decisions. This decisiveness would become the expectation among those in the military railroad service. For example, while visiting a Pittsburg foundry in 1862, Scott learned that a city ordinance required the foundry to haul

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<sup>228</sup> Office of the Quartermaster General, Military Railroads, RG 92, Brief History of Military Railroads during the Civil War, Box No. 10, Entry 1525, National Archives, Washington, D. C. See also "Correspondence between Governor Hicks and General Butler, *New York Times*, April 29, 1861 at [www.nytimes.com/1861/04/29/news/gov-hicks-gen-butler-following-correspondence-between-governor-maryland.htm](http://www.nytimes.com/1861/04/29/news/gov-hicks-gen-butler-following-correspondence-between-governor-maryland.htm) (accessed May 31, 2013).

<sup>229</sup> *Appendix to the Congressional Globe*, 37<sup>th</sup> Cong., 2<sup>nd</sup> sess., January 31, 1862 at <http://memory.loc.gov.html> (accessed May 19, 2013).

<sup>230</sup> Samuel Richey Kamm, *The Civil War Career of Thomas A. Scott* (Philadelphia: University of Pennsylvania Press, 1940) 38, 68, and 136.

finished work to the Allegheny River by horse drawn wagons. "Citing wartime necessity Scott ordered a railroad siding built directly from the foundry to the river. The one thousand dollar expense saved the government drayage costs by ninety percent."<sup>231</sup>

The next step for the War Department's newborn authority to take over railroads, as necessary, was to appoint a central administrator. Stanton wasted no time. On February 11<sup>th</sup>, he appointed Daniel C. McCallum military director and superintendent of railroads in the United States. McCallum would be responsible to the War Department and report directly to Stanton.

McCallum was an excellent choice for the position. As superintendent of the Erie Railroad before the war, he designed a new management system to adjust to the increasing length of company railroads. It was virtually impossible for one person to travel and inspect the entire 340 miles of track, the equipment, repairs, and ticket operations of the railroad. Recognizing the limitations, McCallum developed a decentralized "but highly integrated management structure."<sup>232</sup> This meant three radical changes to the way a company did business. First, local managers had to resolve problems as they arose. "Subordinates not only had to make correct decisions on complicated and critical issues, but they had to make them fast."<sup>233</sup> Second, McCallum's new system demanded "*personal accountability through every grade of service*."<sup>234</sup> Third, frequent written reports were required, with considerable data, to keep upper management informed on each section's work. These reports included "on-time percentages, passenger and freight manifests, speed, tonnage, traffic volume to and from

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<sup>231</sup> Clark, Jr., 48.

<sup>232</sup> Clark, Jr. 14.

<sup>233</sup> Clark, Jr. 14. See Alfred D. Chandler, Jr. "The Railroads: Pioneers in Modern Corporate Management," *Business History Review* 39 (1965): 17.

<sup>234</sup> Clark, Jr., 13. The author pointed out that Chandler cited Daniel C. McCallum, "Superintendent's Report," March 25, 1856, in *Annual Report of the New York and Erie Railroad Company for 1855* (New York, 1856), 33-37, 39-41, 50-54, and 57-59.

specific destinations, rail life, and fuel efficiency.”<sup>235</sup> For military railroads there were additional burdens: replacing destroyed locomotives, bridges, and track; conflict between civilian passenger and freight demands and the War Department’s demands; general’s individual needs against the greater needs of the army; and sorting out army priorities to determine what should be shipped first; men, artillery, supplies, or the wounded.

It took time for McCallum to organize his new department, but an unanticipated crisis that his department had to learn to address, became apparent when General McClellan asked Irwin McDowell’s corps to join him and threaten Richmond from the north. McDowell assured the War Department that he would not move until he established a supply line. This required opening the Richmond, Fredericksburg & Potomac Railroad from Aquia Creek to Fredericksburg. Track was not only destroyed, but for a three mile stretch “not a vestige of track remained.”<sup>236</sup> The need to rebuild quickly or in some cases build the railroad and some wharfs at Aquia Creek, left Stanton and McDowell nonplussed. The Secretary of War sought advice, so whether on McCallum’s or Scott’s recommendation, he called first to Washington, Daniel Harris, and then Herman Haupt.

Daniel Harris was the former mayor of Springfield, Massachusetts, and president of the Connecticut River Railroad. A highly skilled engineer, he was known for supervising the construction of twenty-seven bridges along the Hartford, Providence & Fishkill Railroad, his cautious business style, and his strong opposition to one of Herman Haupt’s major investments, the Hoosac Tunnel project.<sup>237</sup> Stanton explained the work required, and Harris asked for time to

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<sup>235</sup> Clark, Jr., 14.

<sup>236</sup> Turner, 149.

<sup>237</sup> Eulogies of the Press, “Memorial tributes to Daniel L. Harris, with Biography and Extracts from his Journal and Letters,” The Internet Archive, [www.archive.org/stream/memorialtributes00burtuoft/memorialtributes00burtuoft\\_djvu.txt](http://www.archive.org/stream/memorialtributes00burtuoft/memorialtributes00burtuoft_djvu.txt) (accessed June 2, 2013).

consider a decision. Stanton need an immediate answer so he called Haupt to Washington, offered the same assignment, and Haupt accepted.<sup>238</sup>

The work force was initially made up of soldiers detailed from infantry regiments, many who were disinclined to spend time as laborers. Some of these men had skills Haupt put to good use, but others needed simple and careful instructions about what they were supposed to do. For example, Haupt devised a simple instrument made of sticks to level the rail bed. In three days, working around the clock, his work crews re-laid three miles of rails, and then prepared to rebuild two bridges—one over Accokeek Creek, and the other over Potomac Creek.<sup>239</sup>

The Accokeek Creek trestle bridge was 150 feet long, and built over a 30-foot deep chasm. Fifteen hours after the construction began General McDowell rode over the finished bridge in a locomotive.<sup>240</sup> It was a remarkable achievement and congratulations came in from the War Department. The most incredible work, however, was yet to come as Haupt moved immediately to Potomac Creek and started plans for a bridge “that would span a gorge almost four hundred feet wide with a maximum height of ninety feet over the water, ““a frightful looking chasm.””<sup>241</sup>

Taking soldiers from the 6<sup>th</sup> and 7<sup>th</sup> Wisconsin Infantry, and the 19<sup>th</sup> Indiana Infantry regiments, Haupt asked the officers to make a list of each soldier’s pre-war occupation. From the list Haupt organized the men “into teamsters, choppers, carpenters, mechanics, and

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<sup>238</sup> After some time passed Harris finally responded in the affirmative to Stanton’s offer, but received no offer. Harris then travelled to Washington where he was told that Haupt had taken the job. Stanton offered Harris a job as Haupt’s assistant; Harris immediately declined the offer.

<sup>239</sup> James A. Ward, *That Man Haupt: A Biography of Herman Haupt* (Baton Rouge: Louisiana State University Press, 1973), 115. See also Thienel, *Mr. Lincoln’s Bridge Builders*, 64-65. Herman Haupt, *Reminiscences of General Herman Haupt* (Milwaukee: Wright & Joys Company, 1901).

<sup>240</sup> Ward, 116.

<sup>241</sup> Ward, 116.



laborers, and formed them into squads, each under a non-commissioned officer.”<sup>242</sup> As the crews went about their business, Haupt began to formulate the idea of a civilian construction corps. Operating with untrained and in some cases noncompliant soldiers, he had already asked General Halleck if the general would be open to the idea. Halleck, a West Point trained engineer and scholar, believed experienced military engineer soldiers like those from Captain Duane’s Engineer Battalion eventually should be assigned the work. Haupt deferred to the general for the time being even as he continued to ruminate on his plan. Now as he organized his work gangs, a nascent structure for a construction corps now formed.

To speed up construction on the Potomac Creek bridge, he “hastened transportation of the logs from the woods to the bridge site by building a wooden tramway, for which he procured several sets of rollers.”<sup>243</sup> Instead of building the lower section of the bridge with trestlework, he had the soldiers lay crib work because, “many of the men were accustomed to building log houses and were not carpenters, I put them at work [with] which I supposed they were familiar.”<sup>244</sup> It rained for nine days straight, but the bridge was completed and the first locomotive crossed. Lincoln and various cabinet members came out to see this wonderful accomplishment. The President said: “I have seen the most remarkable structure that human eyes ever rested upon. That man Haupt has built a bridge across the Potomac Creek 400 feet long, nearly 100 feet high and running trains over it. There is nothing in it but bean poles and cornstalks.”<sup>245</sup>

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<sup>242</sup> Ward, 116, and Thienel, 65-66.

<sup>243</sup> Haupt, *Reminiscences*, 48-49.

<sup>244</sup> Haupt, 48-49. A trestle is a rigid frame consisting of a series of short spans supported by a complex network of cross-braced posts or framed latticework. A crib is a frame of timber placed horizontally on top of each other to form a wall. A crib also referred to a square structure made up of timber and used to support a road placed on top. Cribs made effective approaches to bridges.

<sup>245</sup> Haupt, 46.

A third bridge over the Rappahannock River, its construction supervised by Daniel Stone, a respected railroad contractor, was completed at the same time as Haupt finished the Potomac Bridge. Stone's was also an impressive achievement. The War Department had succeeded in finding a handful of brilliant railroad men, especially Haupt, who had worked miracles during the month of May 1862, yet the organizational component of military railroad operations was just in its infancy. The question of how to develop and where to find skilled work crews was unresolved. Furthermore, Stanton's management of this fledgling railroad bureau was perplexing and impulsive. As the Peninsula Campaign entered June, Confederate General "Stonewall" Jackson began his advance up the Shenandoah Valley forcing Lincoln to withhold McDowell from moving on Richmond, and instead move him to Front Royal on the Manassas Gap Railroad.<sup>246</sup> To supply McDowell's army, the Orange and Alexandria Railroad had to be repaired from Alexandria to Manassas, and the Manassas Gap Railroad rebuilt west to Front Royal.<sup>247</sup> The problem was that Haupt, Stone, and McCallum had overlapping authority.

With a Confederate threat to Washington and a Union threat to Richmond developing simultaneously, open supply lines was a significant element both for McDowell and McClellan. Fourteen months after Fort Sumter's capture the war in the eastern theater was finally about to erupt. As in the western theater, the Federal armies needed to maximize its engineering advantage, which included efficient and skillful use of the railroad. Southern generals had the advantage of advancing along familiar roads, selecting the most advantageous terrain on which to fight, and using great natural barriers like mountains, rivers, swamps, and woodlands to defend against and harass Yankee invaders. Yet, within the Northern command structure there

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<sup>246</sup> Jackson had defeated General Nathaniel P. Banks at Front Royal May 23<sup>rd</sup>, and at Winchester on May 25<sup>th</sup>.

<sup>247</sup> Ward, 118.

was an emerging, albeit vague, understanding by May 1862, that if they expected to defeat the South, the Union would have to engineer the victory.

## CHAPTER 6

### ENGINEERS, PIONEERS, AND RAILROAD MEN

**Out of the whole [one hundred officers], we have thus far gotten not more than a *dozen* good men—men who can lay any claim to be called engineers.**

**Confederate Colonel Jeremy F. Gilmer to his wife, October 12, 1862**

**I was obliged to stand straddle of his body while I lifted the balk, shoved it out to the boat which Dunlap & Kinney were in and the two Corporals, in spite of their wounded condition, fastened their end while I fastened mine.**

**Captain Wesley Brainerd, 50<sup>th</sup> New York Volunteers, December 11, 1862 at Fredericksburg, Virginia**

By the spring of 1862 a sharp contrast had started to emerge between the operation of northern railroads and those of the South, and in the role played by volunteer troops in keeping them in good repair. These troops had no prior military engineering experience, and therefore their innovation and improvisation was matched only by the remarkable speed with which they accomplished their work. For the North 1862 would bring about improvements in pontoon bridge design, the development of prefabricated bridges, better railroad management, and innovations to map making. Conversely, southern railroad management and engineering operations continued to struggle, and when General Joseph Johnston had an opportunity to severely damage George McClellan's Army of the Potomac in southeastern Virginia (the Peninsula) he failed to do so because he lacked a basic tool of any military operation—adequate maps—and enough skilled topographical engineers to make them.

The battle of Fair Oaks and Seven Pines, May 31, 1862, was a pyrrhic victory for the Confederates. Of the 60,000 men General Johnston had on hand to fight, the right wing of his army under General James Longstreet attacked the Union position with only six of thirteen brigades available, and no more than four of the six brigades were engaged at any one time.

The reason for this, according to historian Thomas B. Buell, was that because the Confederate army on the peninsula lacked an understanding of the roads and terrain making it impossible to get troops into position in a timely fashion. Buell wrote that a coordinated attack was impossible.<sup>1</sup> When Stonewall Jackson broke off his Shenandoah Valley Campaign to reinforce the southern army defending Richmond, then Brigadier General Richard Taylor observed, "The Confederates knew no more about the topography of the country than they did about Central Africa." He continued, "Here was a limited district, the whole of it within a day's march of the city of Richmond...and yet we were profoundly ignorant of the country, were without maps, sketches or proper guides, and nearly as helpless as if we had been transferred to the banks of the [Congo]."<sup>2</sup> Taylor's comments pointed out a major flaw in southern military operations throughout the war. The general understanding that fighting in the south gave the mapping advantage to the Confederacy was inaccurate. Southern commanders could rely on local citizens to provide information about roads, but this knowledge was inadequate when it came to campaign planning or moving thousands of men and material. What was determined passable by a local farmer was not necessary adequate for an army corps of twenty-five thousand men.

General Johnston and General Robert E. Lee, who replaced him after the former suffered a wound on June 1<sup>st</sup>, did not have a blatant disregard for maps. What they did have instead was a lack of mapmakers and a formal military bureau to establish, catalogue, and distribute maps. Before the war the United States Army had an established and functioning organization prepared to adapt to wartime conditions, this was the Corps of Topographical Engineers. The Confederate War Department was never able to match the Union's topographical bureau.

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<sup>1</sup> Thomas A. Buell, *The Warrior Generals: Combat Leadership in the Civil War* (New York: Three Rivers Press, 1997), 70.

<sup>2</sup> Buell, 70.

When the war began there were forty-five topographical engineering officers in the United States Army and only seven decided to join the Confederacy. Of those only four, Charles Read Collins, William Holding Echols, Joseph Dixon, and Joseph Christmas Ives served as southern topographical engineers during the war.<sup>3</sup> Jed Hotchkiss, a civilian before 1861, would become the most famous Confederate topographer of the Civil War.<sup>4</sup> A schoolteacher and self-taught mapmaker and surveyor during the antebellum period, he joined General Jackson's staff and provided the eccentric and aggressive general with a map of the Shenandoah Valley in March 1862, and after the Valley Campaign continued to work on the map for at least another eighteen months. Hotchkiss continued his service with the Army of Northern Virginia after Jackson's death, but never received a military rank from the Confederate government.

After the fiasco at Seven Pines, the new commanding general, Robert E. Lee, an engineer himself, initiated a plan to make sure all engineering officers in the field army, including topographers, reported to one man, the army's chief engineer at Lee's headquarters.<sup>5</sup> This organization prevented engineers assigned with army corps and divisions from acting on different sets of orders. Lee appointed Lieutenant Colonel Walter Stevens of the engineers as head of the Department of Richmond, responsible for the city's defenses. Then on June 6, 1862, Lee commissioned Albert H. Campbell captain of engineers and asked him to report directly to

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<sup>3</sup> George T. Ness, Jr. "Engineers of the Civil War," *The Military Engineer*, May-June 1952, 181. See also Robert E. L. Krick, *Staff Officers in Gray: A Biographical Register of the Staff Officers in the Army of Northern Virginia* (Chapel Hill: The University of North Carolina Press, 2003), 71-72, 101, 324-325, 335, 355.

<sup>4</sup> According to Earl McElfresh, Hotchkiss used the shortened form of his name on virtually all occasions. On his gravestone he is referred to as Jed.

<sup>5</sup> Lee ranked second in his West Point class of 1829, and upon graduation entered the Corps of Engineers. He had worked on harbor, fortification, and surveying projects when war with Mexico broke out in the spring of 1846. He served with distinction as an engineer on General Winfield Scott's staff, but after the war he longed for a combat command. His wish was granted in 1855 when he was transferred to the cavalry and by 1860 was promoted to colonel.

Stevens.<sup>6</sup> By December, Campbell's office in Richmond became the map bureau of the engineering department.<sup>7</sup> Hotchkiss, for his part, placed little faith in Campbell remembering him for the "large amount of bad work he had done and for the long time he took to do it in."<sup>8</sup> Yet, regardless of Hotchkiss's censure of Campbell, the few well-trained mapmakers of the Confederacy including William Willis Blackford and James Keith Boswell, experienced great difficulty procuring the proper equipment. Besides pencils, tracing paper, and field notebooks, topographical engineers needed telescopes, prismatic compasses, odometers, barometers, T-squares, and boxes of colors.<sup>9</sup> Other priorities and the Union blockade made these items hard to get.

Maps of various areas of the country were available in Richmond. These county maps made in peacetime, however, were worthless for wartime armies. Most of these maps identified towns, were small scale, and "showed no terrain features short of a mountain range."<sup>10</sup> Military maps not only needed to include accurate distances of roads and intricate terrain features including culverts, woodlands, and swamps, but they also needed to identify potable streams, springs, cultivated fields, pastures, and orchards.<sup>11</sup> Effective military maps had to distinguish a road from a footpath or a trail through a swamp and bridge symbols on a map had to differentiate between a stone structure and a footbridge.<sup>12</sup>

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<sup>6</sup> Krick, 90.

<sup>7</sup> James L. Nichols, "Confederate Map Supply," *The Military Engineer*, January-February, 1954, 28.

<sup>8</sup> Peter W. Roper, *Jedediah Hotchkiss: Rebel Mapmaker and Virginia Businessman* (Shippensburg, PA: White Mane Publishing, 1992), 193.

<sup>9</sup> McElfresh, 29.

<sup>10</sup> Earl B. McElfresh, *Maps and Mapmakers of the Civil War* (New York: Harry N. Abrams, Inc., Publishers, 1999), 17.

<sup>11</sup> McElfresh, 17.

<sup>12</sup> McElfresh, 21.

All topographical engineers used ingeniously simple ways to measure distances. The length of a horse (between seven and ten feet) to gauge the width of a road, keeping track of how many paces it took a horse to cover 500 yards, and the length of the engineer's steps all were employed in determining distance. Engineers used frames of reference, and consequently, taught themselves what a church steeple looked like from ten miles away or what a house looked like five miles away.<sup>13</sup> This spatial acuity helped engineers estimate the distance between infantry units on a battlefield, or determine the distance enemy forces were from their own positions.

Just like the skilled civilians who could be called upon to enhance and operate the North's military railroads, Union topographical engineers had the advantage of a fully formed organization and the resources of civilian organizations including the United States Coast Survey, the Smithsonian Institution, the Naval Hydrographic Office, and the Pacific Wagon Road Office, an agency within the Interior Department.<sup>14</sup>

The United States Coast Survey was the oldest scientific organization in the United States. Its superintendent at the time of the Civil War, Alexander Dallas Bache, was a West Point graduate class of 1825, and he had served as the first president of the National Academy of Sciences. Bache had established the first magnetic observatory in the U. S. and by 1861 he agency had mapped the entire coast of the United States and had posted numerous observing stations along the coastline. Throughout the war Professor Bache furnished the armies in the field with civilian mapmakers to augment the work done by topographical engineers on headquarter staffs.<sup>15</sup>

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<sup>13</sup> McElfresh, 33.

<sup>14</sup> McElfresh, 29.

<sup>15</sup> Office of Coast Survey, "History of Coast Survey," National Oceanic and Atmospheric Administration [www.nauticalcharts.noaa.gov/staff/hist.html](http://www.nauticalcharts.noaa.gov/staff/hist.html) (accessed February 5, 2014). The



Throughout the Peninsula Campaign McClellan's chief topographer, Brigadier General Andrew Atkinson Humphreys, five lieutenants, Coast Survey assistants, and civil engineers working under arduous conditions, skillfully mapped out the complex landscape over which McClellan was attempting to move 115,000 men. Humphreys's men made six maps to assist commanding generals in negotiating territory as well as Coast Survey maps of the James and York Rivers and the state map of Henrico County, Virginia.<sup>16</sup>

During the campaign, McClellan noticed that there was considerable overlap between Humphreys's work and that of the army's chief engineer Brigadier General John G. Barnard. Reconnaissance of roads, positions of the enemy, and the construction of siege and defensive works were tasks McClellan wrote, "habitually performed by detail from either corps as the convenience of the service demanded."<sup>17</sup> Since both topographical engineers and engineers performed overlapping jobs, eventually, as an experiment, McClellan would unite the two corps under Captain Duane of the engineers.

Poor maps had proved problematic for the southern army at Fair Oaks and Seven Pines. Yet, for the Army of the Potomac, skilled engineering from an unlikely source, the First Minnesota Infantry, proved to be the reason McClellan's army avoided disaster. Five bridges were constructed over the Chickahominy River west of McClellan's base of operation at White House, one by the First Minnesota. The Chickahominy flowed through an area of heavily

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Smithsonian Institution, established in 1846 was first designated as a center for scientific research, but soon became a repository for ethnographic artifacts and animal and plant specimens from around the world. The Naval Hydrographic Office made nautical charts and measured the physical features of oceans, lakes, and rivers and made predictions about changes to those features in the future. The Pacific Wagon Road Office, under the Department of the Interior, had surveyed and built a wagon road from New Mexico to California in the 1850s.

<sup>16</sup> Report of Brigadier General Andrew A. Humphreys, U. S. Army, Chief of Topographical Engineers, February 20, 1863 in *O. R.* ser. 1, vol. XI, part 1, 152.

<sup>17</sup> McClellan, 65.

timbered swamp, which was generally 300 to 400 yards wide.<sup>18</sup> When the battle began on May 31<sup>st</sup> Union forces were deployed on a northwestern line along the river with the exception of Brigadier General Erasmus Darwin Keyes's Fourth Corps, which had crossed to the Richmond side of the river and advanced as far as Fair Oaks Station on the Confederates' right flank and Seven Pines on their left flank. Keyes's men were isolated, and Confederate General Johnston decided to take advantage of the situation in the hopes of encircling Keyes and destroying his entire corps. McClellan was frantic. The general ordered Brigadier General Edwin Vose Sumner's Second Corps to cross the river immediately and reinforce the retreating Keyes, but Sumner faced a disaster waiting to happen. Three days of heavy rains had turned the river into swollen rapids, and the flooring of the bridge the Minnesotans built was rising, soon to tear apart under the pressure of the water.

Longstreet's corps was to envelop the Union right by taking the Nine Mile Road. D. H. Hill was to make a secondary attack along the Williamsburg Road, and Benjamin Huger was to protect the Confederate right flank along Charles City Road. Without good maps, Longstreet's corps managed to get on the wrong roads, the ones assigned to Hill and Huger. As a result, approximately 30,000 men were congested along a five-mile stretch of road and were unable to move. Johnston ordered the attack for 6:00am, but it took Longstreet seven hours to sort out the confusion and bring six of his brigades on line. The critical time lost and a sturdy bridge built by two companies from the First Minnesota under the command of Captain Mark W. Downie and second lieutenant Christopher Heffelfinger saved Keyes's corps from destruction and the Army of the Potomac from humiliation. James A. Wright of Company F described the construction process. "The whole structure was a simple one, and just such a one as I had seen

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<sup>18</sup> *O. R.* ser. 1, vol. XI, part I, 106. No. 2 - Reports of Brigadier General John G. Barnard, U. S. Army, Chief Engineer of operations from May 23, 1861 to August 15, 1862.

built on the Cannon River when the first stage road was made to St. Paul. ‘Cribs’—or pens of logs were built at proper distances apart, to the desired height. On these cribs, long stringers were laid; and on these, the flooring of the bridge. The logs of these cribs were notched together at the corners and were fastened with pins and withes, until the weight—as they were built up—forced them to the bottom. These cribs had to be held in position until they found a resting place in the mud.”<sup>19</sup>

Instead of withes, which were willow branches or long flexible twigs from a tree or shrub, Captain Downie suggested the use of grapevines because he felt that with swift running water in the river the grapevines would provide more stability. McClellan had ordered General Edwin Sumner’s II Corps forward to reinforce Keyes isolated force and when Sumner reached the bridge, as Downie predicted, high water was affecting the stability of the structure, Colonel Alexander of the engineers implored Sumner not to cross.

“General Sumner, you cannot cross this bridge.”

“Can’t cross the bridge? I can, sir. I will, sir!”

“Don’t you see the approaches are breaking up and the logs displaced? It is impossible.”

“Impossible? Sir, I tell you I can cross. I am ordered.”<sup>20</sup>

The approaches at both ends of the bridge were a morass. Colonel Alexander observed, once on the bridge, “it swayed to and fro to the angry flood below or the living freight above, settling down and grasping the solid stumps by which it was made secure as the line advanced.”<sup>21</sup> Led by Sumner, Brigadier General John Sedgwick’s division and Brigadier General Israel Richardson’s division crossed throughout the night and arrived in time to save Keyes left

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<sup>19</sup> Jeffrey S. Williams, “The Bridge that Saved the Army: The ‘Grapevine Bridge’ and the Battle of Fair Oaks,” *This Week in the Civil War*, posted May 29, 2012, <http://thisweekinthecivilwar.com/?p=1254> (accessed June 5, 2013).

<sup>20</sup> Thienel, 48.

<sup>21</sup> Williams, 2.

wing from collapse. Just as the last soldier walked off the bridge, soldiers later recalled, the strength and tension binding the bridge materials together broke apart and the bridge collapsed with a deafening sound into the turgid river.<sup>22</sup>

After Lee took command of the army he ordered a general withdrawal from the Fair Oaks area. This gave both armies time to reorganize and for McClellan time to repair and build more bridges. Again the volunteer engineers would demonstrate ingenuity and innovation, but their efforts also reveal a problem within the command structure. One of the most remarkable bridges constructed by men from both the 15<sup>th</sup> and 50<sup>th</sup> New York Engineers was called Woodbury Bridge. In six days of rain the engineers constructed a causeway 15 feet wide, to the bridge through a swamp. The causeway and bridge covered a distance of one mile, and an earth embankment on each side protected the bridge against rising water.<sup>23</sup>

The Engineer Brigade, with the assistance of the Third Vermont Regiment also built a bridge opposite Dr. Peterfield Trent's home (McClellan's Headquarters) that was 1,080 feet long and constructed with 40 cribs and 6 trestles.<sup>24</sup> Another officer from the 15<sup>th</sup> New York, Captain William A. Ketchum, almost lost a bridge to rising water, but after removing a damaged trestle and skillfully replacing it, finished his project in nineteen hours. Yet, he issued a complaint in his report to Major General Daniel Phineas Woodbury commander of the Engineer Brigade, which would reveal early problems with the Union army's command structure. Ketchum wrote, "I would also beg leave respectfully to report that I was very much annoyed by the constant interference of officers higher in rank than myself, who came to me ordering me to hurry up the work, and representing that they had the authority of the general commanding."<sup>25</sup>

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<sup>22</sup> Thienel, 48.

<sup>23</sup> Thienel, 53.

<sup>24</sup> *O. R.* ser 1, vol. XI, part 1, 148.

<sup>25</sup> *O. R.* ser. 1, vol XI, part 1, 151.

The restoration and refitting of both armies finally came to an end on June 25<sup>th</sup> at Oak Grove. In an attempt to drive Confederate units from his front and begin a progressive assault on Richmond, McClellan ordered an attack that was repulsed by a larger Rebel force. There were 626 Northern and 441 Southern casualties. The next day Lee seized the initiative in what later would be called the Seven Days' Battles. The ferocity of the Confederate attacks at Mechanicsville on June 26<sup>th</sup> and Gaines's Mill on June 27<sup>th</sup> demonstrated two things: McClellan did not have the stomach to fight, and Lee and his men did. On the same day the fighting began at Oak Grove, McClellan considered moving his base of operation from White House to somewhere along the James River near the navy's gunboats. Barnard sent Woodbury to White Oak Swamp Creek to build three bridges and to corduroy a road through the swamp itself. The latter was approximately five miles southeast of the Grapevine Bridge. The creek was narrow and not difficult to bridge, but it was bound on each side by approximately 200 yards of swamp. Cutting trees, building a raised corduroy road, and doing it all in twenty-four hours was the challenge. On the 27<sup>th</sup> McClellan ordered the army to "change the base of operation" to the James River and Lee's intention was to cut them off.

Fighting continued at Savage's Station on the 29<sup>th</sup>, but the *dénouement* was to be at White Oak Swamp. If Stonewall Jackson could crossover to the left or south bank of the Chickahominy River and then strike the retreating Federals from the flank or rear he would destroy McClellan's army. Jackson, however, had one major obstacle in his path. To carry out Lee's orders he had to rebuild a bridge across the river. Union engineers had destroyed all the structures they had worked so hard to construct and maintain. From New Bridge near Gaines's Mill to Bottom Bridge east of Savage's Station everything was destroyed. On June 29<sup>th</sup> Jackson

ordered Major Robert Lewis Dabney, former schoolteacher and pastor, to rebuild the Grapevine Bridge.<sup>26</sup>

Dabney served as Jackson's assistant adjutant general, and in that role he was the general's advisor, confidante, and spiritual director, but as an engineer, Dabney incompetent. The only logical explanation for the reason why Jackson selected the major was because there were no engineers available. To compound Jackson's two problems, a bridge had to be built and he had an unskilled engineer to build it, the men Dabney chose as laborers knew nothing of carpentry and construction, and these men were not pleased to be used as work gangs. This became a common theme throughout the rest of the war—southern soldiers did not sign up to dig ditches and labor at menial tasks, they signed up to kill Yankees.<sup>27</sup>

Help arrived around mid-morning. Captain Claiborne Rice Mason, a road builder before the war and self-taught engineer, arrived with his slaves and took over the work on the bridge. A martinet, Mason was confident his slaves would do exactly as told, and the bridge would be finished before noon. Unfortunately for Mason the Chickahominy River remained high and rebuilding it required some improvisation on behalf of the workers who were not allowed to think for themselves. The problem was with the center section.

Union engineers had also had problems with the center section. After the first Grapevine Bridge tore apart due to the high and swift current, McClellan immediately ordered it rebuilt, and the assignment went to Captain Ira Spaulding of the 50<sup>th</sup> New York Volunteer Engineers. After his men had been in the cold water for at least nine hours, frequently diving beneath the surface to place the legs of the trestles, Spaulding realized the rapid current was

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<sup>26</sup> Douglas Southall Freeman, *Manassas to Malvern Hill* vol. 1 in *Lee's Lieutenants: A Study in Command* (New York: Charles Scribner's Sons, 1942), 561.

<sup>27</sup> Freeman, 561. See also R. L. Dabney to Jed Hotchkiss, April 22, 1896, Papers of Jedediah Hotchkiss, accession no. 2822 and 2907, Special Collections, The University of Virginia, Charlottesville, VA.

shifting the legs of the center portion of the bridge. It would only be a matter of time before the trestle section in question would be carried down the river. Spaulding's solution was to dismantle the center section and then anchor and tie off a pontoon in the middle of the bridge. The floating pontoons could now ride the current provided they were lashed to the anchored trestle sections. So the new center was connected to the side rails of the trestle sections; one coming from the south bank and the one coming from the north bank. After twelve hours the bridge was completed.<sup>28</sup>

Now Confederate Captain Mason had to rebuild the Grapevine Bridge, and it was not clear how he did it. Then twenty-four hours after Dabney started construction it Mason finished the rebuilding on the morning of June 30<sup>th</sup>. Meanwhile, the main body of the Confederate Army was attacking McClellan's forces at Frayser's Farm. The Union line formed a right angle along White Oak Swamp Creek and was waiting when Jackson's men struck around noon. Jackson's tardiness eliminated any hope of a pincer movement and cutting off the retiring army from its supply base. Jackson was faulted for arriving late and making a poor showing during the Seven Days Battles. Some historians blamed it on his fatigue after fighting a brilliant Valley Campaign. Others argued that personality conflicts with subordinates slowed him down, while some described it as a mystery, citing the man's reflective mind, and his observable eccentricities. Now a lack of army engineers and soldiers who were willing to labor all day in waist high cold water should be added to the list of reasons why Jackson arrived too late to cut McClellan's army off from its supply base, and perhaps alter the course of the war.

The final battle of the Peninsula Campaign was fought on July 1<sup>st</sup> at a place called Malvern Hill. Lee continued to pound away at McClellan's army, but at a high price—5,355 killed

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<sup>28</sup> Thienel, 51. The Grapevine Bridge was called several names including the Upper Trestle Bridge and Sumner's Upper Bridge.

or wounded. A combined total of 8,569 casualties at Malvern Hill forced both armies to break off the fighting, and Lee moved back toward his Richmond defenses and McClellan toward his new base at Harrison's Landing on the James River. The Union Army would not move back to the Washington, D. C. area until August, but the Peninsula Campaign was over. The manpower cost to the Army of Northern Virginia was staggering, but Richmond was saved and the Union Army beaten. Lee had replaced Johnston on June 1<sup>st</sup>, and from then on Lee's reputation as an aggressive and audacious general soared.

Conversely, the Army of the Potomac was slow and poorly led. McClellan's hubris prevented him learning from his mistakes and moving forward. Instead, he blamed others, especially Lincoln and Stanton. The administration believed he had wasted a golden opportunity to end the war, and although he would chase Lee through southern Maryland and stop him at Antietam in September 1862, his reputation for inertia, earned in southeastern Virginia, stuck with him. It was well deserved. Little Mac's inactivity allowed Lee to maintain the initiative and fight on Confederate terms, and it raised questions in Lincoln's mind as to whether McClellan was capable of regaining the initiative, taking risks, and overcoming setbacks without retreating.

Another thing that was not clear in July 1862 was whether the Union's significant advantage in engineering, technology, and logistics, would really matter. For the Confederacy, there were just enough trained army engineers to mark out and supervise the construction of major defenses around key geographic points in the South, making it difficult for Union armies to invade the southern heartland and making it possible to prolong the war and force the war weary Northern public to demand peace and recognition of the Confederacy. Yet, a lack of engineers and poor skills in those within the army had already hampered the South. The disaster at Fort Henry, the inability to establish a management protocol for the railroads, the lack of attention paid to the barebones engineering bureau in Richmond, poor maps, few soldiers



willing to labor on engineering projects, and no engineer battalion or regiment in any of the armies in the field, foretold future logistical problems and raised concerns about how creative and aggressive southern commanders could be with their forces.

It was apparent in July 1862, although perhaps taken for granted by generals such as McClellan, that engineers were essential to northern logistical operations, the army's movements, and finally to victory. Bridge building, military railroad management, road making, extended supply lines, mapmaking, and technological improvisations had all been attempted with a fair amount of success. A better management system for the railroads and a clear chain of command in the army between field and staff officers needed to be worked out but the foundation was laid. Haupt was on the verge of creating the railroad Construction Corps, and McCallum was building the United States Military Railroad Bureau. There were three regiments and one battalion of engineer soldiers in the eastern theater, and there were two regiments and one company of engineer soldiers in the western theater. The United States Coast Survey was assisting the topographical engineers, and a Military Telegraph Corps was established.

The creation of the United States Military Railroad Bureau began in an inconspicuous fashion in the spring of 1861 then Secretary of War Simon Cameron had seized all the commercial telegraph lines around Washington. He then asked Thomas Scott to help him manage the telegraph and railroads lines around the capital.<sup>29</sup>

Scott asked Andrew Carnegie, superintendent of the Pittsburg division of the Pennsylvania Railroad, to assist him and under Carnegie's guidance the first government

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<sup>29</sup> William Rattle Plum, *The Military Telegraph During the Civil War in the United States*, ed. Christopher H. Sterling (New York: Arno Press, 1974), 1:63-64 and 68. See also David Homer Bates, *Lincoln in the Telegraph Office: Recollections of the United States Military Telegraph Corps During the Civil War* (New York: D. Appleton-Century Company, Inc., 1907), 20.

telegraph line was built connecting the War Office with the Navy Yard.<sup>30</sup> Scott then called on four telegraph operators from the Pennsylvania Railroad to report to Washington to form the nucleus of the Signal Telegraph Corps. The corps functioned independently except for supervisors who received a nominal military rank because these men had to draw funds from the Quartermaster Department. All the operators received orders directly from the secretary of war. The corps employed more than 1500 civilian operators and construction workers.<sup>31</sup> After the Peninsula Campaign the telegraph corps started to build more permanent lines hung from poles and protected by Union cavalry patrols. Eventually, copper wire insulated by vulcanized rubber was used to protect the lines from the elements, and by the end of the war the construction corps had laid 15,000 miles of wire.<sup>32</sup>

From the standpoint of the engineers, the Peninsula Campaign demonstrated their mettle. Their last bridge at Barrett's Ferry was built under the direction of Spaulding from the 50<sup>th</sup> New York and Lieutenants Cross and Comstock of the Engineer Battalion, and was made up of five spans of trestle and ninety-six pontoons. The bridge was 1,980 feet long, and despite the deep water and strong tidal currents, it was completed in less than twenty-four hours. Quartermaster General Montgomery Meigs reported 5,899 horses and 8,708 mules drawing 2,578 wagons and 415 ambulances, and 12,378 artillery and cavalry horses moved over the bridge.<sup>33</sup> In General Barnard's report, it was clear he had finally come around to appreciating the skill and commitment of the volunteers. He wrote, "On the Chickahominy and on retreat to the

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<sup>30</sup> Plum, 68.

<sup>31</sup> Bates, 27. See also Rebecca Robins Raines, *Getting the Message Through: A Branch History of the U. S. Army Signal Corps* (Washington D. C.: Center of Military History, 1996), 16-17. The original operators of the telegraph corps were David Strouse, Samuel M. Brown, Richard O'Brian, and David H. Bates. In November Anson Stager was commissioned a colonel and appointed chief superintendent of the telegraph corps.

<sup>32</sup> Eric Ethier, "The Operators," *Civil War Times* 45, no. 10 (January 2007): 17-18. See also McClellan, 75-76.

<sup>33</sup> *O. R.*, ser. 1, vol. XI, part 1, 123.

James the duties of the brigade were arduous, as have been described, and I found in its chief throughout the campaign an officer prompt and fertile in expedients, daring and assiduous in execution, and always exhibiting a wise foresight.”<sup>34</sup>

Barnard’s commentary was also unique among the thousands filed by commanding officers throughout the war. It was a polemic as much as it was a report. Not only did it recap the operations of his men, but it also reflected on the challenges ahead. The report asked two major questions: what went wrong during the campaign and what needed to change in order to best maximize the contribution the engineers would surely make to bringing about the defeat of the Confederacy?

Barnard was candid. The campaign failed because the army lost the initiative from the moment it landed at Fort Monroe. Morale and power rested with the army, but the siege of Yorktown and the fact that the “troops toiled a month in the trenches or lay in the swamps...took a fearful hold of the army, and toil and hardship, unredeemed by the excitement of combat, impaired *morale*.”<sup>35</sup> The disasters of the campaign were self-inflicted, deprived the army of *élan*, diminished manpower and materials.

In order to improve the engineering function within the army, Barnard made four recommendations: (1) promote engineers to adequate rank, (2) provide proper recognition for the distinguished service of engineers, (3) recruit more engineer forces and properly organize them, and (4) provide the engineers with the authority to deliver and maintain the proper tools.

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<sup>34</sup> *O. R.*, ser. 1, vol. XI, part 1, 124. Barnard’s report commended the following volunteer engineer officers: From the 50<sup>th</sup> New York Colonel W. H. Pettes, Major James A. Magruder, captains Hine, Beers, Ford, Brainerd, Perry, and Spaulding. From the 15<sup>th</sup> New York captains Ketchum and Bowers, lieutenants Slosson, Farrell, Hassler, and both C. S. Webster and H. C. Yates who died of disease during the campaign.

<sup>35</sup> *O. R.*, ser. 1, vol. XI, part 1, 130.

The general argued that engineers carried with them great responsibility. The efforts to get ordnance, ammunition, food, and medical assistance to the front lines most often depended on temporary bridges and roadways built under dangerous conditions and over inhospitable ground. Engineers fixed defensive positions and indicated the “points of attack of fortified positions.”<sup>36</sup> Accurate maps had to be prepared to prevent commanders from taking the wrong road and getting lost at a crucial time during a battle. “Adequate rank,” Barnard wrote, “is almost as necessary to an officer for the efficient discharge of his duties as professional knowledge.... To give him the proper weight with those with whom he is associated he should have, as they have, adequate rank.”<sup>37</sup>

This lack of rank Barnard equated with a lack of recognition, distinction, and respect. Field commanders seldom wrote about engineering operations in their reports, and George McClellan, once an army engineer himself, took the work of the engineers for granted. Barnard argued that this lack of recognition was unfair. He also believed that by limiting promotions for engineers the corps had lost good men like George Meade, George Thomas, James McPherson, and William Rosecrans to field commands.<sup>38</sup>

More engineer soldiers were needed and a better chain of command had to be implemented. Each army corps had to have their own engineer troops, a pontoon train, and tools. Under the current system the commanding general detailed engineering soldiers, yet corps and division commanders also demanded work from the same soldiers. For example, the Grapevine Bridge was being rebuilt when General Sumner was ordered to cross it. The engineers did not know he was coming and had not determined the safety of the bridge. Sumner did not

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<sup>36</sup> *O. R.*, ser. 1, vol. XI, part 1, 126-127.

<sup>37</sup> *O. R.*, ser. 1, vol. XI, part 1, 126-127.

<sup>38</sup> *O. R.*, ser. 1, vol. XI, part 1, 126-127. See also George T. Ness, Jr., “Engineers of the Civil War,” in *The Military Engineer*, vol. XLIV, no. 299 (May-June 1952).

care. He planned to cross the river. An engineering party from Sumner's Corps could have arrived at the bridge and focused on its construction. As it was, the actual engineers working on the bridge were undermanned, and as a result, infantry soldiers from the First Minnesota were helping to build the bridge. In addition, the tools used on the bridges were scattered everywhere. Because the tools were distributed by the Quartermaster Department it was difficult to maintain any system of responsibility for the tools. In some cases engineers had problems constructing causeways and bridges because they had no tools or very few of them.

The soldiers, say with the First Minnesota, the Ninth and Twenty-second Massachusetts, or the Third Vermont, infantry regiments who built bridges during the campaign, found an axe or a shovel "a very convenient thing to have at his camp, and carried one off with him. When the army moved he found it inconvenient to carry it and threw it away."<sup>39</sup>

More engineering soldiers were needed as well. Barnard in his report lamented the shortage of engineer troops and tools, yet astute infantry commanders soon recognized that there were men within volunteer infantry regiments who had the skills to build bridges. The antebellum labor force in the North had produced a vast quantity of men who had mechanical or construction skills. They had worked with their hands in clock factories, ship yards, armories, mills, locomotive plants, and they had learned how to fix things sometimes just by improvising. These men would prove to be the Union Army's greatest advantage.

Finally, Barnard evaluated the pontoon equipage used during the campaign to determine what the army should adopt in future offensives. In the fall 1861 Duane had recommended the use of French pontoons and now the general finally agreed. He wrote, "The Birago trestle, of which I had formed so high an opinion, proved itself dangerous and unreliable—useful for an advance guard or detachment, unfit in general for a military bridge."

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<sup>39</sup> *O. R.*, ser. 1, vol. XI, part 1, 127.

He also ruled out American India-rubber and Russian canvas pontoons.<sup>40</sup> The advantage to the Birago trestle was its light weight. The problem was its strength. On the other hand the engineer soldiers had trouble maneuvering the French pontoons into position but they had what Barnard described as “floatation power.” The pontoon was designed to carry a significant amount of traffic. “No make-shift expedient, no ingenious inventions not tested by severe experiment, nor light affair, of which the chief merit alleged is that it is light, will be likely to do what is required, and what the French pontoon has so often done.”<sup>41</sup>

General Barnard was also partially correct when he wrote to Chief Engineer of the United States Army, Brigadier General Joseph Totten in January 1863 that the “movements of the whole army were determined by the engineers.”<sup>42</sup> Because besides bridge and road building the railroads had played a critical role in the Army of the Potomac’s and the newly formed Army of Virginia’s actions in the late summer and fall of 1862.

When General McDowell was ordered to break off his movement toward Richmond on May 26, 1862 and move west into the Shenandoah Valley through Front Royal to trap “Stonewall” Jackson the necessity of developing a transportation plan was critical. The Orange & Alexandria and Manassas Gap railroads would become the central characters in his army’s rapid

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<sup>40</sup> O. R., ser. 1, vol. XI, part 1, 128. The Birago trestle was shaped like an isosceles trapezoid except there was no top or bottom line. The sides were held together by a two by four piece of wood 20 feet long in the middle of the two sides. It looked like a sawhorse. Chains were attached to the top of the sides. The general principle was that the trestle would be positioned and then the legs were pushed through a cap that acted like a shoe to anchor the trestle to the floor. The chains were used to help anchor the base. The balk was then used to connect two trestles. The chess was then laid at ninety degrees angles to the balk, and the floor of the bridge was built atop the chess. See J. C. Duane, *Manual for Engineer Troops* (New York: D. Van Nostrand, 1862), 20, plates 2 and 4. George W. Cullum, *Systems of Military Bridges in use by the United States Army: Those Adopted by the Great European Powers and such as are employed in British India with directions for the Preservation, Destruction, and Re-establishment of Bridges* (New York: D. Van Nostrand, 1863), 156-157.

<sup>41</sup> O. R., ser. 1, vol. XI, part 1, 128.

<sup>42</sup> O. R., ser. 1, vol. XI, part 1, 126.

shift of position. Haupt and his civilian construction crew repaired the lines so quickly that supplies were flowing into Front Royal by June 1<sup>st</sup>. It was an apocryphal comment, but runaway slaves remarked, "The Yankees can build bridges faster than the Rebs can burn them down."<sup>43</sup>

When McDowell's was ordered to the Shenandoah Valley, the move exposed a major flaw in the young military railroad department's command structure. Stanton had given McCallum the same authority to "enter upon, take possession of, hold and use all railroads...that may be required for the transport of troops, arms, ammunition and military supplies."<sup>44</sup> These same instructions had been given to Haupt and Daniel Stone, and now the former was to operate in Stone's territory. The result was that Stone vehemently objected to Haupt's orders. Haupt, puzzled by the management confusion and conflicting authority took his concerns to McDowell. Notified by McDowell about the predicament, without hesitation, Stanton wired Haupt giving him supreme authority over the railroads "within the geographical limits of the Department of the Rappahannock."<sup>45</sup> This management decision still left a problem because theoretically Stanton gave Haupt authority over Stone and over McCallum who was the head of military railroads.

Fortunately, serendipity brought together McCallum and Haupt. Both understood each other's gifts and talents. McCallum was a skilled engineer with considerable administrative skills, and he understood the magnitude of the work ahead and the need for overall control of his department. Northern Virginia was his immediate focus, but soon the army's western theater of operation would require his attention as well. Conversely, Haupt wanted to be working in the

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<sup>43</sup> Haupt, *Reminiscences of General Herman Haupt*, 50.

<sup>44</sup> Turner, 155.

<sup>45</sup> *O. R.*, ser. 1, vol. XII, part 3, 275.

field, engaged in the construction of railroads and the transportation problems that frequently arose. Both men tacitly accepted each others role and this turned into a boon for the North.<sup>46</sup>

Haupt, now as chief of construction and transportation for the Department of the Rappahannock started an organization process that revealed his true genius. First, he analyzed the number of deficiencies in railroad operations up to that point in the war. He discovered that there was significant military interference in running the trains, equipment was insufficient, and supply depots refused to unload cars in a timely fashion and never returned them. Operators were not always at their posts, and there were no timetables. Trains used for military personnel and equipment did not run on a schedule. Consequently, he issued his first set of general orders on June 2<sup>nd</sup> outlining expectations of his personnel, and establishing operating standards for army commanders. No military officers, except McDowell, were to interfere in the running of the trains. The trains would run on a schedule, to which everyone was to adhere. All trains would depart on time, fully loaded or not. Conductors and agents were to report to Haupt on a daily basis, noting exact arrival and departure times of the trains.<sup>47</sup> Before Haupt's regulations, trains had operated by telegraph and when the wires were cut the trains stood still.<sup>48</sup>

Of course Haupt's general orders did not eliminate his headaches. Just two days after he published his regulations, he received an order from Quartermaster General Meigs directing him to report to a quartermaster officer at a depot in order to expedite a shipment of supplies to Union cavalry units who had been without for several days. Haupt turned the telegram over to McDowell. McDowell then made a decision that no doubt altered the course of the war. He telegraphed Stanton the following: "I beg that the Quartermaster-General's telegram, directing Colonel Haupt to report to Colonel Rucker, may be revoked.... With the broken-down road, and

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<sup>46</sup> Clark, Jr., 63.

<sup>47</sup> *O. R.*, ser. 3, vol. II, 102-103.

<sup>48</sup> Turner, 159.



weak, worn-out locomotives, bridges going down with the freshet, and insufficient assistance, he has difficulty enough without adding to them by placing him under an officer who has had no experience in the business of railroad management, of which Haupt is the head.” Understanding Haupt would not tolerate serving under someone with fewer skills than himself, McDowell added this final sentence, “I shall lose [him] to all intents and purposes if he is placed under an officer who is not under my command, and who knows comparatively nothing of the business he is to superintend.”<sup>49</sup> Stanton rescinded the order. This was, without exaggeration, one of Stanton’s most important decisions of the war.

With the support of McDowell and Stanton, Haupt continued to provide structure to railroad operations. As he supervised various construction crews mending track, building bridges, and repairing locomotives, an inchoate concept of a permanent Construction Corps began to seep into his business-like mind. Just one week after McDowell’s telegram to Stanton, Haupt issued his blueprint for a Construction Corps. Laborers recruited from civilian life and from regiments within his department would be paid extra for their services in exchange for working hard. The expectations were not ambiguous: “Men who are not willing to work, even for sixteen hours continuously, when required, are not wanted in the Construction Corps of the Rappahannock and are requested to leave it and return to their regiments at once.”<sup>50</sup> Men were formed into squads of ten men commanded by a non-commissioned officer, and either a civilian foreman or an army lieutenant commanded two squads. Multiple squads were lead by a superintendent or army captain.

Haupt kept up a furious pace and did not care whom he offended. He was confident in his ability to deliver a superb railroad system to the army and took whatever actions necessary

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<sup>49</sup> *O. R.*, ser. 1, vol. XII, part 3, 334.

<sup>50</sup> Haupt, *Reminiscences of General Herman Haupt*, 64-66.

to accomplish the task. New regulations came out from his office at the end of June. Quartermaster and commissary officers were forbidden to load cars without proper authority. The common practice of shipping materials used by officers for their own private use was no longer permitted. Haupt made many an officer angry and unhappy, but he remained impervious to their demands.

McCallum and Haupt continued to implement the military railroad system as Major General John Pope was given command of the newly reorganized Department of the Rappahannock now known as the Army of Virginia. Fresh from his western theater victories, Pope arrived in Virginia ready to go on the offensive. Although aggressive, Pope possessed a McClellan complex. The hero of Island No. 10 believed he was called east to regain the initiative lost by Army of the Potomac's efforts on the Peninsula. He believed the President and War Department selected him because he proved himself to be the top general in the army. Pope would crush Lee's army and end the Civil War.

Unlike McDowell, who was made a corps commander under Pope, the major general refused to recognize Haupt as part of the army organization and made clear that "a separate and independent department for the construction and operation of the railroads was unnecessary."<sup>51</sup> Since the railroads were used to transport supplies Pope placed his quartermaster department in charge of them. Haupt then went to Washington, explained his displeasure with the arrangement and asked to be relieved. Stanton granted his request and the railroad man went back to his home in Massachusetts just as the Army of Virginia started its summer offensive.

If Pope hoped to destroy Lee's army somewhere in Virginia, he would need the control of the railroads to accomplish it. His major supply line from Washington extended twenty-five

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<sup>51</sup> Haupt, *Reminiscences of General Herman Haupt*, 69.

miles to Manassas Junction along the Orange & Alexandria Railroad, where warehouses and railroad cars stored a wealth of food, clothing, shoes, and ammunition. His forward base of operation was another thirty miles south to Rappahannock Station. The Army of Virginia continued south until August 9<sup>th</sup> when it clashed with 24,000 men under “Stonewall” Jackson at Cedar Mountain.

After General John Pope became the new commander of the Army of Virginia, and had dismissed Herman Haupt’s value to the army, he soon realized the error of his ways, as did the War Department for accepting the railroad man’s resignation. Assistant Secretary of War P. H. Watson telegraphed Haupt after the Battle of Cedar Mountain: “Come back immediately; cannot get along without you; not a wheel moving on any of the roads.”<sup>52</sup>

In Haupt’s absence confusion reigned. Generals interfered with timetables, quartermasters neglected to unload and return cars, and large supply stores sat untouched. During this period of chaos and confusion, Haupt decided to return. Within weeks he brought back some semblance of order, but the meddling conduct of generals and staff officers did not cease. For example, on August 23<sup>rd</sup> Brigadier General Samuel Davis Sturgis announced to Haupt that the general was to assume military control of the railroads for the benefit of his division. In October, a Confederate freight conductor working for the South Side Railroad refused to pick up a rush shipment of ammunition over a four-day period that was needed in Knoxville to supply General Kirby Smith’s campaign in Kentucky. Complaints came to the secretary of war who took the matter up with quartermaster Myers. Myers told Secretary of War Randolph “he had no control over the railroads.” Randolph knew this and let the matter drop.<sup>53</sup>

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<sup>52</sup> Haupt, 70.

<sup>53</sup> Black, III, 105-106.

Haupt immediately contacted the War Department and sent a telegram to the Sturgis: "You have now detained 5 trains 2 ½ hours. You kept the sick from coming to Alexandria where the Medical Director has long been waiting with ambulances. Some of the sick have died in the cars. The engines may be ruined by standing so long fired without the ability to move." Enclosing a copy of Pope's general order dated August 18, 1862 giving Haupt complete control over the railroads, the colonel then told Sturgis that unless ordered by Stanton, Halleck, or Pope, the general's men were not to board the train that evening.<sup>54</sup> Halleck then telegraphed Haupt and Sturgis to say that no one was to give orders to the colonel's subordinates except through Haupt, and no one was to interfere in the running of the trains.<sup>55</sup>

When Sturgis received Haupt's message countermanding the general's order to take control of the train his anger was heard and felt by everyone. "God damned son of a bitch," he bellowed and then threatened to shoot the colonel if he continued to cause problems. He would have Haupt arrested and disgraced. How dare he embarrass a superior officer. "I want to see how the damn son of a bitch looks in the face,"<sup>56</sup> Sturgis sent provost marshal guards to bring Haupt to the general's headquarters. By the time Haupt arrived under guard Sturgis was drunk. At the same time Halleck's dispatch arrived giving complete authority over the railroads to Haupt. He then had a difficult time convincing the intoxicated general that the note was from Halleck not Pope. Throughout the next few hours Sturgis just kept repeating, "I don't care for

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<sup>54</sup> Records of the Office of the Quartermaster General, Transportation 1834-1917: Office of the United States Military Railroad, 1860-1867, Headquarters, Correspondence Letters received by Colonel H. Haupt, Chief of Construction and Transportation, 1862, RG 92, Box 1, National Archives, Washington, D. C.

<sup>55</sup> Halleck to Haupt, August 23, 1862, Military Telegraph, RG 92, National Archives, Washington, D. C.

<sup>56</sup> RG 92, National Archives, Washington, D. C.

John Pope a pinch of owl dung.”<sup>57</sup> Sturgis finally blew himself out and Colonel Haupt went back to work only to deal with the next crisis.

Five days after the Sturgis incident the Army of Virginia met disaster at Second Bull Run. The railroads, under Haupt’s direction, however, continued to establish some noteworthy accomplishments. On the single tracked Orange & Alexandria railroad operators managed to maintain a steady flow of supplies and men to the battlefield and to evacuate the wounded and support the army’s withdrawal. The construction corps made repairs to the lines, corrected derailments, and built bridges. In a twenty-four period the effective management of the rails allowed the army to transport 15,000 soldiers, ammunition, food, forage, and wounded.<sup>58</sup> Haupt worked for days without sleep and Stanton, Lincoln, and the cabinet were most grateful for his efforts. On September 5<sup>th</sup> he was promoted to brigadier general. Haupt, however, did not sign the commission because he never wanted to be under binding military orders.<sup>59</sup> Stanton would only tolerate this arrangement for a short time longer.

Meanwhile, Haupt continued to suggest to Stanton ways in which the military railroad bureau could be improved, especially in the western theater. Haupt did not see McCallum as the head of all military railroads, and instead saw him as just the chief administrator. Now Haupt suggested McCallum be promoted to brigadier general and placed in charge, and Haupt who saw himself as the current director of military railroads and head of the construction bureau, would remain chief of construction and transportation and would report to McCallum “all matters appertaining to the office details.”<sup>60</sup> Stanton, who was upset with Haupt for not signing his commission, filed the latter’s recommendations and did nothing to revamp the railroad

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<sup>57</sup> Ward, 127.

<sup>58</sup> Ward, 131.

<sup>59</sup> Ward, 168.

<sup>60</sup> *O. R.*, ser. 3, vol. II, 548-549.

bureau. It would continue to operate as it did throughout the summer of 1862 with men assigned as repair engineers and superintendents to specific railroads and all reporting to Haupt. The Construction Corps by December 1862 was made up of 1,700 to 2,000 men and were used as the situation dictated.<sup>61</sup>

Construction squads were augmented by numbers of runaway slaves that first trickled and then started to flood into Union camps. McClellan insisted the runaways be returned to their owners and many field commanders complied with the general's order. Evidence suggested that railroad superintendents were less willing to dismiss the impoverished blacks, and instead put them to work on railroad construction. In early October, the engineer in charge of railroad repairs, Erasmus L. Wentz, wrote McCallum imploring him to send shoes so the contraband could continue to work. "The negro force that I have on the Norfolk and Petersburg Railroad in Government employ, are so poorly shod that I find it impossible to work them any longer without furnishing them with shoes." He continued, "I find it impossible to procure the necessary permission from Military Authority here."<sup>62</sup>

In the summer and fall of 1862, under Haupt's leadership, the United States Military Railroad remained in its adolescent phase but accomplished two things that would guide the service throughout the rest of the war. Military personnel would not interfere with railroad operations. Civilian experts, some now in uniform, recruited by McCallum and Haupt, would control the United States Military Railroad. Officers were prevented from commandeering cars

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<sup>61</sup> McCallum, *United States Military Railroads*, 10. John H. Devereux was superintendent of all railroads running from Alexandria. Erasmus L. Wentz was superintendent of the Richmond & York River Railroad and the Norfolk railroads. William W. Wright, former Gettysburg College student and assistant engineer on the Pennsylvania Railroad was superintendent of the Aquia Creek Railroad. Adna Anderson and J. J. Moore served as construction supervisors.

<sup>62</sup> Railroads and the Making of Modern America, "Letter from E. L. Wentz to Daniel McCallum, October 13, 1862," University of Nebraska, Lincoln, <http://railroads.unl.edu/resources/timelinecontraband/index.php> (accessed June 12, 2013).

for their own use, and soldiers, for example were stopped from stealing wood intended for locomotive fuel.<sup>63</sup> Strict schedules and protocols were maintained moving men and material, loading and unloading cars, and in following shipping priorities: subsistence, forage, ammunition, hospital supplies, veteran troops, and then new recruits.<sup>64</sup>

Unlike the Federal army, the Confederate Army of Northern Virginia did not have skilled manpower, or support from the Confederate government regarding the control of the railroads, yet both Robert E. Lee and Stonewall Jackson understood the railroad's value. Lee had disengaged from actions around Richmond in the summer of 1862 and utilized the railroad to operate against Pope's army. During the Second Bull Run campaign Jackson managed to capture seven locomotives of the United States Military Railroad.<sup>65</sup> What happened to the locomotives, however, was a sad commentary on Confederate railroad management and this would beleaguer the South for the remainder of the war.

A brief background is in order. Shortly before First Bull Run, President Davis appointed William Shepperd Ashe, major and assistant quartermaster, to be in charge of Confederate railroad transportation in Virginia. He was the president of the Wilmington & Weldon Railroad and just before the outbreak of hostilities he discussed plans for the creation of a Southern rail system.<sup>66</sup> His problems in the fall of 1861 and winter of 1862 were monumental. Many of the major railways were only single-track, like the Orange & Alexandria, rolling stock and engines were limited, freight was backed up at stations in Tennessee with cargo headed for Richmond, railroad presidents focused on making a profit, and governors protected their sovereign status

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<sup>63</sup> Clark, Jr. 64.

<sup>64</sup> Clark, Jr. 65.

<sup>65</sup> Black, III, 102.

<sup>66</sup> Black, III, 65.

under the principles of states' rights.<sup>67</sup> Under these conditions any attempt by military officers to interfere in the operation of the railroad, or in the repair of locomotives and track, often was met with a scathing letter from the lines president.

Encouraged by Secretary of War George W. Randolph, just a week before the Second Battle of Bull Run, President Davis recommended the appointment of someone to coordinate railway operations throughout the South, but Quartermaster General Abraham C. Meyers opposed the idea. Government control, he argued, would anger railroad personnel, cost too much money, and confuse public and private accounts. Further discussion on the matter went silent when on September 1, 1862 Generals Jackson and Lee presented seven locomotives to the quartermaster's department in Richmond.<sup>68</sup>

It was decided that the seven engines would be divided by lots and the results were that the Orange & Alexandria secured three and the Virginia Central and Richmond & Danville two each. This infuriated the president of the B & O, but the new railroad manager, Captain Mason Morfit, countered that the B & O had less need of additional locomotives to rent to the government.<sup>69</sup> President of the railroad, John S. Barbour, Jr., and a number of his employees, had taken the captured equipment across the Rappahannock to safety so Barbour felt entitled to his choice of engines. The unfolding dispute over how they were distributed was a microcosm of the Confederacy's transportation squabbles.

Theoretically, the captured locomotives belonged to the army since Lee and Jackson confiscated them. Yet, there was no transportation sage within the War Department to dictate the terms of their use because private companies operated all the railroad lines. The management problem was even more cumbersome when supplies came from outside the state.

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<sup>67</sup> *O. R.*, ser. 1, vol. IV, 617, 634.

<sup>68</sup> Black, III, 102.

<sup>69</sup> *Journal*, Confederate States Congress, II, 267. Black, III, 102.



For example, Morfit's sphere of influence did not extend south beyond Roanoke. North Carolina had their own coordinator of military railroad traffic, as did the other states in the Confederacy.<sup>70</sup>

Also, it was tortuously difficult to construct new lines. During the 1850s the South witnessed an expansion of lines primarily designed to move agricultural goods, not freight or passengers, to coastal centers for export overseas. This meant that when the war broke out serious gaps existed between important supply areas, especially connecting the heartland with the outer rim of the Confederacy, which would see the heaviest fighting and largest concentration of troops. One such gap was between Danville, Virginia and Greensboro, North Carolina. Greensboro was connected to Wilmington, Charleston, and Atlanta by rail, and although there was a line 130 miles east of the city that connected central and eastern North Carolina with Petersburg and Richmond, a western link running along the edge of the Appalachian Mountains did not exist.

It made sense to build the line but powerful business interests in North Carolina had initial doubts because it would divert western commerce to Virginia and not the North Carolina coast. All parties finally agreed to build the line after months of haggling between the Confederate government and Richmond and North Carolina businessmen and politicians. The Piedmont Railroad Company, subsidized by the government, selected Captain Edmund T. D. Myers, son of the quartermaster general to supervise the construction. Young Myers was a capable engineer and a good choice. The 28-mile line was successfully completed by late 1863, but not without major frustrations.<sup>71</sup>

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<sup>70</sup> Black, III, 104-105.

<sup>71</sup> Black, III, 148-153.

The first problem was labor. Funds from the Richmond & Danville were used to purchase slave labor. When that effort failed to produce enough workers the War Department cited a Virginia state law allowing them to impress slaves from owners in order to work on the line, but the governor of North Carolina, Zebulon Vance, refused to assist in contributing to the labor pool. He made it clear that he was not in favor of the road, and when Secretary of War James A. Seddon suggested a change of gauge for the road to match the Richmond & Danville, the governor responded in his inexorable and cynical style. "In regards to the gauge of the roads I have to say that the proposition to make it conform with the Virginia road had been disposed of in the negative before yours [telegram] was received."<sup>72</sup>

Second, Myers could not get supplies and iron fast enough because private companies, including the long disused Roanoke Valley Railroad, blocked his attempts to secure the tracks. Myer wrote to Jeremy Gilmer in July 1863 advocating a complete takeover of the project by the Engineer Bureau, and Gilmer agreed. Gilmer for his part endorsed Myers's suggestion and presented it to Secretary of War Seddon. The secretary, who understood the political climate in the capital and among the governors, just acknowledged the receipt of the idea and then ignored it.<sup>73</sup>

In the summer of 1862 the South did enjoy one bright moment of success in its railroad operations. After the Union capture of Corinth, Mississippi and began moving slowly east through northern Alabama, Confederate General Kirby Smith realized that with considerable reinforcements, he could mount a surprise offensive from Knoxville and Chattanooga into northern Kentucky striking at the Union army's critical western supply area. Yet for General Braxton Bragg to join Smith on this potentially decisive campaign, he would have to travel a

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<sup>72</sup> Black, III, 152

<sup>73</sup> Black, III. 153.

circuitous route to avoid Richard Buell's eastbound forces. Bragg would move 30,000 men over 770 miles using six different railroads to Chattanooga and then launch a fall offensive with Smith, which would come to a sorry close for Bragg at the Battle of Perryville.<sup>74</sup>

Confederate railroad management was not the only decentralized operation in the summer and fall of 1862. It was not until September that Jeremy Gilmer was promoted to colonel to become chief of the engineer bureau in Richmond. Before that he was "acting head." One of the first things he tried to do was persuade General Lee to form bridge building companies within each field army. Men with mechanical skills recruited from regiments would make up these companies and their organization would be permanent.<sup>75</sup> When roadways and bridges had needed repair, field commanders had taken men from the ranks and formed them into pioneer details. The army defined pioneers as units that cut roads through forests or built bridges much like engineer troops did. In 1862 the term "pioneers" usually referenced temporary groups of soldiers who would return to their infantry regiments once the assigned task was completed.

Lee thought Gilmer's idea an intriguing one, but many of Lee's field commanders balked because, they argued, a permanent organization would remove too many men from the infantry or artillery. The commanding general let the idea rest for six months before he revisited it in the spring of 1863. Meanwhile, Gilmer continued to work at supporting the Army of Northern Virginia and improving the general quality of engineering operations. In September as Lee began his Maryland campaign he had no pontoon train, so the Engineer Bureau provided the army with captured equipment.<sup>76</sup> In addition, Gilmer began to supervise the manufacturing of a

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<sup>74</sup> The six railroads Bragg used were the Mobile & Ohio, Mobile & Great Northern, Alabama & Florida of Alabama, Atlanta & West Point, and the Western & Atlantic.

<sup>75</sup> Nichols, *Confederate Engineers*, 92-93.

<sup>76</sup> Nichols, 99.

pontoon train in Virginia, and he sent engineering officer Major James Nocquet to Chattanooga to start constructing pontoons for the Army of Tennessee. Gilmer managed to build about six hundred feet of bridging by the winter of 1863 and stored it at Gordonsville, Virginia, sixty-seven miles northwest of Richmond.<sup>77</sup>

The Southern Confederacy's military struggle for independence was always in conflict with each states' struggle for political and economic independence. When it came to moving vital supplies and men over the railroads this conflict was never more evident. Furthermore, the cultural construct established over five decades before the war was so ingrained in southern citizens that it was almost impossible to challenge even as the war demanded change. Slavery in the South had created an entire culture dedicated to the proposition that manual labor was beneath most whites. The wealthy were in charge and expected to get their way. When the war started there were soon too many chiefs. Generals, plantation owners, businessmen, governors, cabinet members, politicians, bureau chiefs, and the president, all crossed paths and all practiced a management style among each other that wavered between obstinate and detrimental on the one hand to deferential on the other.

For the Union army the late summer and fall of 1862 would bring about in the western theater some organizational changes to the management of the railroads and engineers, along with technological innovations to assist in engineering operations. In the eastern theater, however, poor communications between field and staff engineers would contribute to one of greatest disasters the Army of the Potomac experienced during the war.

The situation in the western theater in the late summer and fall of 1862 demanded the same attention to organizational detail that existed for the Union's eastern armies and the task was more challenging given the size and scope of operations. Whereas McClellan and Pope had

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<sup>77</sup> Nichols, 99.

the Engineer Battalion and Brigade to build bridges and roads, supplemented by Wrigley's Independent Company of Engineers formed in Philadelphia and assigned to the defense of Washington, General Buell's Army of the Ohio, had the First Michigan Engineers and Mechanics, the Missouri Engineers, and a company of engineer troops from Kentucky, covering five states and over twenty-five different railroads. It was 345 miles from Memphis to Chattanooga and 300 miles from Chattanooga to Louisville. All of this territory had to be covered and tracks and bridges had to be repaired and built without the assistance of a General Haupt or a civilian Construction Corps. Improvisation and the skilled management of resources was required to develop the organizational model to support further strategic initiatives necessary to tighten the grip on Confederate resources. These strategic initiatives had to be accomplished without the Federal army suffering serious setbacks, reversals, or a major defeat.

Yet setbacks occurred on a regular basis as Confederate cavalry, led by Nathan Bedford Forrest and John Hunt Morgan, raided isolated Union outposts, destroyed bridges, mangled track, cut telegraph wires, and sliced through vital supply lines preventing General Buell from controlling eastern Tennessee. By mid-September 1862, Buell's Army of the Ohio moved on a west to east axis along the Memphis & Charleston Railroad. The First Michigan Engineers worked all summer maintaining and repairing this railroad as well as the Nashville & Chattanooga Railroad as far as Stevenson, Alabama. Before Buell's army could finally enter Chattanooga a 2,000-foot pontoon bridge had to be thrown across the Tennessee River, but his engineers did not have a pontoon train. Instead, operating two local saw mills, Colonel Innes and his engineer soldiers first had to build it.

It was difficult to do because his men had no nails and the oakum and pitch used as caulking had yet to arrive from Louisville and Cincinnati.<sup>78</sup> There was more bad news. Confederate raiders had captured several engineers and runaway slaves who were working with these men. North of Nashville, Morgan's men had destroyed a railroad tunnel bringing supplies from Kentucky to a halt, and Bragg who skillfully had used the railroad to move his force of 30,000 around Buell, arrived in Chattanooga ahead of the Army of the Ohio. Now Bragg and Kirby Smith using the Cumberland Mountains as a screen raced north toward Louisville and Lexington. Buell had no choice but to follow abandoning northern Alabama and middle Tennessee to Nashville. The engineers were forced to destroy machinery in the railroad machine shop and the partially built pontoons. The Michigan engineers, only 550 men in ten companies, had to march on the double quick north to the rendezvous point at Bowling Green. Companies A, B, D, G, and H were working on a large railroad bridge north of Nashville, Company E was in Huntsville, Alabama, and companies C, F, I, and K were in Stevenson.<sup>79</sup>

Buell caught up with Bragg and Smith on October 8<sup>th</sup> at the battle of Perryville and stopped the Confederate attempt to capture the wealth of army stores in Louisville and humiliate the North. Buell did not pursue the retreating Southerners, and this cost him his job. His replacement was William S. Rosecrans, recent victor of a fierce fight at Corinth, Mississippi driving off 23,000 Confederates under the command of General Earl Van Dorn. Now Rosecrans, a West Point graduate and army engineer before the war, sharp and ambitious, prepared to reorganize the army, which included a stronger and more efficient engineer service. Rosecrans would enjoy some success and one major failure before being laid in the tomb of the mostly forgotten generals. Yet, to his great credit, he did bring about changes to the structure and

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<sup>78</sup> Hoffman, 93.

<sup>79</sup> Hoffman, 98.

operation of army engineers that would reverberate throughout the entire Union army for the remainder of the war.

So now as head of Buell's former command, renamed the Army of the Cumberland, Rosecrans evaluated his engineering needs. To Rosecrans, engineer soldiers were essential, and he had too few of them. The First Michigan Engineers and Mechanics had done well but were spread too thin during the summer and early fall. They had no pontoon train and no experience throwing one across a river, and the regiment stubbornly refused to drill.<sup>80</sup> Furthermore, the men were still not paid for engineer duty and rumors spread that a mutiny was possible. Members of Rosecrans staff did not trust the Michigan regiment, including Innes and the other officers. Next, the 70<sup>th</sup> Indiana known as the "Railroad Regiment" had worked at repairing tracks and bridges, but Rosecrans wanted a more permanent unit.<sup>81</sup>

The Army of the Cumberland had only one officer from the Corps of Engineers, Captain James St. Clair Morton.<sup>82</sup> Morton was an iconoclast of the first order. As historian Philip L Shiman, in his essay "Engineering and Command: The Case of General William S. Rosecrans 1862-1863," pointed out, Morton was not afraid to challenge conventional wisdom. Before the war he publicly criticized the use of masonry fortifications along the coast, and instead, advocated the use of earthwork fortifications, "a heresy to a corps whose prime mission was the construction of great forts of stone and brick."<sup>83</sup> Rosecrans, raised a Methodist and while attending West Point, a bastion of Episcopalianism, converted to Catholicism as a cadet, was an iconoclast himself, so there was no doubt he had a soft spot for Morton.

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<sup>80</sup> Larry J. Daniel, *Days of Glory: The Army of the Cumberland, 1861-1865* (Baton Rouge: Louisiana State University Press, 2004), 188-189.

<sup>81</sup> Daniel, 188-189.

<sup>82</sup> Philip L. Shiman, "Engineering and Command: The Case of General William S. Rosecrans 1862-1863," in *The Art of Command in the Civil War*, ed. Steven E. Woodworth (Lincoln: University of Nebraska Press, 1998), 88.

<sup>83</sup> Shiman, 92.

The Army of the Cumberland also had just one topographical engineer, Captain Nathaniel Michler, who was responsible for mapping Middle Tennessee and central Kentucky. Morton, Michler, and John B. Anderson, a civilian railroad engineer Rosecrans inherited from Buell to serve as superintendent of railroads, were not enough to satisfy Rosecrans's needs over a large geographical area. All three men were highly skilled professionals. Anderson had hired a civilian construction crew made up of carpenters and laborers who worked from a special construction train to repair railroad bridges, but the overwhelming amount of work required hindered the army's movement.<sup>84</sup> Rosecrans asked the War Department for more engineering officers, and he told the new General-in-Chief Henry Halleck, that he would not launch an offensive to regain control of the Nashville to Chattanooga corridor until he was satisfied that the army's supply link from Nashville to central Kentucky was repaired and secured. "The Army of the Potomac cannot possibly be as much in need of engineers as I am," he wrote the War Department, and within a month two more engineers arrived.<sup>85</sup>

Rosecrans energetically set about addressing his engineering problems. First, he ordered every brigade and division commander to assign an officer to topographical duty. It was a stroke of brilliance. Rosecrans was aware that these officers would not have the technical ability to produce detailed maps, but they could be taught what to look for when in the field. Thus, these officers recorded information about roads, bridges, and geographic phenomena like culverts, wooded areas, streams, wetlands, and open fields. This data was forwarded to Michler who with several assistants following his careful instructions, made and reproduced maps. Michler did not like the idea of untrained officers collecting data for the mapmakers. Topographical engineers

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<sup>84</sup> Shiman, 89. See also *O. R.*, ser. 1, vol. XVI, part 1, 297-298 and 300.

<sup>85</sup> Shiman, 90. See also *O. R.*, ser. 1, vol. XX, part 2, 65, 120, 215-216. The two officers from the Corps of Engineers were Lieutenant George Burroughs and Second Lieutenant H. C. Wharton. Both graduated in June 1862 from West Point.



required a keen sense of observation and the ability to measure distance. Officers assigned to this task from infantry brigades and divisions would make costly mistakes, Michler argued. Rosecrans did not like or appreciate his objections and Michler was forced to work within this unorthodox system.

Next, the commanding general assigned Morton the task of training and commanding a Pioneer Brigade. Engineer soldiers were paid more than infantrymen, but infantry occasionally detailed to serve as road builders or on bridge repair were not. An army commander, therefore, did not need permission from the War Department to organize pioneer units. Rosecrans ordered that twenty men from each regiment, half mechanics and half laborers, be detailed as pioneers. "The most intelligent and energetic lieutenants in the regiment, with the best knowledge of civil engineering will be detailed to command, assisted by 2 non-commissioned officers."<sup>86</sup> Most regimental colonels were pleased to comply with Rosecrans's order believing that their best men detached to the pioneers would serve only temporarily, and for the most part would remain with their infantry regiments. This proved not to be the case.<sup>87</sup> Approximately 2,000 men were organized into three pioneer battalions and although at some point they were expected to return to their infantry regiments, became permanent units. Unlike the First Michigan whose men refused to drill, the Pioneer Battalions would not only train as engineer troops, but also as infantry and were brigaded together with an attached battery, the Chicago Board of Trade Battery.<sup>88</sup>

To Rosecrans's satisfaction, Morton created a command structure for the Pioneer Brigade even though it was designated as a temporary organization. He assigned someone to the role of quartermaster and another officer to adjutant, and he made acting majors and

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<sup>86</sup> *O. R.*, ser. 1, vol. XX, part 2, 6-7.

<sup>87</sup> Shiman, 91.

<sup>88</sup> Daniel, 189.

captains out of men who were still officially lieutenants.<sup>89</sup> The soldiers in the brigade, such as William Wesley Perkins, III, found the work hard, yet better than having “the cannon boll [sic] flying over a fellow [sic] head.” Private Perkins described the duties in a letter to his brother Rice: “We are ordered to hull all the wood we can in camp [;] some goes every day from this company. There is someone from every regiment for pioneers and macanic [sic].”<sup>90</sup>

Morton also continued the practice of forcing free African Americans and runaway slaves to work on the fortifications around Nashville. Union conduct toward blacks in the South often was as cruel and callous as that of the plantation owners from whom they fled. President Lincoln’s Preliminary Emancipation Proclamation, issued after the battle of Antietam, had no effect on racial attitudes, especially among army generals, most of whom, like Rosecrans were Democrats. Despite this malicious treatment and the deplorable conduct of northern soldiers’ towards blacks, many African Americans did believe that in laboring for the Union Army they were actively contributing to their emancipation and freedom.<sup>91</sup>

Pioneers could not be paid as engineers, but they did receive extra pay authorized for fatigue duty: twenty-five cents extra per day for soldiers working with common tools such as an

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<sup>89</sup> John Fitch, *Annals of the Army of the Cumberland* (Philadelphia: J. B. Lippincott, 1863), 184-186.

<sup>90</sup> Thomas E. Parson, “Shovels and Pickaxes,” *Civil War Times*, August 2001, 80. Each squad carried the following tools:

|                     |                              |
|---------------------|------------------------------|
| Six Felling Axes    | Six Hammers                  |
| Six Hatchets        | Two Half-Inch Augurs         |
| Two Cross-Cut Saws  | Two Inch Augurs              |
| Two Cross-Cut Files | Two Two-Inch Augurs          |
| Two Hand-Saws       | 20 lbs. Nails, Assorted      |
| Two Hand-Saw Files  | 40 lbs. Spikes, Assorted     |
| Six Spades          | One Coil Rope                |
| Two Shovels         | One Wagon, with Four Horses, |
| Three Picks         | or Mules                     |

<sup>91</sup> Bobby L. Lovett, “Nashville’s Fort Negley: A Symbol of Blacks’ Involvement with the Union Army,” *Tennessee Historical Quarterly* 41 (Spring 1982): 3-9. See also Fitch, 619-620, 632-633. Peter Maslowski, *Treason Must Be Made Odious: Military Occupation and Wartime Reconstruction in Nashville, Tennessee, 1862-1865* (Milwood, New York: KTO Press, 1978), 100.

axe or shovel and forty cents extra per day for those who worked with carpenter tools such as augers.<sup>92</sup> Members of the First Michigan Engineers and Mechanics were also promised extra pay but not a cent had been forthcoming. Since the passage of legislation on July 17, 1862 retroactively recognizing volunteer engineer troops and placing them on the same pay scale as regular army engineer troops, the men of the First were anxiously awaiting their back pay. The money arrived in camp in September but Paymaster Major Charles T. Larned refused to pay the men without specific orders from the War Department because he was not certain when the regiment's status officially changed.<sup>93</sup> Fractious soldiers began to talk of mutiny. Ezra Stearns recorded in his diary, "Excitement is increasing...the men talk of making a strike," and on November 10<sup>th</sup> they did. Many of the men blamed Colonel Innes for not working hard enough on their behalf and others were just tired of serving for almost over a year without pay.<sup>94</sup> Given the circumstances it was surprising that only one quarter of the regiment actually refused to work. Many feared arrest and others were talked out of striking by their officers. Finally, a telegram arrived from the War Department in late November ordering Rosecrans to pay the regiment engineer wages under General Orders No. 177 and one week later the men were paid. Most of the mutineers served thirty days of hard labor without pay and then returned to the regiment.<sup>95</sup>

As the problems of pay, manpower, and mapping were sorted out and Rosecrans continued to gather supplies in Nashville for an eventual attempt at moving the army forward toward Chattanooga, as far as his engineers were concerned he still had one major problem. He had no pontoon train. On November 22<sup>nd</sup> he wrote the United States Army's chief engineer

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<sup>92</sup> Shiman, 93.

<sup>93</sup> Hoffman, 114.

<sup>94</sup> Hoffman, 115.

<sup>95</sup> Hoffman, 117-120. An iron pontoon was made of three sealed metal tubes connected by forge welding. The tubes stayed afloat because of the dead air trapped inside the tubes.

Brigadier General Totten requesting iron pontoons 700 yards long. Perhaps displaying his knowledge of military equipment or perhaps being a contrarian, Rosecrans insisted on the iron instead of the wooden bateaux or frame of the pontoon. The wooden ones leaked and the iron ones were better, Rosecrans said, and he wanted them at once.<sup>96</sup> Iron pontoons, developed by the Prussian and Austrian armies, were non-existent in the United States.<sup>97</sup>

Totten responded by saying it would take the Engineer Department six weeks to build wooden bateaux and at least ten weeks to build the iron pontoons, and furthermore, the Engineer Department had no model for an iron bateaux, and no one had experience in building them. Rosecrans was not pleased with Totten's response.<sup>98</sup> Fifteen days after the initial request was submitted, Totten's chief assistant, Brigadier General George W. Cullum, finally convinced Rosecrans that wooden bateaux, built in Cincinnati under the supervision of the Department of the Ohio's chief engineer, Lieutenant Miles Daniel McAlester was the best alternative.<sup>99</sup> Unlike the pontoons Rosecrans described as leaky, built by the First Michigan and later destroyed by the First Michigan because of the army's sudden retreat north, the new wooden bateaux would be built with seasoned wood. Unfortunately, Rosecrans did not provide a sufficient number of wagons to move the entire train over roads. Instead, the railroads transported a number of the pontoons when needed, especially during the Murfreesboro campaign.<sup>100</sup>

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<sup>96</sup> *O. R.*, ser. 1, vol. XX, part 2, 83, 94, 97, 98.

<sup>97</sup> The Birago trestle was also invented in Europe under the direction of Karl Ritter von Birago, an Austrian military engineer in the 1830s and 1840s.

<sup>98</sup> *O. R.*, ser. 1, vol. XX, part 2, 102, 120, 133-134.

<sup>99</sup> Another option besides the wooden pontoon was the canvas pontoon. Instead of a pontoon boat, a wooden framed bateaux was covered with common cotton canvas. The benefit of such a pontoon was that the frames were light and easy to transport, the problem was that the canvas was not dependable. Rosecrans suggested to Cullum a double-canvas paulin [tarpaulin] pulled over a light foldable frame, which was a prototype. The idea for the frame would not be fully developed until 1864.

<sup>100</sup> Shiman, 95. *O. R.*, ser. 1, vol. XXX, part 3, 56, 85-86.

In the eastern theater there were plenty of pontoons available for use by the Army of the Potomac, yet similar to Rosecrans's Murfreesboro offensive, there was a lack of transportation to move them. In addition, poor coordination between field commanders and department heads in the eastern theater would lead to a military disaster for the army in December 1862. President Lincoln had finally relieved McClellan from command and replaced him with Rhode Island native Major General Ambrose Burnside. Known for his loyalty, honesty, and sideburns, Burnside understood that Washington was looking for a decisive battle, and he immediately set to designing a plan to bring about just such a battle.

Lee's forces were stationed around Culpeper and Gordonsville, Virginia both on the Orange & Alexandria Railroad. At Gordonsville, approximately thirty miles south of Culpeper, the Orange & Alexandria connected with the Virginia Central Railroad, which was the southern army's critical supply link with their depots both in Richmond on the eastern end of the line and Staunton on the western end. Burnside proposed to feint an attack on Lee's lead elements in Culpeper and slip west to Fredericksburg, cross the Rappahannock River, and then moving east again along the turnpike through Chancellorsville, eventually striking at Lee and cutting off his supply line. On paper it was an interesting plan, but the execution of it required shifting 120,000 men without tipping off the enemy as to the northern army's intentions. Crossing the Rappahannock quickly required that the engineers arrive at the river with the pontoon trains at the same time the army arrived. A delay would give Lee's cavalry time to report the whereabouts of the Burnside's forces so Lee could prepare a formidable defensive position.

By the end of 1862 the Union Army had worked out some command and control issues that plagued them earlier in the year, but the battle of Fredericksburg was about to reveal that the engineers still functioned under an inchoate command system.

A brief introduction to the *dramatis personæ* during the Army of the Potomac's offensive in December 1862 helps explain the blunders. At the head of the army was General Burnside, and he was coordinating his efforts with General-in-Chief Henry Halleck. Halleck was not the commanding general of all the Union armies in the field, but rather served Lincoln and Stanton as a chief of staff. He could make suggestions to Burnside, and he would convey the President's concerns and wishes to army commanders in the field, yet he had no command responsibility. It was a confusing arrangement. General Meigs, head of the Quartermaster bureau and General Totten of the Engineering bureau reported to Stanton, but quartermasters and engineers attached to various field armies did not necessarily report to the bureaus chiefs but rather to their commanding generals. Haupt operated on his own informing General McCallum of his supply needs, and both men reported to Stanton.

Here was where it got complicated. After taking command, Burnside appointed Lieutenant Cyrus Ballou Comstock to his staff as chief engineer Army of the Potomac. Comstock graduated first in his West Point class of 1855 and was seven years younger than Captain Duane who commanded the Engineer Battalion. General Daniel Woodbury commanded the Engineer Brigade and both Duane and Woodbury had reported to General Barnard, but Barnard was now chief engineer in the Department of Washington, DC. Now both General Woodbury and Captain Duane reported to Lieutenant Comstock!

During the Peninsula and Maryland campaigns Comstock served as chief engineer for General Edwin Sumner's II Corps. Now as chief engineer for the entire Army of the Potomac and anticipating a late fall offensive, he ordered the Engineer Battalion to move to Falmouth, Virginia, just northwest of Fredericksburg, to await the arrival of the pontoons. On November 12<sup>th</sup> Burnside met with Halleck, Meigs, and Haupt to discuss the best possible supply line for the upcoming campaign, and Haupt suggested to the generals that using the Potomac River landings

at Aquia Creek and Belle Plain afforded the army a more secure route than the turnpike from Alexandria to Falmouth. Warehouses and wharfs could be rebuilt, and the Richmond, Fredericksburg & Potomac railroad that ran from Aquia Creek to Falmouth was in good condition.<sup>101</sup>

Lincoln approved the change of base from Falmouth to Aquia Creek and Belle Plain on the fourteenth. Haupt reported to Burnside at 11:00am November 17<sup>th</sup> that in addition to 800 feet of wharves to be built, small railroad cars would be pushed to a damaged bridge and civilian carpenters would repair the damage. When the larger cars and engines arrived they would be unloaded and placed on the track to start delivering supplies to Falmouth. Smith shops and machine shops complete with lathes, planers, portable engines, and small tools were also built.<sup>102</sup> In eleven days the rail line was opened and Haupt started to think ahead about repairing the track and bridges beyond Fredericksburg. He wrote Burnside that he tried to procure more civilians to continue work on the wharves and bridges but that Halleck did not favor “my idea of forming a construction and transportation corps...for our work.” Haupt continued, “He [Halleck] thinks that the engineer troops, who have been enlisted, and receive double pay for this particular duty, should attend to it.”<sup>103</sup> Haupt then suggested that several engineering companies be turned over to his control for his labor force that he would train. Burnside did not respond to this request.

Ignoring the axiom, “the devil is in the details,” after his meeting with Halleck on November 12<sup>th</sup>, Burnside made two costly assumptions. First, when Halleck told him that he would inform General Woodbury to move the pontoons to Falmouth, Burnside assumed Halleck would give specific instructions regarding the urgency of the movement. He did not. Second,

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<sup>101</sup> Thienel, 75.

<sup>102</sup> *O. R.*, ser. 1, vol. XXI, 764.

<sup>103</sup> *O. R.*, ser. 1, vol. XXI, 856.

Burnside assumed that the other pontoon train with Captain Duane had moved from McClellan's former headquarters to Washington. It had not.<sup>104</sup>

Finally on the 14<sup>th</sup> Comstock contacted Woodbury and asked about the location of the pontoon train. Surprised the pontoons were needed so quickly, Woodbury recommended to Halleck that the entire operation be delayed at least five days. When Halleck refused to listen to anything about a delay, Woodbury then told Halleck that he would leave immediately provided the quartermasters furnished him with the 270 horses or mules he needed to move the train to Falmouth. The horses arrived five days later and the first set of pontoons rolled into Falmouth on the 25<sup>th</sup>. As originally scheduled, Burnside's army began their march and arrived in Falmouth on the 20<sup>th</sup> where they waited five days for the pontoons.

The second train began its movement south under the command of Major Ira Spaulding. Woodbury did not provide the major with a sense of urgency so as his train became bogged down in molasses like mud along the turnpike road from Alexandria to Falmouth, he moved his pontoon boats to the Potomac and floated them to Belle Plain. His wagons carrying the chess, balk, and tools continued to slog through the mud toward Falmouth. Comstock was not aware Spaulding's pontoons were destined for Belle Plain so no wagons greeted them there, prepared to move the boats to Falmouth. Burnside could not understand why it took so long to deliver the pontoons, and he was furious with Woodbury. The delay in Burnside's entire movement gave Lee's army ample opportunity to prepare defensive positions on the southern bank of the Rappahannock at Fredericksburg, and to wait and see what the Union general would do next.

The fifteen-day delay between when the first pontoons arrived in Falmouth and the day Burnside started his attack at Fredericksburg was the result of a lack of pontoons and the weather. Burnside met with Lincoln on November 27<sup>th</sup> to discuss his plan, which Burnside

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<sup>104</sup> Thienel, 77.



revised since the Army of Northern Virginia occupied the city of Fredericksburg and the hills beyond it. Although the President remained skeptical, he admired Burnside's unquestioned determination. Lincoln wrote Halleck stating that the commanding general believed he could cross "the river in the face of the enemy and drive him away, but that, to use his own expression, it is somewhat risky."<sup>105</sup> With chronic pressure from the Northern press about the army's inactivity, and living with the torturous idleness of the army under McClellan, Lincoln was emotionally ready for a fight. Intellectually, he was not so sure of Burnside's initiative, but it was probably refreshing to work with a general who wanted to engage the enemy rather than a cautious one who wanted endlessly to maneuver.

Burnside's revised plan called for six bridges to be thrown across the Rappahannock by the engineers. Two pontoon trains had arrived with approximately seventy-six bateaux, yet each bridge would require between eighteen to twenty pontoons to build.<sup>106</sup> Once Lincoln gave tacit approval to Burnside's plan, the general's assistant adjutant general H. W. Bowers telegraphed Captain O. E. Hine of the 50<sup>th</sup> New York ordering him to send an additional forty-three pontoons, thirty-eight wagons, and sixteen sets of trestles, to Belle Plain.<sup>107</sup> Hine was in charge of the engineer's workshop near the Washington navy yard, and after he sent the extra pontoons on December 3<sup>rd</sup> Bowers requisitioned up to eighty more bateaux, some with chess and balk.<sup>108</sup>

Then on December 5<sup>th</sup> winter came to northern Virginia like a lion as rain, sleet, and three inches of snow covered the ground. For the next three days bitter cold arrived with

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<sup>105</sup> Roy P. Basler, ed., *The Collected Works of Abraham Lincoln* (New Brunswick, NJ: Rutgers University Press, 1953), 5:514. See also John G. Nicolay and John Hay, *Abraham Lincoln: A History* (New York: The Century Company, 1890), 6:200.

<sup>106</sup> Mathew Brady, "Pontoon Bridge on the Rappahannock," in Benson J. Lossing, *Mathew Brady's Illustrated History of the Civil War* (repr., New York, Portland House, 1996), 234. Timothy O'Sullivan, "Meade's Pontoon Bridge at Fredericksburg," in William C. Davis and Bell L. Wiley, *Civil War: A Complete Photographic History* (New York: Tess Press, 2000), 326.

<sup>107</sup> *O. R.*, ser. 1, vol. XXI, 802-807.

<sup>108</sup> *O. R.*, ser. 1, vol. XXI, 808-819.

temperatures dropping to as low as sixteen degrees as men huddled around camp fires to keep warm. The fear now was that the river would freeze.<sup>109</sup> Yet, by December 10<sup>th</sup> temperatures turned somewhat milder and Burnside decided to launch his attack. The next day at 3:00am, screened by the fog floating atop the Rappahannock, the Engineer Battalion, ordered to build a bridge for General Franklin's Left Grand Division, started moving away from the center of the Union line east. A steep embankment at the river's edge prevented the engineers from bringing the wagons to the rivers edge, and instead, they had to haul the 1,600-pound pontoons 200 yards to the water.<sup>110</sup> The bridge, along with the two next to it built by the 15<sup>th</sup> New York Volunteer Engineers and led by Lieutenant H. V. Slosson, took the entire day as ice on the river had to be broken, men suffering from exposure had to be pulled from the icy cold water, and Confederate skirmishers harassed the bridge builders wounding two men.

Those engineers building the center and western bridges were less fortunate than Lieutenant Slosson's men.<sup>111</sup> The 50<sup>th</sup> New York began construction on the center bridge but under constant enemy fire the entire day they could not complete the work. By late afternoon men from the 15<sup>th</sup> New York were called upon to finish the bridge. Using several of the pontoons as boats the engineers rowed men from the 89<sup>th</sup> New York Infantry to the western bank of the river, and these soldiers were able to drive off Confederate sharpshooters, and the bridge was finished by dusk.<sup>112</sup>

The two western bridges now remained to be built directly across from the town of Fredericksburg, and this meant that Confederate soldiers could use buildings and cellars to hide from Union artillery and infantry who tried to drive them away from shooting at the engineers.

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<sup>109</sup> George C. Rable, *Fredericksburg! Fredericksburg!* (Chapel Hill: The University of North Carolina Press, 2002), 136-139.

<sup>110</sup> Thienel, 79-80.

<sup>111</sup> The distance between the eastern bridges and western bridges was about two miles.

<sup>112</sup> Thienel, 83.

At 4:00am on December 12<sup>th</sup> pandemonium broke out at the bridge. Captain Wesley Brainerd wrote of the chaos: "At the signal we started on a double-quick, ten men besides myself.... When I reached the end of the bridge but five of my men were with me, the other five had either been killed or were wounded and were crawling off."<sup>113</sup> Within minutes Brainerd was the only man left on the bridge and then his left arm jerked over his head and he thought he "had been hit with a bar of hot iron," collapsing onto the bridge. Somehow he managed to get to the river's edge and with the help of his comrades made it to an aid station before bleeding to death.<sup>114</sup>

Finally men of the 7<sup>th</sup> Michigan, 89<sup>th</sup> New York, and the 19<sup>th</sup> and 20<sup>th</sup> Massachusetts Regiments crossed the river in pontoons "and carried handsomely the houses and shelters occupied by the Confederates..." and this allowed the engineers the freedom to complete the bridges. The next day Burnside's army crossed all six pontoon bridges and attacked the entrenched enemy. The wanton killing that went on at Marye's Heights was devastating to the Army of the Potomac and Burnside lost his command. General Woodbury was exonerated for his role in the transportation of the pontoons in the weeks leading up to the battle, but was dismissed as commander of the Engineer Brigade and sent to Fort Tortugas in the Florida Keys where he contracted yellow fever and died the following year.<sup>115</sup> The Engineer Brigade's losses at Fredericksburg were nine killed, fifty wounded, and two captured.<sup>116</sup>

The year ended and the Army of the Potomac was no closer to capturing Richmond or defeating Robert E. Lee's Army of Northern Virginia than they were when the year began. Out west the Army of the Cumberland gained back some territory along the Nashville to

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<sup>113</sup> Ed Malles, ed., *Bridge Building in Wartime: Colonel Wesley Brainerd's Memoir of the 50<sup>th</sup> New York Volunteer Engineers* (Knoxville: The University of Tennessee Press, 1997), 113.

<sup>114</sup> Malles, 113-114.

<sup>115</sup> Thienel, 87.

<sup>116</sup> Thienel, 87.

Chattanooga corridor and now attention would turn to the Mississippi River and the city of Vicksburg. Nonetheless, the Confederacy still held the critical coastal ports of Charleston, Wilmington, and Mobile and held the entire lower South. Confederate and Union soldiers were fighting with skill and determination, and both sides had officers who led well and others who led less well. The most significant difference between the two sides was in their ability to manage an emerging modern war. The size of the armies, dictated new untried methods of moving men and material over complex terrain. There was no book on how to do this, but as historian Bruce Catton pointed, "The volunteer army [Union] was teeming with men quite capable of playing the part of military engineers if some capable officer directed them."<sup>117</sup> Some officers had recognized mechanical skills in their men and had started to utilize these assets. McClellan had formed two volunteer engineering regiments, Rosecrans established a Pioneer Brigade, and the War Department turned over the operation of the military railroads to Herman Haupt. Now as the war entered its third year, Union officers started to recognize that by tapping into their soldiers' mechanical skills and ingenuity anything was possible tried and a great deal could be accomplished.

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<sup>117</sup> Bruce Catton, *Reflections on the Civil War*, ed. John Leekley (Garden City, NY: Doubleday & Company, Inc., 1981), 189-190.

## **CHAPTER 7**

### **VICKSBURG**

**While work [was] underway General Rawlins, Dana, and I spent time together passing from bridge site to bridge site encouraging officers and men in their novel and necessary work and with admiration for the volunteer soldier and his unequaled capacity for practical bridge building.**

**Lieutenant Colonel James H. Wilson, Corps of Engineers, USA**

**I learned that General McPherson was using mortars made of trunks of trees (gum trees being the best) to throw 6 and 12-pound shells....**

**First Lieutenant P. C. Hains, USA**

The strategic significance of Vicksburg has been a topic of debate among historians for several decades. In the epic narratives of the war by Douglas Southall Freeman, Bruce Catton, and Shelby Foote the capture of Vicksburg torn the Confederacy in two, making it impossible for those southerners living in the eastern half of the country to reap the benefits of important supplies that, with Vicksburg in Confederate hands, would have flowed from the west and sustained the war effort. This thesis held sway for many years until the work of historians such as Herman Hattaway, Archer Jones, and most recently Albert Castel, proved that the amount of material goods coming from the western half of the Confederacy did not contribute measurably to supplies in the east. Of course, this revelation then raised another challenging question. Was the capture of Vicksburg as important as we had come to believe it was?

The answer is it was. The capture of Vicksburg accomplished four critical strategic objectives. First, it gained control of the Mississippi River for the Union Navy. This was important because both the Union Army of the Gulf and the navy's Mississippi River squadron needed to work against Confederate forces including guerrilla's operating in Louisiana. In addition, the navy was able to move large quantities of supplies along the river to points where these supplies

would be unloaded and then transported overland to Union armies operating deep within the heartland of the Confederacy.

Second, the capture of Vicksburg was a great boost for Union morale, and conversely, a significance setback for southern soldiers and civilians. Third, the victory at Vicksburg eliminated an entire Confederate army from the war, and finally, it elevated the status of General Grant in the eyes of the northern public, and especially in the eyes of President Lincoln. Lincoln would select Grant to rescue the beleaguered Union forces inside Chattanooga, which the general would accomplish, and after that Grant would be promoted to lieutenant general and placed in charge of all Union armies. That decision also turned out quite well.

Vicksburg was the most important campaign of the war, and Grant's determination to capture the "Gibraltar of the Confederacy" and the risks he took to do so also made the campaign the most remarkable of the war and perhaps even in American military history. Vicksburg's capture, however, would not have been accomplished without an extraordinary engineering effort, made even more incredible by the fact that when the campaign began Grant had at his disposal only three army engineers, and a company and regiment of volunteer engineer soldiers. The story of what happened to bring about the Union army's success at Vicksburg captures the essence of how the North engineered victory during the war.

Operations around Vicksburg did not begin well for the Union army and navy. Yet, the willingness to try different approaches to get at Vicksburg, spoke to the army's increasing confidence and faith in volunteer soldiers' ingenuity, proficiency, and versatility. If an idea could be imagined then it could be attempted even though there was no guarantee of success. This was true in the early summer of 1862 Admiral David G. Farragut, Commodore David D. Porter, and General Benjamin Butler hatched a plan to conquer Vicksburg.

Porter's mortar schooners and 3,000 soldiers sent by Butler under the command of Brigadier General Thomas Williams would ascend the river and once below the town the mortars would lob their 200-pound shells in a bombardment that would destroy the city and knock out all the Confederate batteries. Williams's men would then occupy Vicksburg. If this attack failed Williams would attempt to dig a canal across De Soto Peninsula, a narrow neck of land about 5,000 feet wide on a sharp bend in the Mississippi River. Peering down from the heights of Vicksburg the Mississippi looked like an inverted C. This bend in the river provided an opportunity for Union engineers to dig a cutoff and permanently alter the course of the river. In civil engineer David F. Bastian's carefully researched, *Grant's Canal*, he wrote of the canal project: "The slope of the projected waterway would be much greater than the natural course and, once completed, gravity would propel the water across the peninsula rather than around it."<sup>1</sup> The goal was to change the course of the Mississippi and to turn Vicksburg into an inland town.

The idea of changing the course of the Mississippi was not new. In the 1850s the U. S. government hired civil engineer Charles Ellet, Jr. to study and recommend how flood prevention and navigation improvements could be made along the Ohio and Mississippi Rivers. One of Ellet's suggestions was a cutoff over the De Soto Peninsula, opposite Vicksburg.<sup>2</sup> The consequence of just such a cutoff was irreparable damage to Vicksburg's economy, and as a result of extensive lobbying efforts by the city fathers, the state legislature passed a bill in 1858 outlawing efforts, which would have resulted in a cutoff.<sup>3</sup>

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<sup>1</sup> David F. Bastian, *Grant's Canal: The Union's Attempt to Bypass Vicksburg* (Shippensburg, PA: White Mane Publishing Company, Inc., 1995), 7.

<sup>2</sup> Charles Ellet, Jr., *The Mississippi and Ohio Rivers* (Philadelphia: Lippincott, Grambo & Company, 1853), 191-192.

<sup>3</sup> Bastian, 3.

Now, as Porter's flotilla steamed toward Vicksburg, Lieutenant Colonel Alfred W. Ellet's ram fleet started up river from Memphis to block a possible Confederate escape from Vicksburg by the river. There was some sad irony here. Charles Ellet, Jr., initiator, designer, and head of the U. S. Ram Fleet in 1862 was mortally wounded and died on June 21<sup>st</sup> standing aboard *Queen of the West* during a combined army-navy operation to capture Memphis. His brother, Alfred, now ram fleet commander was headed toward Vicksburg to support a possible canal operation that his brother had worked on and proposed in the 1850s.

Farragut and Porter's force did manage to slip eight ships past the relentless cannonade from the city's guns, but sixteen sailors were killed and another twelve were wounded. Running warships past Vicksburg could be done, but nothing was accomplished by doing so. Confederate guns would continue to rain down terror on any Union gunboat attempting to pass the heights, and supplies to the city would continue to arrive overland from as far away as Mobile, Alabama. Confederate quartermasters could ship goods from Mobile north along the Mobile & Ohio Railroad as far as Meridian, Mississippi. Supplies were then shipped west on the Southern Railroad of Mississippi to Jackson and then onto Vicksburg. Confederate forces under General Sterling Price also controlled the Mobile & Ohio from Meridian as far north as Tupelo. Under these circumstances moving the mighty Mississippi seemed like the best option.

Williams set about surveying the site and selecting the path the canal was to take. With the help of his 3,000-man force and slaves from surrounding plantations the excavating began with initial success. The work itself was brutal. Men moved dirt in excessive heat and humidity, had very little in the way of clean drinking water, and fought constantly with mosquitoes.<sup>4</sup> The ditch was fifteen feet wide and approximately three feet deep. An embankment or levee on either end blocked the river from entering the ditch, and the idea was that when ready, the

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<sup>4</sup> Bastian, 14-15.



levees would be broken and millions of gallons of water from the river would rush into the canal flooding the entire area and forcing the river to form a new channel. Unfortunately, as men were doing the thankless and back breaking work of cutting trees, removing stumps, and shoveling dirt the river began to fall at a rate of a foot per day.<sup>5</sup> A correspondent for the *Chicago Tribune* wrote, "... when the levee at each end of it [canal] was cut through, it was found to be above the level of the water."<sup>6</sup> To rectify the problem the center of the ditch was dug five feet deeper and the earth was thrown on three-foot deep sections actually raising them closer to the surface.

By late July the river had fallen twenty-five feet, the summer heat remained oppressive, half of Williams' work force was sick and disabled, and Farragut was anxious to leave the area. The project resulted in failure, and the men were evacuated from the peninsula. Vicksburg continued to stand as the South's Rock of Gibraltar. The Union Army had no further plans to solve the military problem of how to capture Vicksburg until October when General Halleck turned the Department of Tennessee over to General Grant. Within one week Grant was ready to move on Vicksburg in the most direct way possible.

Any map revealed that Grant's operational directives made perfect sense, and if successful, would have allow Grant to besiege the city. He would move south to Holly Springs, Mississippi, approximately 150 miles from his primary supply base located in Columbus, Kentucky. The railroads carried the necessary war materials for his 40,000 men on a direct north/south axis and from Holly Springs continued south along the Mississippi Central Railroad to Jackson, Mississippi. From Jackson, Grant planned to move due west and assault the city of Vicksburg by the back door, its most vulnerable defensive position. To place additional pressure

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<sup>5</sup> Bastian, 17.

<sup>6</sup> *Harper's Weekly*, vol. 6, no. 292, August 2, 1862, 482. See also Bastian, 19-20.

on Confederate commander General John C. Pemberton, Grant would send 32,000 men under General William T. Sherman from Memphis up the Yazoo River to the heights north of Vicksburg known as Chickasaw Bluffs. This plan would force Pemberton to divide his force of 32,000 men hence giving the advantage to the Federal attackers. The major flaw in this strategy, and the reason why it failed, was because Grant failed to protect his own extended supply lines.

The overland advance came to an abrupt halt in the last week of December 1862. Confederate cavalry under Earl Van Dorn and Nathan Bedford Forest raised havoc with Grant's plan. Van Dorn's horse soldiers captured Grant's critical advance base at Holly Springs, and Forest destroyed sixty miles of railroad track along the 180 miles of roadway between Holly Springs and Jackson. This disaster forced Grant to return to Grand Junction, Tennessee and reconsider his options. These Confederate initiatives also left Sherman's force exposed to an onslaught. Grant was unable to get word to Sherman that his advance had been stopped, but Pemberton knew this and met Sherman at Chickasaw Bluffs with almost his entire force in solid, entrenched positions. Hacking through dense cockle berry hedgerows on the river's bank, crossing a bayou, and coping with cold wet weather, Sherman's command assaulted the bluffs and within three days determined the enemy's fortifications were impregnable. Sherman gathered his wounded, buried his dead and retreated back to Memphis.<sup>7</sup>

The operation against Vicksburg was carefully monitored back east in the halls of Congress, in the White House, and by the press. Early in the new year a *New York Times* correspondent wrote: "With the best disposition in the world to be satisfied with Western war movement, in view of their general gratifying success, we confess we find it impossible to regard

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<sup>7</sup> Phillip M. Thienel, *Seven Story Mountain: The Union Campaign at Vicksburg* (Jefferson, NC: McFarland & Company, Inc., 1998), 18-19. The Chickasaw Bluffs expedition was a combined army-navy operation. Sherman's men were transported on the Yazoo by Rear Admiral David D. Porter's river fleet.

the result of our operations against Vicksburg without strong disfavor.... We were promised a speedy success, and had a right to expect it.”<sup>8</sup> In the same article the author harshly criticized the confusion in authority that marked the early stages of the Vicksburg campaign. General John A. McClernand, before the war a prominent Illinois politician and member of Congress had been authorized by Halleck and Lincoln to raise a force for a river expedition against Vicksburg. This completed, McClernand expected to command the Chickasaw Bluffs’ movement. Grant wanted Sherman to lead the offensive. McClernand was a close political ally of the president, and he complained vehemently to the White House that some of those he recruited were men Grant assigned to Sherman for the Yazoo River movement. These complaints did not go over well with Grant, and the dispute between the generals was well known and considered an impediment to the entire operation.<sup>9</sup>

After the battle of Chickasaw Bluffs, McClernand reasserted himself and regained control of his recruits. He named them the Army of the Mississippi, and launched a successful attack on Fort Hindman, or Arkansas Post, at the same time the *New York Times* article appeared in the papers. The capture of Fort Hindman proved to be a crucial factor in the months ahead because Confederate forces were now prevented from operating on Union supply lines and on the Union Army’s flank. Rebel raiders and partisans used Arkansas Post as a safe haven to resupply, strike at Union supply lines and then retreat to the safety of the fort. Despite the capture, however, Grant was furious. He believed, correctly, that two armies acting independently from one another would bring repeated failures in efforts to capture Vicksburg. He wrote to Halleck pleading his case for a unified command and this was approved. Now moving to Milliken’s Bend, Louisiana on January 29, 1863, Grant took personal command of

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<sup>8</sup> *New York Times*, January 12, 1863.

<sup>9</sup> Thienel, *Seven Story Mountain*, 14-15.

Vicksburg operations. He reorganized the Army of the Tennessee into four corps, and he appointed McClernand senior corps commander.<sup>10</sup>

In *War and Peace*, Leo Tolstoy wrote: “If in the accounts given by historians...we find that wars and battles appear to follow a definite plan laid down beforehand, the only deduction we can make...is that these accounts are not true.”<sup>11</sup> During the Vicksburg Campaign anyone who believed that Grant was following a distinct plan was only kidding himself. He had once remarked to a staff officer, “In war anything is better than indecision. We must decide. If I am wrong, we shall soon find out, and can do the other thing. But not to decide wastes both time and money, and may ruin everything.”<sup>12</sup> Grant took to heart his own advice. After his initial plan to capture Vicksburg had died at Holly Springs and Chickasaw Bluffs, he would operate under the notion that trial and error was the only feasible method of capturing the city. Improvisation would highlight the next six months of campaigning.

Vicksburg’s location and the geography of the surrounding area was the obstacle preventing Grant from having any opportunity to capture the South’s most important bastion along the Mississippi. Without cutting the central supply artery from Jackson to Vicksburg, the latter could be defended indefinitely. Getting to Jackson and then moving his army west to besiege Vicksburg was the all-consuming problem. The bluffs along the eastern riverbank ran north and south for approximately 100 miles. North of the town the Yazoo River and its swampy bottomland delta stretched for 175 miles north and south and another 60 miles east and west. South of Vicksburg the bluffs were fortified as far as Grand Gulf, 40 miles below the city at the

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<sup>10</sup> Thienel, *Mr. Lincoln’s Bridge Builders*, 113. The corps were led by the following major generals: XIII Corps, John A. McClernand; XV Corps, William T. Sherman; XVI Corps, Stephen A. Hurlbut (this corps remained in Memphis as reserves); and XVII Corps, James B. McPherson.

<sup>11</sup> Quoted in Thomas B. Buell, *The Warrior Generals: Combat Leadership in the Civil War* (New York: Three Rivers Press, 1997), 238.

<sup>12</sup> Buell, 247.

junction of the Big Black River and the Mississippi.<sup>13</sup> Finally, on the Louisiana side of the river a maze of bayous, swamps, and lakes, all part of the Mississippi flood plain, made passage all but impossible. The difficult geography to overcome did not include Confederate cavalry and saboteurs prepared to build man made obstructions to an area already deemed impassable.

Grant, however, had confidence in his engineers' ability to improvise and move his army and their supplies where he imagined moving them, or at least making the attempt. This was truly remarkable, first because the terrain was treacherous, second because he had only three engineer officers and two engineer units present when he began operating against Vicksburg in January 1863, and third because he would need to rely on infantry as engineer and pioneer soldiers.<sup>14</sup>

One group of engineer soldiers was that of Captain William F. Patterson's Kentucky Company of Mechanics and Engineers, and the other was Colonel Josiah Bissell's 1<sup>st</sup> Missouri Engineer Regiment. Both were undersized units, which alone were not capable of building the causeways and bridges required to move the army where Grant wanted to move it. Nonetheless, Grant and his corps commanders soon found the additional skills they sought among the men serving in the infantry. To augment the engineer troops he had the army would form pioneer companies, draft infantry regiments, and use runaway slaves under the supervision and guidance of officers and non-commissioned officers actually serving as engineers. The men in the ranks who had developed mechanical skills before the war would now be ordered to apply those skills, although unknown to them at the time, to the most important campaign of the war.

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<sup>13</sup> Thienel, *Seven Story Mountain*, 12.

<sup>14</sup> Grant's staff engineer was Captain Frederick Prime and his staff topographical engineer was Lieutenant James H. Wilson. The third engineer was on Sherman's staff, Captain William L. B. Jenney.

For two months in the late winter and early spring of 1863 Grant ordered four simultaneous attempts to get his men and supplies on *terra firma* east of Vicksburg. Using Milliken's Bend, 20 miles northwest of Vicksburg on the Mississippi, as the advance supply base, the following four expeditions were launched. First, there was an effort to re-open Williams's original canal and then to dig one at Duckport, Louisiana. The second effort was to connect Lake Providence, 60 miles north of Vicksburg with the Tensas, Black, and Red Rivers, by-passing a series of forts and batteries guarding approaches to the city from the Mississippi River. Next, an attempt would be made to blast a hole in the levee to open the Yazoo Pass, 200 miles north of Vicksburg, to access the Tallahatchie River and then approach the city from the northeast. Finally, the engineers and navy would endeavor to enter Steele's Bayou, forty miles north of Lake Providence, and strike at the city from the north. All four of these expeditions would keep the army's supply lines connected and protected. All four of these expeditions would require ingenuity and innovation, and all four of these expeditions would fail.

Grant placed little faith in the Yazoo Pass option. The failed Chickasaw Bayou venture taught several important lessons. Confederates had mined the river, which resulted in the sinking of the ironclad *Cairo*, and they had chained together floating logs, which blocked the navigable channel leading to Yazoo City forty miles north of Vicksburg.<sup>15</sup> Grant was also aware that Confederate guns along the bluffs commanded any potential landing spot for a move on Vicksburg. Further, the winter rains had elevated the river's water level and the run-off flooded small streams and swamps. Yet the flooding could work as a Union advantage.

The Yazoo Pass was a former ship passage that had enabled transports from the Mississippi into Moon Lake just on the east bank of the Mississippi River, 305 miles north of Vicksburg. From Moon Lake ships could access Coldwater River, which ran into the Tallahatchee

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<sup>15</sup> Bastian, 25. The *Cairo* is now on display at Vicksburg National Military Park.

River and eventually dumped into the Yazoo. By using this route Grant's army might get to dry land just north of Haynes' Bluff and attack the stronghold from its flank. It was a long shot. The pass had become a mosquito infested, stagnant place overgrown with vegetation.<sup>16</sup> The levee was 18-feet high and there was a difference in height of eight and one-half feet between the water in Moon Lake and the pass. Lieutenant Colonel Wilson of Grant's staff reported that if a small crevasse could be cut the force of water would enlarge the gap and within days ships would be able to pass through.

On February 3<sup>rd</sup> Wilson placed a mine in what would become the mouth of the cut, and then two crevasses were dug about twenty feet apart. The mine was detonated sending debris everywhere and widening the gap in the levee as torrents of water powered through. The next day Wilson wrote: "The Pass is open, and a river 75 or 80 yards wide is running through it with the greatest velocity.... By 11pm the opening was 40 yards wide, and the water pouring through like nothing else I ever saw except Niagara Falls. Logs, trees, and great masses of earth were torn away with the greatest of ease." Within a few days the powerful flow of water would subside, and the navy would send shallow draft vessels through the new channel to explore the region to determine the next move. Wilson wrote Grant's Chief of Staff John A. Rawlins, "The work is a perfect success."<sup>17</sup>

For ten grueling days steamboats slugged their way through the pass as the men on board cut cottonwoods and sycamores that reached completely over the stream. Some were four feet wide at the base and weighed thirty-five tons. Because of the flooding, there was also no more than a three-foot wide strip of dry land along the bank on which to work. Wilson reported, "Our greatest difficulty so far has been to obtain tackle strong enough to resist

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<sup>16</sup> Thienel, *Seven Story Mountain*, 39-40.

<sup>17</sup> *O. R. ser. 1*, vol. XXIV. part 1, 373.

strain...to lift the heaviest logs.”<sup>18</sup> It was six miles from the Mississippi to the levee, cut by Wilson, on the west side of Moon Lake, and from there through the pass to Coldwater River another fourteen miles.

Grant wrote to Halleck on March 7<sup>th</sup> that Commander Watson Smith had travelled the thirty miles of the Coldwater and entered the Tallahatchee with “2 ironclads, (*Chillicothe* and *Baron De Kalb*), 2 rams, and 6 light draught gunboats, under the command of Commander Smith, and ... 14 transports with 6,000 soldiers.”<sup>19</sup> Commander Smith, Wilson, and Grant remained optimistic as steady movement continued, yet from the moment the levee was cut in early February there was no disguising the Federal’s intentions and Confederate General Pemberton had time to respond. Partisans felled sycamore, oak, elm, and pecan trees into the streams, and with driftwood, formed taxing obstacles to remove. Using slaves from surrounding plantations, Confederates also hastily built a fortification at the confluence of the Tallahatchee, Greenwood, and Yazoo Rivers, Fort Pemberton. High water, as a result of flooding the pass and fourteen days of rain since February 1<sup>st</sup>, eliminated any hope of landing troops on dry ground to flank the batteries. The Confederates quietly waited for Smith’s small fleet to arrive.<sup>20</sup>

The naval assault began on March 11<sup>th</sup> and continued until the 13<sup>th</sup> with no appreciable damage to the fort. The gunboats approached to within 800 yards and no further.<sup>21</sup> Wilson blamed Smith and the navy. “I can see a disposition on the part of the Navy to keep from a close and desperate engagement. I tried to give them backbone but they are not confident. Smith not the equal of Lord Nelson.”<sup>22</sup> In fairness to Smith, the tight channel, the obstacles in the water, the lack of repair facilities, and no pressure on the fortification’s flank by Union infantry, allowed

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<sup>18</sup> O. R. ser. 1, vol. XXIV, part 1, 371-390.

<sup>19</sup> O. R. ser. 1, vol. XXIV, part 1, 20.

<sup>20</sup> Thienel, *Seven Story Mountain*, 57-65.

<sup>21</sup> Thienel, *Seven Story Mountain*, 68.

<sup>22</sup> O. R., ser. 1, vol. XXIV, part 1, 371-390.



the Confederate guns to focus on the small river fleet. Wilson devoted considerable attention to the Yazoo Pass operation, but it was at a dead end. The flotilla reversed course and started back to the Mississippi. Grant though was not ready to give up on the idea of attacking Vicksburg from the north. Reconnaissance confirmed the efficacy of a route through Steele's Bayou to Black Bayou and Deer Creek. Entering the Yazoo River there, an attempt could be made to land troops between Yazoo City and Haynes' Bluff, where the army could attack the Confederate army's right flank at Vicksburg.<sup>23</sup>

From the outset, Admiral Porter's vessels had problems navigating Steele's Bayou. Shallow water, smokestacks ripped off by overhanging trees, overgrown channels just wide enough for gunboats to pass, and eerie sounds frightened superstitious sailors. When Confederates felled trees, mice, rats, and snakes hit the deck of the gunboats adding to the deplorable and scary conditions in the bayou. Porter forged ahead, travelling one half mile an hour until he finally reached Deer Creek. Behind Porter's boats was General Sherman's detached force made up of his army's Second Division pioneer corps, the 8<sup>th</sup> Missouri Infantry, and two companies of the First Missouri Engineers. Sherman wrote: "Deer Creek is a narrow, sluggish stream, full of willow bushes and overhanging tree limbs inhabited by animals.... Porter's ironclads move like snails...."<sup>24</sup>

At Rolling Fork, Deer Creek turned 180 degrees, emptied into Sunflower River and eventually the Yazoo River. Porter and Sherman had successfully by-passed Haynes' Bluff, and they were approaching Yazoo City. Then a disaster struck that almost cost Porter his entire fleet in the expedition. As the admiral moved about one mile from Rolling Fork his boats became trapped. With Confederate obstacles in the bayou, and sharpshooters along the banks, Sherman

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<sup>23</sup> Thienel, *Seven Story Mountain*, 69.

<sup>24</sup> *O. R.*, ser. 1, vol. XXIV, part 1, 432-433.

reported, “an avalanche of water from Rolling Rock,” created a logjam for Porter’s ships.

Sherman pointed out that the floodwater “actually came from Colonel Wilson’s act to cut the levee on the Mississippi....”<sup>25</sup>

When Sherman learned Porter’s fleet was in trouble, he sent infantry through the bayous to rescue the navy. Once the soldiers secured the area and the pioneers, engineers, and infantry cleared the obstacles from the narrow channel, sailors disconnected the tiller ropes and tackles to the boats’ rudders and backed down the bayous to the safety of the Mississippi.<sup>26</sup> The Steele’s Bayou affair was over, and Grant learned that he could not get at the enemy from the north. The confusion of the expedition was reflected in one commanding officer’s attempt to write his after action report. Under normal campaign conditions officers’ wrote their own reports without assistance, but in this case one of Sherman’s staff officers was asked to assist. The commander said to the staffer in a vexatious tone, “I want you to tell me where I have been, how I went there, what I did, and if I came back the same way I went, or if not, how did I get back.”<sup>27</sup> The break in the Yazoo Pass levee did serve the purpose of flooding the entire area north of Vicksburg and limited the defenders supply lines to just along the roads and railway due east to Jackson. Otherwise, Wilson’s venture and Steele’s Bayou had been confusing and failed operations, but while Grant was trying to get his army north of Vicksburg, he also schemed to move his army south and attack from dry land south and east of the city. Three attempts were made and the first one was to rebuild the De Soto canal.

In January, Grant ordered Colonel Josiah W. Bissell, the intrepid officer responsible for constructing the Island No. 10 canal, to survey Williams’s cutoff and report on the feasibility of

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<sup>25</sup> *O. R.*, ser. 1, vol. XXIV, part 1, 435.

<sup>26</sup> James R. Arnold, *Grant Wins the War: Decision at Vicksburg* (New York: John Wiley & Sons, Inc., 1997), 50-51.

<sup>27</sup> Arnold, 51. See also William L. B Jenny, “Personal Recollections of Vicksburg,” *MOLLUS Papers—Illinois*, 3:256.

reopening the project. Bissell found the canal between nine and twelve feet wide, no more than six feet deep hosting two feet of standing water, and with slack water on both ends outside the levee.<sup>28</sup> After Bissell reported back to Grant, the general sent his chief engineer, Captain Frederick Prime to investigate other places where canals might be cut. Prime determined that a route could be cut from the Mississippi through Lake Providence, forty-five miles north of Milliken's Bend, into the Tensas, Black, and Red Rivers to again join the Mississippi fifty miles above Port Hudson. This would serve several purposes. It would allow the army to by-pass Vicksburg, and it would block the Red River supply route to the Confederates in Vicksburg. It would also position Grant's army in such a way that he could move on Vicksburg and transport troops south to Port Hudson to assist General Nathaniel Banks' Army of the Gulf in capturing the Confederate stronghold there. Grant ordered General McPherson to construct the 400-mile Lake Providence route, a task described by historian Phillip Thienel as being "of significant magnitude."<sup>29</sup>

Both canal efforts began in late January and haphazard leadership at the De Soto canal forced Grant to place Prime in charge of that project. When the captain arrived he counted a number of problems, The Mississippi rose five to six inches daily but the water entering the canal was not forceful enough to scour the sides of the ditch changing the course of the river. Instead, water oozed into the low-lying areas spreading for several miles. Deepening and widening the canal to increase the channel flow was difficult because there was already two to three feet of water in the ditch, and Prime lacked heavy equipment to dredge the channel. Levees built one and a half miles northeast of the actual canal and designed to keep the area around the canal as dry as possible, started to leak as did the railroad embankment three miles

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<sup>28</sup> Jenney, "Personal Recollections of Vicksburg," MOLLUS—Illinois, 3:252.

<sup>29</sup> Thienel, *Seven Story Mountain*, 33.

northeast of the canal limiting the space where the men working on the project could pitch their tents.<sup>30</sup> Thirty-nine infantry regiments called the dreary swamps home. A Vicksburg National Military Park historian wrote, "Sanitary facilities were wretched.... Many men sickened and large numbers died...burial parties were seen ""almost every hour on the levees—the only possible place for a grave.""<sup>31</sup> Finally, steamboat captains complained about the entrance to the canal because it was adjacent to an eddy, which they claimed would prevent the cutoff from succeeding.<sup>32</sup>

What was critical for the success of the canal was not the depth, although it needed to be deep enough to allow heavy vessels through, but the width. The canal needed to be sixty feet wide in order for transports, rams, and ironclads to pass through. As the sides of the ditch were dug away the stagnant water in the canal spread making it difficult to dig deeper than three or four feet. Constant rains raised the level of water in the canal, saturated the ground, and left soldiers in a dismal state. Captain Henry G. Ankeny, Company H, 4<sup>th</sup> Iowa Infantry, wrote to his wife: "At camp near Vicksburg raining constantly, terrific thunder, camp overflowed. What we suffer will never be known outside these precincts. Work on the canal going on.... Great deal of sickness prevailing in the army. Some new regiments have 300 sick. Many die. 72 left in my company."<sup>33</sup>

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<sup>30</sup> Edwin Cole Bearss, *Vicksburg is the Key*, vol. 1 of *The Campaign for Vicksburg* (Dayton, OH: Morningside House, Inc., 1985), 438-439.

<sup>31</sup> Bearss, 439. See also *O. R.*, ser. 1, vol. XXIV, part 3, 10. John A. Bering and Thomas Montgomery, *History of the Forty-eighth Ohio Veteran Volunteer Infantry, Giving a Complete Account of the Regiment, from its Organization at Camp Dennison, Ohio in October, 1861, to the Close of the War, and its Final Muster Out, May 10, 1866* (Hillsboro, OH, 1880), 70-72. *O. R.*, ser. 1, Vol. XXIV, part 1, 437, 441, 445-447, 450-454. T. B. Marshall, *History of the Eighty-third Ohio Volunteer Infantry* (Eighty-third Ohio Volunteer Infantry Association, Cincinnati, 1912).

<sup>32</sup> Bastian, 33.

<sup>33</sup> Thienel, *Seven Story Mountain*, 49-50.

Colonel Bissell's regiment arrived on the scene in mid-February and Prime put them to work extracting stumps in the present canal and in digging a channel 200 feet long to draw off the water between the canal and a plantation on the peninsula. Prime ordered work parties to dam both the entrance and exit to the canal and he ordered the raising of the canal levees. Wooden frames were built to support the dams, and 500 contrabands from surrounding plantations were assigned to the new entrance. The black laborers only dug four feet before hitting water, and the soldiers worked twenty-four hours a day to strengthen the levees protecting their campgrounds. As men frantically worked the water in the canal rose to within seven feet of the water level in the Mississippi.<sup>34</sup>

To lower the water level around the new entrance to the canal the engineers built a steam powered sump pump, which drew down the water level as the black laborers completed digging a sixty foot wide entrance that was four feet deep. Incessant rain in late February continued to hamper activity even though two steam dredges arrived from Memphis and started to clear an approach channel for the new entrance.<sup>35</sup> Then the weather broke. Now with dredging operations underway, Bissell's engineer troops cutting out stumps from the expanding canal, and soldiers working around the clock, a sense of optimism began to spread as the water appeared to recede. Henri Lovie, a correspondent-illustrator for *Frank Leslie's Illustrated Newspaper*, predicted to his readership "we will...be able to run our largest boats through the cut-off in less that two weeks."<sup>36</sup>

Confederate General Pemberton and his staff observed the canal project with great interest and they moved batteries to positions opposite the canal's exit. Pemberton, a

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<sup>34</sup> Bastian, 38. See also *O. R.*, ser. 1, vol. XXIV, part 1, 120.

<sup>35</sup> Bastian, 41-42. The names of the two dredges were the *Sampson* and *Hercules*.

<sup>36</sup> Lovie to Editor, *Frank Leslie's Illustrated Newspaper*, March 28, 1863, 14. One of the few illustrations we have of the De Soto canal project is Lovie's drawing titled "The Head of the Canal, Opposite Vicksburg, Miss.," in March 28, 1863 paper, 8-9.

Pennsylvanian who joined the Southern cause as a result of his marriage to a Virginian woman, was cognizant of Yankee determination and ingenuity. He informed the southern War Department of the canal work, and reported that if successful, he would need to fortify Grand Gulf forty-six river miles south of Vicksburg and only twenty-three miles over roads. Anticipating Federal success, Pemberton ordered two regiments under General John S. Bowen to Grand Gulf where the river changed course from northeast to west and eddies made navigation problematic. Bluffs extending for six miles also afforded Bowen the opportunity to deliver plunging fire and extend his line so additional guns would cover the entrance to the Big Black River seven miles south of Grand Gulf.<sup>37</sup>

Meanwhile, Captain Prime had begun work on a battery position to defend the exit of the canal. With most of the Missouri engineers employed on the canal removing stumps and operating the dredges, and Company D building pontoons used for transporting soldiers and supplies through the bayous, Prime assigned Company I, 35<sup>th</sup> Missouri Infantry, the task of building the casemates, gabions, and fascines to strengthen the canal's gun positions. Lieutenant Christian Lochbiler and his company, skilled with hand tools, prepared thirty gabions and 120 fascines.<sup>38</sup>

The better weather instilled in all the men working on the batteries and canal a false sense of security. The Mississippi continued to rise and on the night of March 6<sup>th</sup> the mighty

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<sup>37</sup> Bearss, 688-691.

<sup>38</sup> Thienel, *Seven Story Mountain*, 52-53. Bissell's regiment did not bring its pontoon train in Memphis to Vicksburg. See also *Company I*, Muster-Event Report, MF 594, National Archives, Washington, DC. Captain Patterson's Kentucky Company of Mechanics and Engineers received orders to join General McClernand corps, and Patterson was placed in charge of McClernand's pioneer corps. Casemates were bomb-proof enclosures made of ten foot long oak logs 12 to 14 inches thick. Gabions were crude cylindrical wicker baskets generally two feet in diameter and three feet tall and open at both ends. Once in place, gabions were filled with dirt and placed side by side to serve as revetment material. Fascines, tightly bound bundles of small straight tree branches were used as foundation and topping material within gabion revetments.

river broke through the upper dam and cascaded through the channel. The force of the water did not blow out the lower dam, but as the water pooled in the channel the levee built parallel to the canal from excavation started to leak. This was the same levee purposely cut to expel water during the heavy rains in February. Within hours of the initial breach the crevasse in the levee started to vomit water so forcefully a 150-foot wide opening emptied four to five feet of water over the campsites near the canal.<sup>39</sup>

To relieve pressure the downstream dam was blasted out and then attention turned to closing the gap. Men laid sandbags in the gap while one of the dredges was guided into the canal.<sup>40</sup> Water pressure knocked soldiers down into the mud, made visibility poor, raised adrenalin levels, and drenched clothing. Sticks and large branches cut arms, legs, and faces and some men lost their breath as gallons of river water flew into mouths and noses. Once the dredge arrived it attempted to scoop earth to dump onto the sandbags, but all it was able to gather was mud that oozed from the iron bucket. Prime then ordered foraging parties to dismantle buildings on plantations, and he called upriver for a pile driver. In eight days the wooden planks collected reinforced the levee and the dredge managed to place enough dirt and mud to close the breach. All this frenetic work left a gap to the east of the canal entrance and perpendicular to the levee.<sup>41</sup>

When the pile driver arrived, the engineers drove a post into this final gap and then planned to attach an earthen-filled barge to the post. The latter, acting as a bollard and anchored in mud gave way against the weight of the barge almost capsizing the dredge. Prime decided to cut the mooring lines and let the current take the barge away. He then asked the

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<sup>39</sup> *O. R.*, ser. 1, vol. XXIV, part 1, 122.

<sup>40</sup> Civil War dredges were floating steam shovels. The length of the beam holding the shovel limited the depth of dredging. Dredges were not self-propelled. The dredge moved using winching cables than ran from the machines platform to the shore.

<sup>41</sup> *O. R.*, ser. 1, vol. XXIV, part 1, 122-123.

engineers to alter the course of the water streaming into the gap by opening a run-off near the new entrance. This finally stopped the water from flowing into the canal, although water continued to leak out through crevasses in the levee. It had been ten days since the initial breach.

Now Prime was ready for the final push. The dredges began moving through the canal widening the channel to the proper width as they closed to within one half mile of the exit. Prime believed the steam-powered machines would accomplish the remaining work in the canal and felt operations along the Yazoo River needed his attention, so he turned the command over to Colonel George F. Pride, Grant's chief engineer of military railroads. Perhaps Prime determined the canal was a forlorn hope. Confederate guns opposite the canal's exit began to shell the dredges as they came within range. Prime's suggestion to Grant was to consider altering the course of the canal. Pride for his part was more than capable of seeing the canal project to a successful conclusion, but he could not prevent Southern batteries from the nightly cannonades directed at the dredges. On March 22<sup>nd</sup> Grant determined the canal was a failure, and although work continued for two more days the dredges and soldiers were quietly withdrawn. He wrote to General Banks: "...I have prosecuted that work [the canal], and would before this have had it completed to the width of 60 feet but for the heavy rise in the river breaking down the dam across the upper end. It is exceedingly doubtful if this canal can be made of any practical use, even if completed. The enemy have established a battery of heavy guns opposite the mouth of the canal, completely commanding it for one-half its length."<sup>42</sup> It would not be until 1877 that the river naturally broke through the De Soto peninsula, and today a section of Grant's Canal can be seen off Interstate 20 in Madison Parish, Louisiana. In 1863 the

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<sup>42</sup> *Official Records of the Union and Confederate Navies in the War of Rebellion*, series 1, volume 20 (Washington, DC: Government Printing Office, 1905), 8-9. Hereafter cited *ORN*.



canal was over five miles south from the bend in the river, which was opposite the city. Today the remains of the canal are only a mile and a half south of the river. The channel at this point is a mile wide, 100 feet deep during high water, and this portion of the mighty Mississippi passes one mile south of the city.

Grant was never convinced the De Soto canal operation would succeed. He agreed with Sherman's assessment that the efforts there were "labor lost," but Grant did hold out hope that an avenue cut in the Lake Providence region, seventy-five miles north of the city "bids fair to be the most practicable route for turning Vicksburg."<sup>43</sup> If a canal could be opened from the Mississippi into Lake Providence, then a channel made between Bayou Baxter and Bayou Macon, the Union army and navy would access 200-miles of waterway leading to the mouth of the Red River 150-miles south of Vicksburg.<sup>44</sup> General McPherson was given command of the operation, and by the time one of his division commanders, General John McArthur, reached Lake Providence, Grant's chief of artillery, Lieutenant W. L. Duff, had nearly completed the canal connecting the Mississippi and the lake.

When McPherson arrived he immediately investigated Bayou Baxter south, seven miles beyond the lake, looking for a spot where his men could clear a watercourse between the two bayous. McPherson was a West Point trained engineer having graduated first in his class in 1853 he worked on river and harbor improvements before the war. He was Grant's chief engineer for the Fort Henry, Fort Donelson, and Shiloh campaigns, and promoted to major general, United States Volunteers, when he was given command of the XVII Corps in December 1862. Now he had a decision to make. Option one was to send soldiers to dig a canal between Bayou Baxter and Bayou Macon, clear trees and debris from the passage, and build the proper

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<sup>43</sup> *O. R.*, ser. 1, vol. XXIV, part 3, 32-33.

<sup>44</sup> Bearss, 467.

levees. This task would prove arduous work because heavy rains had left area lowlands covered in two to three feet of water. If the water level in the lake continued to rise the work of digging a canal, albeit a two-mile one, would become more torturous and frustrating.

Option two was to open the levee at the entrance to the Mississippi allowing water to overflow the lake, the bayou, and the surrounding area. Then, using Bissell's Island No. 10 technique, McPherson would order steamboats and barges into the proposed bayou connecting waterway, using the steamboats' capstans to haul out the trees and logs felled by the men on the barges. Finally, the trees would be sawed off below the surface of the water.<sup>45</sup>

Before McPherson made his decision he considered one more possibility. On March 1<sup>st</sup> the general travelled north just over the Louisiana and Arkansas border to discover that the town of Ashton, Arkansas on the Mississippi was just six-miles east of Bayou Macon. This might prove the best option because blowing out the levee in Ashton would flood the countryside beyond with water deep enough for boats to reach the bayou. He asked Colonel Bissell if the plan seemed feasible to him, and when Bissell reported back in the affirmative, McPherson ordered Bissell to open the levee in Ashton.<sup>46</sup> Furthermore, McPherson decided not to open the Lake Providence levee, but instead to lift the steam tug *J. A. Rawlins* over the dam into the lake, and from there move her into the water course being opened between Baxter and Macon to assist in hauling out snags and logs. A detail from the 15<sup>th</sup> Iowa Infantry used ropes, tackle, and rollers to move the 3500-ton vessel over the levee, through the Village of Lake Providence, and into the lake.<sup>47</sup>

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<sup>45</sup> Bearss, 471 and *O. R.*, ser. 1, vol. XXIV, part 3, 41-42, and 76.

<sup>46</sup> *O. R.*, ser. 1, vol. XXIV, part 3, 78-79.

<sup>47</sup> William W. Belknap, *History of the Fifteenth Regiment, Iowa Veteran Volunteer Infantry, from October, 1861, to August, 1865, When Disbanded at the End of the War* (Keokuk, IA: 1887), 245-246.

When Bissell opened the levee at Ashton so much water poured through that a ten to fifteen mile area was flooded except it did not pool deep enough in the area between Ashton and Bayou Macon to navigate a large ship or ironclad. Now McPherson was ready to open the levee at Lake Providence. Breached on March 17<sup>th</sup>, one day later the opening had been scoured from thirty feet to 200 feet wide and the entrance was estimated to be twenty feet deep. In five days the level of the lake and the Mississippi were equal.<sup>48</sup> By this time, however, Grant was frustrated. Multiple attempts to safely extend his supply lines and move his army south of Vicksburg had washed out. The Mississippi River would not do the army's bidding. It would not be controlled. High water dampened efforts to open waterways, and the eventual drop in the water level would surely ground vessels trying to pass through the backwater, bayous, and swamps of Louisiana. He wrote to Halleck: "The work of getting through Lake Providence and Bayou Macon, there is but little possibility of proving successful. The land from Lake Providence and also from Bayou Macon recedes until the lowest interval between the two widens out into a cypress swamp, where Bayou Baxter, which connects the two, is lost. This flat is now filled to the depth of several feet of water, making the work of clearing out the timber exceedingly slow, and rendering it impracticable to make an artificial channel."<sup>49</sup>

With four attempts to get at Vicksburg all ending in failure, Grant needed to find a more reliable way to by-pass the city, if one existed. He would soon discover that perhaps an overland passage would work marching his forces and supplies approximately 90-miles along the western side of the great river, while at the same time disguising his movements from the enemy. Also, he understood that his engineers and infantrymen would have to build that route.

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<sup>48</sup> Bearss, 477. *O. R.*, ser. 1, vol. XXIV, part 3, 86-87, 120, and 134. Belknap, 243-246.

<sup>49</sup> *O. R.*, ser. 1, vol. XXIV, part 1, 20.

When Grant decided to march south General McClelland's XIII Corps was camped at Milliken's Bend and in the best location to conduct a reconnaissance of the region. Sherman's XV Corps was at Young's Point, McPherson's XVII Corps was at Lake Providence, and Hurlbut's XVI Corps was in Corinth. Grant was aware of a single wagon road resting on the natural levee bordering two bayous to the town of New Carthage twenty-miles below Vicksburg. The road was through a cypress swamp so Grant needed McClelland to determine if an alternate method of moving supplies to New Carthage could be found.<sup>50</sup> McClelland selected Brigadier General Peter J. Osterhaus, commander of the Ninth Division to oversee the operation. Osterhaus, born in Koblenz, Rhenish Prussia, learned the building trade under his father's tutelage, and at the age of twenty, entered the Prussian Army. He joined the revolutionaries in 1848 and then fled to the United States. His dream was to become an historian but now he found himself in the role of pathfinder.<sup>51</sup>

The men chosen for the assignment were the 69<sup>th</sup> Indiana Infantry under the command of Colonel Thomas W. Bennett. Bennett, a product of antebellum common school education, had become a professor of mathematics and natural sciences and a lawyer before the war.<sup>52</sup> Bennett's reconnaissance force would include two companies of the 2<sup>nd</sup> Illinois Cavalry, two mountain howitzers manned by a detachment from the 6<sup>th</sup> Missouri Cavalry, and Patterson's Kentucky Company of Engineers and Mechanics.

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<sup>50</sup> Warren E. Grabau, *Ninety-Eight Days: A Geographer's View of the Vicksburg Campaign* (Knoxville: The University of Tennessee Press, 2000), 60-62. *O. R.*, ser. 1, vol. XXIV, part 1, 46, 151-152.

<sup>51</sup> Mary Bobbitt Townsend, *Yankee Warhorse: A Biography of Major General Peter J. Osterhaus* (Columbia, MO: University of Missouri Press, 2012), 7.

<sup>52</sup> Indiana County History Preservation Society, "Thomas W. Bennett," Fayette, Franklin, Union and Wayne Counties, Indiana: Portrait and Biographical Record, [www.countyhistory.org/books/doc.fayet/513.htm](http://www.countyhistory.org/books/doc.fayet/513.htm) (accessed June 29, 2013).

Forcing a passage south along Roundaway Bayou to New Carthage was a dangerous proposition. Everything was underwater except the levees along the bayou and there were ample opportunities for the Confederates to stage an ambush or place rifle pits across the road in advance of a Union force. The route selected had to guarantee the safe passage of supplies, and the roadway had to guarantee it could handle heavy, continuous traffic.<sup>53</sup> A military wagon generally carried three to four thousand pounds of cargo that included about twenty pounds of fodder and grain per day for the six horses. Each infantry division of approximately 6,000 men required a minimum of 18,000 pounds of food per day, which meant each division needed over twenty wagons of food for a three day march. This did not include ammunition wagons, ambulances, a portable forge, fuel for the forge, and when they were available, a pontoon train. In addition, 100 to 130 horses were required to move a six-gun battery, ammunition, and supplies, consuming 3,600 pounds of fodder each day. Therefore, identifying the proper road was not as simple as finding a path through the woods.<sup>54</sup>

On the first day from Milliken's Bend, Bennett's command marched southwest toward the little village of Richmond. Patterson's engineers built a 200 foot-long bridge across Roundaway Bayou to Richmond using boards salvaged from a nearby plantation. Patterson then moved south toward New Carthage. With this first leg of the supply line opened at Richmond, Osterhaus sent his division forward, and he personally led Bennett's vanguard toward Pointe Clear plantation where Roundaway Bayou and Bayou Vidal joined. This was only two-miles north of New Carthage, but the area was entirely underwater including the houses in the village, all but their roofs. Water rushed through porous levees, which prevented the engineers from building a bridge. That evening contraband slaves told Osterhaus that there was a large scow

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<sup>53</sup> Grabau, 62. *O. R.*, ser. 1, vol. XXIV, part 1, 495.

<sup>54</sup> Grabau, 32-33.

hidden on Bayou Vidal several miles from their position.<sup>55</sup> The scow was retrieved and Patterson and his men converted it into a small gunship. They boarded the sides up with planks to a height of about five to six feet cutting holes for oars and gun ports. As geographer Warren Grabau wrote, they “mounted the mountain howitzer in the bow. She was named *Opossum*, probably because she was a denizen of the swamp.”<sup>56</sup>

The *Opossum* chased away the small Confederate force at New Carthage so Osterhaus continued another mile and a half south to Joshua James’s plantation, lone, surrounded by twenty acres of dry ground. From this position the Mississippi levee ran unbroken forty-one river miles south to St. Joseph. Osterhaus was told that Confederate cavalry under Major Isaac F. Harrison was in the immediate area along with two infantry regiments and a six-gun battery. It was imperative for the Union advance guard to hold the plantation so it could become the staging area for a Mississippi River crossing.

On April 6<sup>th</sup> Grant ordered McClelland to move his remaining divisions to the vicinity of New Carthage. This opened the Milliken’s Bend area for McPherson’s corps moving from Lake Providence. Developments were dictating commanders’ act with alacrity. Problems that required immediate solutions were confronting officers by the hour. There was no time to send a request up the chain of command only to await a response. General Osterhaus appointed Major John W. Beekman of the 12<sup>th</sup> Ohio Infantry to be the acting engineer on all work within the Ninth Division.<sup>57</sup> Beekman would organize the runaway slaves flooding the Union lines into working parties. Patterson was to gather as many soldiers as possible with mechanical skills to join him at the sawmill on lone plantation to build pontoons and boats. Men and equipment

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<sup>55</sup> *O. R.*, ser. 1, vol. XXIV, part 1, 171.

<sup>56</sup> Grabau, 65.

<sup>57</sup> Thienel, *Seven Story Mountain*, 129.

were ferried from Pointe Clear to New Carthage and lone plantation as fast as boats could be assembled.

Meanwhile, Grant decided the southern passage along the Louisiana side of the Mississippi was his final option to move his forces south. Crossing over the river onto dry land, he would lay siege to Vicksburg. Unlike the previous attempts to by-pass Vicksburg, to abandon this new plan was to end the campaign. There were no options left to Grant, and because Admiral Porter had agreed to run his ironclads and transports past the city's guns to meet Grant's army somewhere south of Vicksburg, the stakes were exceptionally high. Moving downstream, the warships would have the current with them, and Porter was confident his ships would make it by the Confederate guns guarding the river. Porter then warned the general that his plan better work because it would be impossible to return the 5,000-ton ships back upstream. Porter said: "I am ready to cooperate with you in the matter of landing troops on the other side, but you must recollect that, when those gunboats once go below, we give up all hopes of getting them up again."<sup>58</sup>

Gunships, transports, and barges ran the batteries on April 16<sup>th</sup> and 18<sup>th</sup> so Grant rode to McClernand's headquarters at Pointe Clear to prepare for the crossing. When he arrived he did not like what he saw. First, he observed that the supply line from Milliken's Bend was hampered by narrow roadways and bayous. Next, the staging area around Pointe Clear, New Carthage, and Lone was too small to bivouac more than five divisions and his entire army consisting of ten divisions was necessary for a successful amphibious landing. Finally, the navy transports would need to move twenty-miles upstream to Warrenton where the men, artillery, and horses would disembark, and then the transports would return to New Carthage for the next trip. By this time General Pemberton, alerted to the enemy's landing, would rush men to Warrenton, only eight

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<sup>58</sup> Grabau, 61. *O. R.*, ser. 1, vol. XXIV, part 3, 151-152.

miles south of Vicksburg, and destroy those Union soldiers on the east bank of the Mississippi before they could be reinforced by sufficient numbers. No, Grant would move his army farther south and strike at the Confederate fortifications at Grand Gulf.

Osterhaus reported that twenty-five miles to the south of Ione was Hard Times. The roads and extended area around Hard Times were dry and it was only five miles from Grand Gulf. This sounded promising, but Grant remained skeptical. He asked his chief engineer, Colonel Wilson, to scout the area and assess the Osterhaus plan to determine if an alternate route might be more feasible. The problem was that for Osterhaus's division, already on dry ground beyond New Carthage, a movement overland to Mrs. Perkins plantation and then following the levee around Lake St. Joseph to Hard Times, made perfect sense. Moving seven more divisions and enormous amounts of supplies between Pointe Clear and New Carthage, where deep running water made bridging difficult, was a significant concern. Barges had managed to move material through Roundaway Bayou to Richmond and Pointe Clear, and there was a channel between Pointe Clear and New Carthage. Yet, Grant was also worried that the barges would eventually get stuck in the bayou because the Mississippi River had finally begun to fall at a rate of six inches per day.<sup>59</sup> After the war Grant recalled, "I visited New Carthage in person, and saw that the process of getting troops through in the way we were doing was so tedious that a better method must be devised. The water was falling, and in a few days, there would not be depth enough to use boats; nor would the land be dry enough to march over."<sup>60</sup>

After his reconnaissance, Wilson confirmed McClelland's report that a possible route existed along a road that arched northwest, then southeast, along Bayou Vidal to Perkins plantation. Sections of the road, however, needed serious bridging. Grant ordered acting chief

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<sup>59</sup> Grabau, 82.

<sup>60</sup> Ulysses S. Grant, *Personal Memoirs of U. S. Grant* (New York: Penguin Books, 1999), 253-254.



engineer of the XIII Corps, Lieutenant Peter Conover Hains to move forward the India rubber pontoon train, but the pontoons were never used on the western side of the Mississippi. The cylinders were subject to puncture by tree stumps and debris in the bayous.<sup>61</sup>

Brigadier General Alvin P. Hovey's 12<sup>th</sup> Division was assigned the task of opening the causeway along Bayou Vidal with the assistance of his own pioneer corps under Captain George W. Jackson and Patterson's Kentucky engineers. Jackson was from Huntington, Indiana where the Wabash and Erie Canal passed, and so Jackson was familiar with bridging and watercourses. On April 22<sup>nd</sup> the work began. Under Captain Jackson's direction, soldiers were first assigned the task of cutting and hauling timber for the corduroyed roads and bridges. Patterson with his men and additional infantrymen started work on the first bridge.

The bridge was constructed of a 100-foot long flatboat anchored across the main channel bayou by a cable and chain on the south end, and a brace against a tree on the north end. Timber ties six or eight inches in thickness were laid over the gunwales of the flatboat, upon which rested 8 by 12 stringers (frames) supporting the floor planks. Now men standing neck high in water began building four more sections toward each shore. The first section beyond the flatboat was made of 12- inch by 12-inch timber notched halfway into existing tree trunks with additional planks attached from the flatboat to the notches. The remaining spans were trestle sections formed of four uprights secured at the top and bottom by square logs. The roadway was fixed in place by heavy beams pinned to the floor planks. The bridge was 362 feet long but only 240 feet of it rested on trestles and was immovable. Patterson feared that if the

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<sup>61</sup> Thienel, *Seven Story Mountain*, 140. Peter C. Hains is best known for his creation of the Tidal Basin in Washington, DC, and his laying out of the Panama Canal. Hains served in the army Corps of Engineers through World War I.

bayou rose or fell more than 18 inches the connection between the floating sections and the stationary ones might render the bridge impassable.<sup>62</sup>

Upon completing the first bridge, Patterson's engineers marched south along the bayou and began work on a curved 550-foot bridge using newly built 40-foot long flatboats with piers and trestles on each end. The boats were anchored to a 2 ½ -inch line, stretched from shore to shore and supported in the center by a tree. Some of the boats were fastened directly to the cable passing over their bows, and short ropes connected others.<sup>63</sup>

A third bridge, 150-feet long was constructed across a slough. It rested on a center pier, formed of logs placed crosswise, and on trestles on either side of the pier. Men slogged through mud, stood in mosquito infested water, and developed trench foot and blisters, yet by April 25<sup>th</sup> the work was completed. Three bridges over a combined 1,000-feet in length, and two miles of corduroyed road, through woods and lowlands, were open for traffic. General Hovey described it as "the great military route through the overflowed lands from Milliken's Bend to the Mississippi River below Vicksburg."<sup>64</sup> Colonel Wilson wrote that the men assigned the task "opened a practicable road, threading one of the most difficult regions that ever tested the resources of an army. The bridges were built by green volunteers who had never seen a bridge train nor had an hour's drill in bridge building. The same may be said of the quality of the men and officers who carried through that remarkable work."<sup>65</sup> It was true that the army had not trained most of the men who worked on the bridge and road construction around Bayou Vidal as engineer soldiers, but they had considerable experience as carpenters, mechanics, boat builders, and lumbermen before the war. The West Point educated Wilson displayed some of his

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<sup>62</sup> O. R., ser. 1, vol. XXIV, part 1, 126-127.

<sup>63</sup> O. R., ser.1, vol. XXIV, part 1, 126-127.

<sup>64</sup> O. R., ser. 1, vol. XXIV, part 1, 601.

<sup>65</sup> Thienel, *Seven Story Mountain*, 141.

arrogance developed as a proud member of the Corps of Engineers. He clearly thought how extraordinary it was to see ordinary soldiers perform such skilled engineering work. Grant was more lucid in his praise writing, “the ingenuity of the Yankee soldier was equal to any emergency.”<sup>66</sup>

As incredible as Northern engineering efforts were to provide Grant’s army with a route south more was about to be asked of them. With passage through Bayou Vidal completed, General Osterhaus ordered Colonel James Keigwin of the 49<sup>th</sup> Indiana Infantry to organize a combat patrol from Mrs. Perkins’s plantation to Hard Times. This patrol’s primary purpose was to drive off a Confederate cavalry unit known to be operating in the region. Moreover, Grant issued two orders: first Colonel Wilson was to ferry across the Mississippi under the cover of darkness to reconnoiter all roads leading from the river to the bluffs, and second, General McClernand was to ready his corps for an amphibious assault on Grand Gulf.<sup>67</sup>

Wilson’s patrol confirmed Grant’s fears. The area north of the Big Black River and west was inundated with water, and there were no practicable roads leading to the highlands. South of the Big Black the hills were swarming with gray coats.<sup>68</sup> Keigwin, with the 49<sup>th</sup> Indiana, 114<sup>th</sup> Ohio, a detachment from the 2<sup>nd</sup> Illinois Cavalry, and a section of the 7<sup>th</sup> Michigan Battery were also not having much luck. Four miles from Mrs. Perkins’s plantation the Confederate cavalry they were looking for burned the bridge over Holt’s Bayou.<sup>69</sup>

Keigwin detailed 100 soldiers from each regiment, and under the direction Colonel John Beekman, who had demonstrated bridge-building skills, rebuilt the structure over the 80-foot wide bayou in three hours. The patrol resumed the march for approximately one mile when

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<sup>66</sup> Grant, *Memoirs*, 254.

<sup>67</sup> Bearss, 283.

<sup>68</sup> *O. R.*, ser.1, vol. XXIV, part 1, 127-128.

<sup>69</sup> Elias Moore, *Diary*, 114<sup>th</sup> Ohio Infantry, April 1-July 4, 1863, files Vicksburg National Military Park, Vicksburg, Mississippi.

they came to another roadblock. The 120-foot bridge over Du Rossett Bayou was destroyed and the current in the stream lapped over the banks. The current was swift, and the riverbed was quicksand.<sup>70</sup> Lieutenant James Fullyard led a fatigue party of men selected from the 49<sup>th</sup> Indiana, and with Lieutenant Francis Tunica of the Corps of Engineers they began work on the bridge. Fullyard was another example of a citizen soldier who could perform engineering duties in the field and whose improvisational ability was not limited, to any degree, by a particular methodology taught and practiced by West Point trained engineers. He was from New Albany, Indiana, the wealthiest area of the state before the war. Located on the Ohio River, the city's fortune was derived from steamboat manufacturing and ancillary industries such as machine shops, foundries, furniture makers, and silversmiths. The American Plate Glass Works was the second largest business in the town. New Albany opened the first public high school in the state in 1853, and by 1859 they hosted the Indiana State Fair. Fullyard was exposed to the perfect storm of change sweeping the North before the war: educational reform, industrial development, and mechanized farming.<sup>71</sup>

Fullyard and Tunica decided to solve the problem of the quicksand by stripping one-half inch weatherboarding from nearby plantation buildings then layering them crosswise and lengthwise at the base of their trestle structure. Once there was enough buoyancy established, working throughout the night, they converted a trestle bridge into a floating bridge. Early the following morning, with a detachment of soldiers left behind to guard the new bridge, Colonel Keigwin's patrol continued on its march toward Hard Times.<sup>72</sup>

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<sup>70</sup> O. R., ser. 1, Vol. XXIV, part 1, 571.

<sup>71</sup> W. H. H. Terrell, *49<sup>th</sup> Indiana Infantry Officers Roster: Report of the Adjutant General of the State of Indiana*, vol. 2 (Indiana, 1865), 483.

<sup>72</sup> O. R., ser. 1, vol. XXIV, part 1, 186. Bearss, 286. Thienel, *Seven Story Mountain*, 157-158.

Early on the 26<sup>th</sup> the combat patrol found Major Harrison's 400-man Confederate cavalry force deployed behind Clark Bayou a quarter of a mile away. Keigwin's men on the northern bank of Phelps Bayou eyeballed the Rebels and the two bridges they had burned to the ground. Not to be denied the roadway to Hard Times, Keigwin opened fire with his artillery and then had his infantry ford the bayous to attack Harrison. The numbers favored Keigwin so Harrison's men mounted and hurriedly left the vicinity.<sup>73</sup> Now Captain William H. Peckinpaugh would have the honor of supervising the construction of the next two bridges.

Peckinpaugh was from Leavenworth, Indiana, the second county east of New Albany and next to Jeffersonville, Colonel Keigwin's home. Although there was no record of Peckinpaugh's occupation before the war, Leavenworth was also on the Ohio River, and the town made its reputation as an important boatbuilding and brick manufacturing center. Around 1845 the town opened a stagecoach line primarily for students who wanted to attend the new state college in Bloomington.<sup>74</sup>

All the construction material for the two bridges was taken from neighboring barns. Large, dry beams 50-feet long were used to support the flooring, which was kept in place by using 6 inch by 6 inch timbers. Several of the banks were steep so the engineers and pioneers dug an approach road by cutting down and tapering the embankments then corduroying the area excavated. This was to prevent the road from becoming a quagmire anticipated with the heavy traffic. Once the bridges were completed, Keigwin reported to Osterhaus that a practical road was opened from Mrs. Perkins's plantation to Hard Times. In his official report, Keigwin was effusive in his praise of his small command. He could not "speak in too high terms of all the officers and men in the detachment. They were ever ready to assist in all the labors of building

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<sup>73</sup> Bearss, 287. *O. R.*, ser. 1, vol. XXIV, part 1, 571-572.

<sup>74</sup> Terrell, 484.

bridges and to obey any command.”<sup>75</sup> Finally, the men of the 49<sup>th</sup> Indiana and 114<sup>th</sup> Ohio returned to their brigades and now prepared for the amphibious attack on Grand Gulf.

The bombardment of Grand Gulf began on April 29, 1863 as Admiral Porter’s Mississippi Squadron attempted to soften the Confederate defenses on the eastern bank of the river. Instead, each member of the fleet took direct hits, damaging the vessels and suffering seventy-five casualties. The defenders had three killed and nineteen wounded, and the infantry waiting in the rear area for the Union infantry assault was untouched. Captain Shirk of the *U. S. S. Tuscumbia* invited two army officers to see the damage to his ship firsthand. A Colonel Warmoth wrote: “The boat was completely riddled. Torn to *smash*. Hog chains broken and a good many other things broken.”<sup>76</sup>

Understanding Clausewitz’s axiom that generals had to anticipate things going wrong on the battlefield, Grant, the quintessential Clausewitzian (even though he never read a word the Prussian wrote), had developed a contingency plan. His scouts had determined the way was clear to march the army farther south toward Disharoon, and they learned from a runaway slave that there was a good road connecting Bruinsburg with Port Gibson on the east bank of the Mississippi. After a fitful night’s sleep, infantrymen from the 24<sup>th</sup> Iowa and 46<sup>th</sup> Indiana marched south to Disharoon where they were ferried across the river and touched the eastern shore of Mississippi in the mid-morning hours of April 30<sup>th</sup>. Grant’s army was now on dry land.<sup>77</sup>

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<sup>75</sup> *O. R.*, ser. 1, vol. XXIV, part 1, 573.

<sup>76</sup> Henry Clay Warmoth, “The Vicksburg Diary of Henry Clay Warmoth, Part II (April 28, 1863-May 26, 1863),” ed. Paul H. Hass, *Journal of Mississippi History*, vol. XXXII (1970), 63. *O. R. N.*, ser. 1, vol. XXIV, 608-628.

<sup>77</sup> Israel Ritter, Private, Company D, 24<sup>th</sup> Iowa Infantry, Diary, September 10, 1862-May 31, 1863, files Vicksburg National Military Park, Vicksburg, Mississippi. *History of the Forty-sixth Regiment Indiana Volunteer Infantry, September, 1861-September, 1865*, compiled by committee (Logansport, Indiana, 1888), 56.

The first contact Grant had with a sizeable Confederate army was on May 1<sup>st</sup> at Port Gibson, ten miles due east of Bruinsburg. Out numbered three to one the Southern forces under General Bowen fought a remarkable delaying action. They retreated north burning two bridges behind them, one over the south fork of Pierre Bayou and the other over the north fork. A railroad bridge linking Port Gibson to Grand Gulf was also burned, but the Federals determined it was not necessary to cross. Grant had accompanied General McPherson into Port Gibson and he was in a hurry to pursue the retreating Confederates north so he immediately ordered Colonel Wilson, Captain Patterson's engineer company, and Captain Stewart R. Tresilian, commander of McPherson's pioneer corps, to begin work at once. The roadway of the suspension bridge over the south fork of Bayou Pierre was completely destroyed so the decision was made to construct a floating bridge about twenty yards north of the old bridge. Plenty of buoyant materials were found by tearing down barns and cotton gins in the neighborhood.<sup>78</sup> Under time constraints, the pioneers and engineers completed the bridge by noon on May 2<sup>nd</sup>, but infantry officers did not think much of the structure, so they tried it out on an artillery piece drawn by a team of mules. Half way across the span started to rock and then it flipped over dumping the gun and mules into the river. One infantryman said, "It was rather an expensive trial, but better than a column of infantry."<sup>79</sup> The next effort proved more successful. The bridge was a continuous raft 166 feet long with three rows of large mill-beams lying across the current in the bayou, and the intervals between the beams were filled by buoyant timber. The entire bridge firmly tied together by a cross-floor or deck. The approaches to the bridge were over

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<sup>78</sup> *O. R.*, ser. 1, vol. XXIV, part 1, 128. Captain William F. Patterson, Kentucky Company of Mechanics and Engineers, Daily Activity Cards, May 3, 1863, microfilm M 397, roll 472, National Archives, Washington, DC.

<sup>79</sup> Thomas B. Marshall, *History of the 83<sup>rd</sup> Ohio Volunteer Infantry: The Greyhound Regiment* (Cincinnati, OH: 1912), 76. Grabau, 171-172.

quicksand so the men laid layers of logs and then covered them with earth to prevent the animal teams from losing their footing on the logs.<sup>80</sup>

Eight miles northeast of the bridge just finished was Grindstone Ferry and a suspension bridge over the north fork of Bayou Pierre. When the engineers arrived the bridge was in flames, so the men in the vanguard and runaways from local plantations quickly extinguished the fire. A section of the bridge's roadway, side-truss, and string-pieces were destroyed. Leaving the charred cross ties in place, the engineers lashed timber planks with wires cut from the telegraph line to the suspension rods that hung down from the chain that spanned the river. New timber was then placed at intervals of three feet and fastened to the vertical planks the engineers had tied to the suspension rods. Wedges were placed between the old burned ties and the new ones in the middle of the roadway. The road covering, obtained from farmhouses, was secured by side rails, spiked and lashed into place. To strengthen the causeway, a rope loop was placed on the suspension cable and then around the end of the cross tie that extended out beyond the rail. A stick was placed inside the loop rope and twisted until the rope was tight and bore the weight of the roadway. The new road was ten inches above the old road. It was a brilliant improvised design. As Phillip Thienel observed, the engineers and pioneers built a "suspension bridge within a suspension bridge."<sup>81</sup>

Captain Andrew Hickenlooper, chief engineer of McPherson's XVII Corps offered sublime praise to the resolute engineers. "The bridging of the South Fork of Bayou Pierre in four hours by Captain Tresillian [sic], a detailed engineer of the Third Division, and the complete reconstruction of the suspension bridge—nearly three hundred feet in length, and forty feet above the bed of North Fork—in a single dark and stormy night by a pioneer corps command by

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<sup>80</sup> Thienel, *Seven Story Mountain*, 180.

<sup>81</sup> Thienel, 181. *O. R.*, ser. 1, vol. XXIV, part 1, 129.



Captain Patterson, assisted by troops worn out by two days and nights of continuous marching and fighting...will ever remain as examples of what may be accomplished by intelligent direction of American soldiers.”<sup>82</sup> Like Tresilian and Patterson, Hickenlooper was one of those men, becoming more frequent as the war continued, who initially served as an artillery or infantry officer, but soon found himself in the engineers. Fighting at Shiloh as captain of the 5<sup>th</sup> Ohio Battery, he was promoted by McPherson chief of artillery and then chief of engineers. A civil engineer before the war, Hickenlooper observed that it was not probable “that in any other army ever organized could such bodies of men have been so quickly selected, efficiently organized, and rapidly qualified for the duties assigned as were the Volunteer Engineer Corps of the Union army, because in no other army of similar magnitude was there ever to be found such a versatility of first class talent subject to command at a moment’s notice.”<sup>83</sup>

In fifteen days, Captain Hickenlooper and his fellow engineers would be called upon to carry out another incredible engineering feat crossing the Big Black River. Before that, however, Grant’s army would break from their supply base, and to the surprise and confusion of General Pemberton, march east to the Mississippi capital of Jackson. There the army would block any attempt by Confederate Joseph Johnston to rescue Pemberton at Vicksburg. Grant would then turn west, defeat the Southern army at Champion’s Hill and continue to pursue the retreating Confederates toward the Big Black River. Once the Big Black was crossed, the city of Vicksburg was next.<sup>84</sup>

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<sup>82</sup> MOLLUS, Ohio Commandery, Brigadier General A. Hickenlooper, “Our Volunteer Engineers,” vol. 3, 1890. *O. R.*, ser. 1, vol. XXIV, part 1, 203-206.

<sup>83</sup> Hickenlooper, 304-305.

<sup>84</sup> In “Pvt. Charles E. Affeld Describes The Mechanicsburg Expeditions” historian Edwin C. Bearss argued that Confederate General Joseph Johnston missed a golden opportunity to relieve Vicksburg along the Mechanicsburg Corridor, which ran northeast from the city, sometime between the last week in May and the first week in June 1863. See Edwin C. Bearss, “Pvt. Charles E. Affeld Describes The Mechanicsburg Expeditions,” *Journal of the Illinois State*

The Battle of Champion's Hill and the Big Black River were decisive victories for the Army of the Tennessee. General Pemberton's Confederates retreated into the eight-miles of fortifications surrounding the north, east, and south of the city. Grant's soldiers began the campaign in late February, struggling under deplorable conditions. Rain, hail, mud, and cold was their lot for several months as they tried to dig canals, move through swamps, and avoid falling prey to typhoid, typhus, and acute diarrhea. In April, as the weather warmed and the flooding abated, the enemy became mosquitoes and snakes. In May, for a period of seventeen days, they fought five successful battles and marched about eighty-two miles and now were at the last obstacle before Vicksburg.<sup>85</sup> Grant demanded no delay, but his concern was that his three corps of 44,000 men were all packed within ten miles of each other. Located like points on an isosceles triangle, McClernand's corps was at the railroad bridge over the Big Black River, McPherson was five miles southeast of McClernand's position. Sherman was five miles northeast of McPherson, and Sherman was nine miles east of McClernand.

Grant imagined a massive logjam as the entire army tried to cross the only bridge over the river, a permanent wooden railroad bridge built on a masonry foundation.<sup>86</sup> Of course, the retreating Southerners burned the entire bridge leaving just the foundation standing. The Big Black River was between forty and seventy yards wide, and at low water stages the banks could be as high as twenty feet. The bed of the river was mostly silt, sand, and soft clay, which meant that, unlike railroad bridges with foundations, road bridges with wooden trestle footings were unstable, and flash flooding would easily wash out these structures.<sup>87</sup> To cope with this unique geographic condition the eight crossing points the locals used from Bridgeport and Grand Gulf

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*Historical Society* 56, no. 2 (Summer 1963): 233-256, <http://www.jstor.org/stable/40190639> (accessed January 3, 2014).

<sup>85</sup> The battles were fought at Port Gibson, Raymond, Jackson, Champion Hill, and Big Black River.

<sup>86</sup> Grabau, 340.

<sup>87</sup> Grabau, 340.

were by ferry. Ferrying 44,000 men, 38 artillery batteries, and all the wagons would take too long. Grant, therefore, ordered the railroad bridge rebuilt and three other floating bridges constructed.<sup>88</sup>

Captain Christian Lochbiher, Company I, 35<sup>th</sup> Missouri Infantry had hauled the India rubber pontoon from Milliken's Bend to the Big Black. Now his regiment, along with the 127<sup>th</sup> Illinois, and four companies of Bissell's Missouri engineers, built the bridge on the army's right flank at Bridgeport to facilitate the crossing of Sherman's corps. Bridgeport was located two miles north of the town of Amsterdam. At Amsterdam the river turned west for six miles, then turned south. One mile from this bend was the burned out railroad bridge.<sup>89</sup>

McPherson discovered two roads around the Amsterdam area leading to the river. One was at Coaker's Ferry a quarter of a mile north of Amsterdam, and one at Hooker's Ferry two miles west of the town. Brigadier General Thomas Edward Greenfield Ransom, a civil engineer before the war, supervised the work on the bridge at Hooker's Ferry and completed it in ten hours.<sup>90</sup> Soldiers cut tall pine trees from the riverbank, stripped them of their limbs, and then they were floated to the opposite shore. The trees were anchored on shore by placing them on wooden tripods that raised the bridge two feet higher than the embankment. Planks collected from houses and barns were used as the roadbed.<sup>91</sup>

The second bridge at Coaker's Ferry, supervised by Captains Hickenlooper and Tresilian required even more imagination than the Kentucky engineers used at Hooker's Ferry. After

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<sup>88</sup> A Union artillery battery consisted of six guns and about 100 horses to pull the caissons, additional ammunition, a portable forge and blacksmith equipment, and forage for the animals.

<sup>89</sup> *O. R.*, ser. 1, vol. XXIV, part 1, 125-126.

<sup>90</sup> Captain Prime was with the men constructing the India rubber pontoon bridge, Hickenlooper and Tresilian supervised the bridge at Coaker's Ferry, and Lieutenants Francis Tunica and Peter Hains along with the Kentucky engineers worked at replacing the railroad bridge. The Official Records makes no mention of who supervised the bridge at Hooker's Ferry. Since Ransom was a civil engineer before the war it was likely that he supervised its construction.

<sup>91</sup> Bearss, 680.

brush fires were lighted so the men could work all night, soldiers from the 48<sup>th</sup> Indiana, 59<sup>th</sup> Indiana, 4<sup>th</sup> Minnesota, and 18<sup>th</sup> Wisconsin torn down several warehouses and hauled the planks and bales of cotton found in the building to the river bank. Nails were recovered from the wood and a guy wire was made from the horses' bridles. A raft was built and with two men aboard ferried to the western bank of the river where they tied a sheer line to a tree that was fastened to a tree on the eastern bank, as well. The river was 102 feet wide. Soldiers took two beams 34 feet long and laid them side by side ten feet apart. The beams were joined together with 1-inch strips nailed two and a half feet apart. Uprights were nailed to the ends of each strip. Two cotton bales were placed on each cross piece and pressed against the end uprights. The bales were kept in place by nailing strips crisscross in front of them. Additional bales of cotton were placed the same way until they filled the entire thirty-four by ten foot frame.<sup>92</sup>

The three sections were floated into the river, fastened together, and tied to the sheer line. The flooring was nailed in place, and at dawn Tresilian watched a 20-pounder Parrot gun sink the bridge only fourteen inches, leaving an excess of buoyancy of sixteen inches.<sup>93</sup>

At the railroad bridge more drama unfolded. Under cover of darkness, Lieutenants Tunica and Hains stealthily moved to the riverbank to determine the extent of the damage to the railroad bridge and to site a location for a new structure. Working with quiet resolve members of the Kentucky engineers stripped the unburned sections of the railroad bridge, dismantled several farmhouses, and under galling sniper fire, constructed a 200-foot long floating raft bridge about 150 yards northwest of the ruined railroad bridge.<sup>94</sup> Colonel Wilson of

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<sup>92</sup> Thienel, *Seven Story Mountain*, 199. *O. R.*, ser. 1, vol. XXIV, part 2, 205.

<sup>93</sup> Thienel, *Seven Story Mountain*, 200.

<sup>94</sup> Bearss, 681.

Grant's staff wrote, "Counting these improvised bridges on the Big Black River and those at Milliken's Bend and Bruinsburg, there were five to six thousand feet of such bridges."<sup>95</sup>

On May 18<sup>th</sup> the Army of the Tennessee crossed the Big Black and formed on the outskirts of Vicksburg. The final phase of the Federal army's campaign to capture the Gibraltar of the Confederacy began. It was not an exaggeration to say that Grant's engineers, pioneers, and infantry regiments had built their way to Vicksburg.

The Confederate defenses surrounding Vicksburg ran in an approximate half-moon north to south for over eight miles. Impressed slaves from neighboring plantations had built a series of redoubts, redans, and lunettes connected by rifle pits.<sup>96</sup> Captain David B. Harris of the Provisional Engineer Corps was responsible in early 1862 for locating and supervising the construction of the first batteries at Vicksburg. The Confederate engineer most responsible for the defenses on the eastern side of the city, however, was Major Samuel Henry Lockett. Lockett graduated second in his class at West Point in 1859 and entered the Corps of Engineers. Born in Virginia, he grew up in Marion, Alabama, and joined the Confederacy at the start of the war. After serving with Braxton Bragg in Tennessee, he was ordered to Vicksburg in June 1862. On his arrival, he set to work surveying and mapping what he described as the "topographical puzzle" of the land formations around the city.<sup>97</sup>

The ridges along the high ground, the deep ravines and gullies, were forested with magnificent magnolia trees and dense undergrowth of cane. Lockett, a skilled engineer,

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<sup>95</sup> James H. Wilson, *Under the Old Flag* (New York: D. Appleton, 1912), 204-207.

<sup>96</sup> A redoubt was a fortification laid out in the shape of a regular or irregular convex polygon. A redan was a fieldwork consisting of two faces joined to form an outward projecting angle. These works were frequently used to guard roads and bridges. Lunettes were field works of two faces forming a salient angle, and two parallel flanks. All of these structures were built inside or were a part of a larger fortification such as a star fort.

<sup>97</sup> Nichols, *Confederate Engineers*, 102. After the war, Lockett became the principle engineer in the construction of the pedestal for the Statue of Liberty.

eventually found a general line of commanding ground surrounding the city, and he determined to focus particular attention on the five major roadways entering Vicksburg. The defenses at their closest point to the city were three quarters of a mile, and the farthest point from the city to the defenses was two miles.<sup>98</sup> Ten earthworks were built one example of which was the 26<sup>th</sup> Louisiana Redoubt. The structure had a six-foot high parapet that was twenty feet wide. On the exterior of the parapet was a ditch that served as a trench ten feet wide and six feet deep, and in front of the trench was a rough palisade and glacis. Beyond the parapet was a two-foot high firestep and a twenty-foot wide terreplein, or horizontal surface, in the rear of the parapet.<sup>99</sup>

In November, Lockett was promoted to chief engineer of the Department of Mississippi and East Louisiana, which meant that he was responsible for the fortifications from Holly Springs to Port Hudson. He would no longer supervise the day-to-day construction of the Vicksburg defenses, and until April 1863, the responsibility for finishing the work was done by committee. Unfortunately, attention to detail lapsed so when Grant's army crossed the Big Black River and Pemberton's forces occupied their fortifications, Lockett noticed a series of problems that he had failed to anticipate.

The redans and redoubts had not been occupied since the construction, and consequently, areas were washed out and weakened by the winter's rains. Along parts of the line rifle pits were never finished, obstructions had not been laid, traverses were incomplete,

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<sup>98</sup> The five roadways were from north to south the Graveyard Road, Jackson Road, Baldwin's Ferry Road, the Alabama & Vicksburg Railroad, and Hall's Ferry Road. Ten forts were built tied together by rifle pits. From the north Fort Hill, the 26<sup>th</sup> Louisiana Redoubt, Stockade Redan (including the 27<sup>th</sup> Louisiana Lunette and Green's Redan) guarding Graveyard Road, the 3<sup>rd</sup> Louisiana Redan and the 21<sup>st</sup> Louisiana Redan guarding Jackson Road, 2<sup>nd</sup> Texas Lunette guarding Baldwin's Ferry Road, the Railroad Redoubt (fort Pettus and Fort Beauregard), the Square Fort, the Salient work guarding Hall's Ferry Road, and South Fort.

<sup>99</sup> Ron Field, *American Civil War Fortifications (3): The Mississippi and River Forts* (Oxford, UK: Osprey Publishing, 2007), 34. The palisade was a crude stockade or stick wall, and the glacis was a wide and gently sloped parapet that gave the defenders a clear field of fire.

and covered ways non-existent. Finally, there were only approximately 500 picks and shovels to be disbursed among 18,500 effectives spread out through eight miles of earthworks.<sup>100</sup> Lockett wrote, "They [the tools] were distributed to the different brigades according to the amount of work required, and being much scattered along our lines were considered so precious by both men and officers that when not in actual use they were hidden for fear that they would be stolen by other troops, or ordered to some other part of the line by the chief engineer. They were entirely inadequate for the work, and the men soon improvised wooden shovels, using their bayonets as picks."<sup>101</sup>

Lockett's work force consisted of twenty-six sappers and miners, eight detailed mechanics and firemen, four overseers for slaves, seventy-two slaves (twenty were sick), three four-mule teams, and twenty-five yoke of draught oxen. In addition, eleven engineer officers were under Lockett's command.<sup>102</sup> Although these officers' names appear in the Official Record little else is known about them. Captain Powhatan Robinson graduated from William and Mary, Lieutenant Arthur W. Gloster was a railroad engineer, and Captain D. Wintter, First Lieutenant E. McMahon, and Second Lieutenant F. Gillooly each commanded a company of sappers and miners.

The under-manned engineer force continued to rely on slave labor to dig new sections of the fortifications and repair existing ones, and although the attackers marveled at the Confederate earthworks there was nothing unique or novel about them. Brigadier General Francis A. Shoup, who commanded troops at the 26<sup>th</sup> Louisiana Redoubt recalled, "The

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<sup>100</sup> Samuel H. Lockett, "The Defense of Vicksburg," in *Battles and Leaders of the Civil War: Retreat From Gettysburg* (New York: Castle Books, 1956), 484 and 488. Mark M. Boatner, III, *The Civil War Dictionary*, 876. Boatner's numbers are taken from Thomas L. Livermore, *Numbers and Losses in the Civil War in America 1861-65* (Boston: Houghton Mifflin Company, 1901).

<sup>101</sup> Lockett, 488.

<sup>102</sup> Samuel H. Lockett, "May 19-July 4, 1863: Report of the Siege of Vicksburg, Mississippi," at [http://www.civilwaralbum.com/vicksburg/lockett\\_or.htm](http://www.civilwaralbum.com/vicksburg/lockett_or.htm) (accessed July 7, 2013).

fortifications about Vicksburg were a poorly run and poorly constructed set of earthworks. But there was no point of the whole line which could not have been carried by a simple assault without ladders or any sort of machines.”<sup>103</sup>

On May 25<sup>th</sup>, Pemberton under a flag of truce, sent a note to Grant proposing a ceasefire, so dead and wounded Federal soldiers in front of Confederate lines could be buried or receive medical assistance. Grant agreed. During the lull in the killing General Sherman introduced himself to Lockett and soon the two were sitting on a log enjoying a pleasant conversation. At one point Sherman said, “You have an admirable position for defense here, and you have taken excellent advantage of the ground.”

“Yes General,” Lockett replied, “but it is equally as well adapted to offensive operations and your engineers have not been slow to discover it.” To this Sherman agreed.<sup>104</sup>

Union engineers and pioneer detachments did adapt to siege operations with aplomb. Since only a handful of army trained engineers were present in the siege lines, soldiers received little instruction in building approach trenches, saps, and mines, but they took what little information they were given and combined it with their own ingenuity to successfully tighten the noose around Vicksburg.<sup>105</sup>

Captain Prime was the army’s chief engineer officer responsible for the entire siege operation. He made it clear the engineering organization to conduct the siege works was

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<sup>103</sup> Field, 33.

<sup>104</sup> Lockett, 490.

<sup>105</sup> The following members of the Corps of Engineers were with Grant at Vicksburg: Captain Frederick E. Prime, Captain Miles Daniel McAlester, Captain Cyrus Ballou Comstock, and First Lieutenant Peter C. Hains. West Pointer, Lieutenant Clemens C. Chaffee, an ordnance officer was detailed on engineer duty with General Sherman, as was aide-de-camp Captain William Le Baron Jenney. Jenney had considerable engineering experience. A 1846 graduate of Phillips Academy in Andover, Massachusetts, he then studied at the Lawrence Scientific School at Harvard before transferring to Paris to study engineering and architecture at the *École Centrale des Arts et Manufactures*. After the war Jenney became known as the Father of the American Skyscraper, designing the first one in Chicago—the ten-story Home Insurance Building—in 1884.



deficient. No doubt believing that trained military engineers familiar with the principles of Sebastien Vauban, considered the father of siege operations for the brilliance he displayed at the siege of Maastricht, Netherlands, June 13 to 26, 1673, were the only ones capable of supervising the complex business around Vicksburg.<sup>106</sup> Prime estimated he needed at least thirty officers for the task and acknowledged those detailed from staffs of corps, with some engineering experience would help. In his official report after the siege he did not, however, mention the three dozen volunteer officers in the Army of the Tennessee who performed engineer officer duties constructing canals, roads, bridges, and clearing swamps and bayous.<sup>107</sup> He also never mentioned Colonel Bissell's Missouri Engineer Regiment, which remained on the west side of the Mississippi maintaining and repairing roads and bridges for the supply wagons, and Captain Patterson's Kentucky Company of Mechanics and Engineers attached to McClernand's XIII Corps.

The plan devised to cross no-man's-land between the two lines, and bring Union soldiers to within close range of the Confederate fortifications was to dig fourteen approach trenches, known as saps, from different locations along the line. Soldiers detached from their units to act as engineer-pioneers were to dig trenches jutting from the Union lines like tentacles to the Confederate lines. Ingenuity and imagination was required as expedients arose.<sup>108</sup>

Soldiers and runaway slaves paid ten dollars a month, were instructed by division engineers and pioneer officers on the techniques of digging saps, constructing sap rollers, fabricating gabions and fascines, building batteries, parallels, magazines, and platforms for 30-pound Parrott guns. Several field guns were obtained from the navy so pioneer soldiers had to

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<sup>106</sup> Captain D'Artagnan, made famous by Alexander Dumas's novel *Three Musketeers* was in real life captain of the Musketeers of the Guard and killed at Maastricht.

<sup>107</sup> *O. R.*, ser. 1, vol. XXIV, part 1, 176-177. *O. R.*, ser 1, Vol. XXIV, part 2, 168-179.

<sup>108</sup> Thienel, *Seven Story Mountain*, 212-213.

haul these pieces from the river thirty miles away.<sup>109</sup> Captain Tresilian built wooden mortars by shrinking iron bands on cylinders of sweet gum trees and boring out the center to set off six or twelve pound shells. These innovative devices could throw a projectile 150 yards. Tresilian also guided soldiers in building twenty-two foot long scaling ladders. A rope was attached to the ladder so men approaching fortifications on their bellies could pull the ladder behind and not be detected by enemy soldiers.<sup>110</sup>

The workhorse of the siege, nonetheless, was the sap roller. As the approach trenches were dug in a zigzagged pattern using the contours of the geography to protect the excavators from enfilading fire, men remained vulnerable to enemy sharpshooters. To defend against this fire sap rollers were pushed along in front of the workers to afford protection. The sap roller was a woven cylinder made from grape vines or cane, open at the top and bottom with braces built on the inside of the cylinder so the roller would maintain its shape, and pushed in front of the men in the trench for protection.<sup>111</sup> The solid cane offered excellent protection, but was too heavy to maneuver over such difficult ground. Some men tried stuffing the rollers with cotton bales to provide more support, but weight remained a problem.

Lieutenant Hains devised an innovative solution to the weight problem of the sap roller. He placed two empty barrels head to head with fascines secured around their exteriors. Hains then tied smaller cane bundles between the fascines, and telegraph wire was wrapped around the exterior to hold everything together.<sup>112</sup>

By the end of June, Prime reported that 1,200 fascines, 1,000 gabions, and six sap rollers had been constructed. In addition, pioneers had built 89 batteries, three magazines, dug twelve

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<sup>109</sup> *O. R.*, ser. 1, vol. XXIV, part 2, 176.

<sup>110</sup> Thienel, *Seven Story Mountain*, 216.

<sup>111</sup> J. C. Duane, *Manual for Engineer Troops*, (New York: D. Van Nostrand, 1862), 67 and 78.

<sup>112</sup> Fascines were long sticks bundled together to protect earthworks.

miles of trenches, hauled 370 wagon loads of lumber, and placed 220 field and siege guns.<sup>113</sup>

The approaches, deriving their names from the brigade or division commander who furnished the working parties, were built with unique characteristics to conform to the terrain in front of them.<sup>114</sup> For example, Thayer's Approach began near the crest of a ridge, ran down the slope, which was toward the Confederate's 26<sup>th</sup> Louisiana Redoubt and then back up the ridge on which the redoubt was positioned. Under the supervision of Captain Herman Klostermann, who commanded the pioneer company of Major General Frederick Steele's First Division, a tunnel was dug from the north side of the first ridge, which placed the pioneers at the base of the second ridge. From this ravine a trench was dug to the foot of the second spur and then two traverse trenches were started up the slope. The trenches were six-feet wide and six-feet deep and were covered by a blinding of bundles of cane laid across the top affording protection against enemy rifle fire.<sup>115</sup>

Logan's Approach was begun on May 26<sup>th</sup> starting one hundred fifty feet southeast of Shirley House and 400 yards east of its objective, the 3<sup>rd</sup> Louisiana Redan. Captain Hickenlooper was in command of the operation and the sap roller used was a railroad flatcar with wooden wheels, stacked with twenty cotton bales. Loopholes in the cotton bales allowed men to use the flatcar as a rolling firing platform. On June 3<sup>rd</sup> the sap reached a knoll so two trenches, one left and one right, were extended from the original sap and a Union battery was positioned there.<sup>116</sup>

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<sup>113</sup> Thienel, *Seven Story Mountain*, 228.

<sup>114</sup> *O. R.*, ser. 1, vol. XXIV, part 2, 171.

<sup>115</sup> *O. R.*, ser. 1, vol. XXIV, part 2, 172. Thayer's Approach was named after Brigadier General John M. Thayer, Third Brigade, First Division, XV Army Corps.

<sup>116</sup> Richard Billies, "Union Siege Operations at Vicksburg," *The North Against South: Understanding the American Civil War on its 150<sup>th</sup> Anniversary Blog*, entry posted April 18, 2012, <http://northagainstsouth.com/union-siege-operations-at-vicksburg/> (accessed July 8, 2013). Logan's Approach was named for Major General John A. Logan, Third Division, XVII Army Corps.

At seventy-five yards from the redan Confederate infantry were able to shot directly into the approach trench bringing work to an abrupt halt. Men from the 23<sup>rd</sup> Indiana Infantry then suggested building a tower behind the Union battery from which a Union sniper could harass the enemy so work on the sap could continue. Hickenlooper agreed to the plan, the tower was built, and "Coonskin's Tower," named after Lieutenant Henry C. Foster, the tower's occupant, effectively shut down Louisiana sharpshooters and the work on the sap continued.<sup>117</sup> By June 16<sup>th</sup> Federal soldiers were within twenty-five yards of the redan. Now with hand grenades being thrown into the Union trench and with Union soldiers attempting to throw them back, a mining operation was begun under the immediate command of Lieutenant Russell of the 7<sup>th</sup> Missouri and Sergeant Morris of the 32<sup>nd</sup> Ohio.<sup>118</sup>

With drills, short-handled picks, and shovels a gallery, four feet wide and five feet in height was driven at right angles to the face of the parapet of the fort. The main gallery was dug 45 feet, while from the end of the main gallery two others were dug out on either side at 45 degrees for a distance of fifteen feet. The reddish clay soil was easy to dig and required very little bracing. Eight hundred pounds of powder was placed in the main shaft and 700 pounds at the end of each of the lateral galleries. From each powder charge two strands of safety fuse was laid to cover the possibility that one might fail to burn. The earth, which had been removed in grain-sacks, was carried back, deposited in a compact manner and well braced by heavy timber, beyond the junction point of the three galleries. The rest of the entrance to the gallery was also packed with dirt.<sup>119</sup>

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<sup>117</sup> Richard Billies, "Union Siege Operations at Vicksburg," The North Against South: Understanding the American Civil War on its 150<sup>th</sup> Anniversary Blog, entry posted April 18, 2012, <http://northagainstsouth.com/union-siege-operations-at-vicksburg/> (accessed July 8, 2013).

<sup>118</sup> Andrew Hickenlooper, "The Vicksburg Mine," in *Battle and Leaders of the Civil War: Retreat From Gettysburg* (New York: Castle Books, 1956), 539.

<sup>119</sup> Hickenlooper, 540-542.

At 3:00pm on June 25<sup>th</sup> the mine exploded leaving a crater thirty feet wide and fifteen feet deep. Hickenlooper wrote, "At the appointed moment it appeared as though the whole fort and connecting outworks commenced an upward movement, gradually breaking into fragments and growing less bulky in appearance, until it looked like an immense fountain of finely pulverized earth, mingled with flashes of fire and clouds of smoke, through which could occasionally be caught a glimpse of some dark objects—men, gun-carriages, shelters, etc."<sup>120</sup> Volunteers from the 31<sup>st</sup> and 45<sup>th</sup> Illinois Infantry ran into the crater only to be met with a withering fire from Confederates who had pulled back from the area because their commanding general sensed imminent danger. The falling debris also formed an artificial parapet commanded from a distance by Confederate artillery. Realizing the Union assault was a forlorn hope, troops were withdrawn to a new line beyond the range of artillery shells.<sup>121</sup>

The Yankees exploded another mine at Logan's Approach on July 1<sup>st</sup>, and a gallery at Ewing's Approach was completed but never used. Southerners made a couple of attempts at mining and counter-mining, for example at A. J. Smith's Approach they tried to blow up a sap roller but underestimated the distance and used a weak charge.<sup>122</sup>

The Army of the Tennessee finally had a choke hold on Vicksburg. Citizens of the town and the soldiers defending it were all suffering. Water was contaminated, disease and malnourishment were ubiquitous, the dead went unburied, and the wounded went unattended. Men, women, and children lived on a diet of mule meat and boiled peas, the smell of human waste filled the air, and there was no hope of relief. There was no choice; on July 4, 1863 Pemberton surrendered to Grant. With sarcasm and exhaustion, Captain Patterson wrote to his

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<sup>120</sup> Hickenlooper, 542.

<sup>121</sup> Hickenlooper, 542.

<sup>122</sup> *O. R.*, ser. 1, vol. XXIV, part 2, 173-176. The Union approaches were Thayer's, Ewing's, Buckland's, Lightburn's, Giles A. Smith's, Ransom's, Logan's, Andre J. Smith's, Carr's, Hovey's, Lauman's, Herron's, and Slack's.

wife, "What shall I say of today? I have had headache. You will see by the paper we have the place. Taking Vicksburg July 4 calculated to make one happy. They were reduced to mule meat. Poor fellows were glad to be captured."<sup>123</sup>

Some historians have argued that the Confederate loss of Vicksburg proved to be a white elephant. Albert Castel, Herman Hattaway, and Archer Jones all agreed that the loss of Vicksburg did not deprive Southern forces of supplies from the trans-Mississippi because little was coming from that region before the loss.<sup>124</sup> Northern commerce along the river did not revive to prewar levels, Southern partisans threatened the safety of Northern river traffic south of the city after it surrendered, and the North just gained more territory to guard, siphoning resources from other operations.<sup>125</sup> These interpretations challenge President Lincoln's notion that after the victory, "The Father of Waters again goes unvexed to the sea."<sup>126</sup>

Lincoln's point, however, was not to suggest after the collapse of Vicksburg that commerce was freely flowing along the Mississippi. The purpose of his letter written to James C. Conkling on August 26, 1863 was to remind Democrats and Republicans alike that he was determined to emancipate the slaves, whether either party agreed with him or not, and to save the Union. Regarding slaves Lincoln wrote, "Why should they [blacks] do any thing for us, if we

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<sup>123</sup> Captain William Patterson, Kentucky Company of Mechanics and Engineers, Letters and Papers, Manuscript Division, MMC 1180, F79 1802, Library of Congress, Washington, DC.

<sup>124</sup> Albert Castel, *Victors in Blue: How Union Generals Fought the Confederates, Battled Each Other, and Won the Civil War* (Lawrence, KS: University Press of Kansas, 2011), 203-204.

<sup>125</sup> Herman Hattaway and Archer Jones, *How the North Won: A Military History of the Civil War* (Urbana: University of Illinois Press, 1983), 421-423. See also Albert Castel, "Vicksburg: Myths and Realities," *North and South* (November 2004): 62-69. Thomas L. Connelly, "Vicksburg: Strategic Point or Propaganda Device?" *Military Affairs* 34 (April 1970): 49-53.

<sup>126</sup> Abraham Lincoln to James C. Conkling, August 26, 1863 in *Abraham Lincoln: Speeches and Writings, 1859-1865*, ed. Don E. Fehrenbacher (New York: The Library of America, 1989), 495-499.

do nothing for them? If they stake their lives for us, they must be prompted by the strongest motive—even the promise of freedom. And the promise being made, must be kept.”<sup>127</sup>

To save the Union, Lincoln believed the war had to be won. “The strength of the rebellion, is its military—its army,” he wrote. “That army dominates all the country, and all the people, within its range.”<sup>128</sup> Destroy the army and the Union destroys the Confederacy and slavery. At Vicksburg, Grant had captured an entire Confederate army. Twenty-nine thousand soldiers surrendered in addition to 172 pieces of artillery, 38,000 projectiles, 58,000 pounds of black powder, 4,800 artillery cartridges, 50,000 shoulder weapons, 600,000 rounds of ammunition, and 350,000 percussion caps.<sup>129</sup>

Union commerce was limited along the Mississippi during the remainder of the war, but that was not the point. A Confederate army was captured and strategically the victory at Vicksburg forced the South to operate its other army groups in a dwindling territory. If Vicksburg had remained in Southern control the North’s ability to destroy the rebellion would be that more difficult. It would continue to delay other major actions including operations along the critical Nashville and Atlanta corridor. With a presidential election coming in 1864, a stalemate favored the peace democrats in the North and threatened President’s Lincoln’s second term. Lincoln’s letter to Conkling in August 1863 was political commentary not strategic analysis. He told his constituencies, “The signs look better.”<sup>130</sup> The signs were much needed victories, and Grant had delivered a huge one.

The capture of the city and 29,000 men was not the only important outcome of Grant’s campaign. The Confederate defeat contributed to the surrender of Port Hudson, south of

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<sup>127</sup> Lincoln to Conkling, 498.

<sup>128</sup> Lincoln to Conkling, 496.

<sup>129</sup> *O. R.*, ser. 1, vol. XXIV, part 2, 178. *O. R.*, ser. 1, vol. XXIV, part 1, 62.

<sup>130</sup> Lincoln to Conkling, 499.

Vicksburg, and it demoralized Southern citizens. Georgia governor Joseph Brown, omitting any mention of Gettysburg, on July 17<sup>th</sup> urged his citizens not to despair over “the late serious disasters to our arms” in Mississippi and Tennessee. A Confederate congressman wrote, “The disastrous movement of Lee into Pennsylvania and the fall of Vicksburg, the later especially, will end in the ruin of the South....”<sup>131</sup> A Texas sergeant in General Johnston’s army wrote after Vicksburg, “I have little hope in the future.”<sup>132</sup> Across the Confederacy the fall of Vicksburg struck like a death knell. In Richmond, chief of the Confederate Ordnance Department, Colonel Josiah Gorgas, wrote in his diary, “...Vicksburg and Port Hudson capitulated, surrendering thirty-five thousand men and forty-five thousand arms. It seems incredible that human power could effect such a change in so brief a space. Yesterday we rode on the pinnacle of success—today absolute ruin seems to be our position. The Confederacy totters to its destruction.”<sup>133</sup>

Vicksburg ensconced Grant as Lincoln’s number one commander. The political machinations were over. The calls from other generals and the press to sack Grant because of his drinking abruptly ended. Soon to become a lieutenant general and commander of all the Union armies, Grant’s brilliance and tenacity would bring about the collapse of the Confederate armies. In hindsight, Grant was the greatest American general of the nineteenth century, and one could argue, the greatest general in American history. Success at Vicksburg gave Grant the chance to prove his greatness.

Finally, Vicksburg tested the mettle of the Union soldier, not just as a warrior but also as an innovator and builder. The campaign proved that defeating the Confederacy on their own

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<sup>131</sup> James R. Arnold, *Grant Wins the War: Decision at Vicksburg* (New York: John Wiley & Sons, Inc., 1997), 304.

<sup>132</sup> Bell Irvin Wiley, ed., *“This Infernal War”: The Confederate Letters of Sergeant Edwin H. Fay* (Austin: University of Texas Press, 1958), 290.

<sup>133</sup> Frank E. Vandiver, *Ploughshares into Swords: Josiah Gorgas and Confederate Ordnance* (Austin: University of Texas Press, 1952), 194-195. Frank E. Vandiver, ed., *The Civil War Diary of General Josiah Gorgas* (Tuscaloosa: University of Alabama Press, 1947), 55.



territory required moving supplies and conquering terrain over vast distances. Control of railroads, roads, and bridges were the fundamental elements needed to take the war to the South. By contrast, Southerners were unable to bring supplies to Vicksburg because of their inability to build additional light draft boats to haul food from the productive plantations of the Yazoo River Delta. Additional food rotted on the Vicksburg wharves because of a lack of public storage facilities.<sup>134</sup>

With a limited number of trained military engineers available to cope with the size and scope of campaigns and armies, northern volunteer soldiers were called upon to assume the role of engineers and pioneers. A Federal infantryman recalled, "Every man in the investing line became an army engineer day and night."<sup>135</sup> Other generals besides Grant now understood the power they had in the volunteer soldier's ability to perform engineering tasks to help move the army into positions generals previously thought inaccessible.

Captain Prime, not always effusive in his praise of volunteer engineers, in his final report of the campaign had to admit his amazement and admiration for what these men accomplished. He conceded, "Over a line so extended and ground so rough as that which surrounds Vicksburg, only a general supervision was possible, and this gave to the siege one of its peculiar characteristics, namely, that many times, at different places, the work that should be done...depended on officers, or even on men, without either theoretical or practical knowledge of siege operations, and who had to rely upon their native good sense and ingenuity."<sup>136</sup>

Vicksburg was a critical victory for the Union. General Grant was a risk taker, and he had vision, determination, and moxie. He also had the men, who in previous lives built ships, labored on railroads, served as mechanics, and worked in business environments that placed a high

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<sup>134</sup> Arnold, 310.

<sup>135</sup> Bearss, 954.

<sup>136</sup> *O. R.*, ser. 1, vol. XXIV, part 2, 177-178.

value on innovation and problem solving. Grant had the men who engineered and built the Army of the Tennessee's victory at Vicksburg.

## CHAPTER 8

### GETTYSBURG AND CHATTANOOGA

**Meade declined the challenge, and Lee resuming the retreat, crossed on the bridge of boats that had been thrown over the river at Falling Waters by the engineers—and a crazy affair it was, too.**

**Lieutenant Colonel Moxey Sorrel, CSA**

**Hold Chattanooga at all hazards. I will be there as soon as possible.**

**General Grant to General Thomas, October 19, 1863**

During the third year of the war the difference between Union and Confederate railroad management, engineering, and the use of infantry as effective engineers or pioneers grew increasingly more apparent. As operations became more complex and the logistical support for those operations became more critical these differences highlighted one of the central reasons for Union success and Confederate setbacks.

In the spring of 1863 while the Army of the Tennessee drew closer to Vicksburg and operated with an unorthodox yet highly effective engineering organization, one thousand miles northeast in Washington, DC, Major General Henry W. Halleck suggested to Congress the establishment of a more orthodox engineer corps suitable to the responsibilities carried out by regular army engineering officers. Halleck found it almost incomprehensible that a first lieutenant, Cyrus B. Comstock, served as chief engineer of the Army of the Potomac. Halleck understood that more army engineers were needed in all theaters of operations. From Vicksburg each week, corps and division commanders requested that the War Department send them additional engineers. In his report on the siege, Captain Prime wrote, “The engineer organization here, as in all our armies, was very deficient, if we judge either from the practice of

nations wiser in the art of war than ourselves or from results. Thirty officers of engineers would have found full employment.”<sup>1</sup>

In the southeast the First New York Volunteer Engineers had built large flat boats provided with hinged aprons at the bow to facilitate the landing of both artillery and troops just north of the Savannah River to cut the Charleston and Savannah Railroad. Detachments of the First New York served at Beaufort, South Carolina, and at Fort Clinch and Fort Old Town, Florida.<sup>2</sup> In all of these places a handful of regular army engineers were assigned to supervise Colonel Edward W. Serrell’s volunteer engineers. In middle Tennessee General Rosecrans used the First Michigan Engineers and Mechanics to repair railroads and bridges, but the engineers reported to and were supervised by regular army engineers. A significant part of the military culture was the understanding that engineering required the best-trained and most technologically skilled officers in the army. Halleck’s proposal was now to give those skilled officers the recognition and ranks they deserved. The chief engineer of a field army, Halleck proposed, would hold the rank of a colonel, and of an army corps the rank of a lieutenant colonel or major. These promotions were overdue. Furthermore, Halleck argued, at the start of the war skilled engineering officers like Rosecrans and Meade offered to lead volunteers and were promoted to brigadier general. It was better for their careers to become field commanders than remain as chief engineers of army groups with the rank of a lieutenant or captain.

Halleck was still not willing to concede, however, that volunteer engineers be placed on the same level as West Point trained regular army engineers. Nonetheless, this professional ethos had started to wear down. Grant discovered that citizen soldiers, together with a small professional cadre of engineers, were capable of improvised solutions to the many logistical

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<sup>1</sup> *O. R.*, ser. 1, Vol. XXIV, part 2, 171.

<sup>2</sup> Phillip M. Thienel, “Engineers in the Union Army, 1861-1865: Department of the South and Army of the James,” *The Military Engineer* (March-April 1955): 110.

challenges faced by the army. Historian Edward Hagerman wrote, “The Civil War forced the regular officer...to reconsider his professionalism from a broader intellectual and organizational perspective. The changes in warfare that he had to bring under control required that he adopt a more open, flexible, and historical, and less static, mechanistic, and absolutist military world view.”<sup>3</sup> For Halleck, before he could reconsider his professionalism from a broader perspective, the first step was to seek proper professional recognition for the role engineers had played in the first two years of the war, and for the role they would surely play as the war continued.

Senator Henry Wilson took up Halleck’s suggestion to provide proper promotions for engineers and to expand the corps of engineers without imposing excessive costs to the already bloated wartime budget. Wilson introduced a bill out of the Committee on Military Affairs to merge the corps of topographical engineers with the corps of engineers and to raise the authorized strength of the latter to 107 officers. At the time there were forty-eight officers in the corps of engineers and another forty in the topographical corps. The bill also included creating five colonels, ten lieutenant colonels, twenty majors, and thirty captains.<sup>4</sup>

Some senators and congressmen felt it was shortsighted to spend money on an expanded corps of engineers and not on additional infantry. Others like General Sherman’s younger brother, Senator John Sherman of Ohio, saw Wilson’s efforts as a mendacious way of expanding the regular army after the war. To Sherman, like most Americans at the time, a standing army was an anathema to the principles of liberty and freedom. Furthermore, Sherman believed that a regular army officer from the corps of engineers promoted to command

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<sup>3</sup> Edward Hagerman, *The American Civil War and the Origins of Modern Warfare: Ideas, Organization, and Field Command* (Bloomington: Indiana University Press, 1992), 238-239.

<sup>4</sup> Congressional Globe, 37<sup>th</sup> Cong., 3<sup>rd</sup> sess., bill S. 528 in *A Century of Lawmaking for a New Nation: U. S. Congressional Documents and Debates, 1774-1875* at <http://lcweb2.loc.gov/cgi-bin/ampage?collId=llsb&fileName=037/llsb037.db&recNum=1987> (accessed March 17, 2010). In addition, the bill called for thirty more lieutenants and ten more second lieutenants.

volunteer armies was still an officer in the corps of engineers.<sup>5</sup> In the senate debate over Wilson's bill Sherman said, "This bill, then, is not for the present purpose, because all the officers who deserve promotion have been promoted and now hold high rank in the volunteer army."<sup>6</sup>

Wilson convinced his colleagues that he would revise the measure, and as a result, the bill passed in both the House and Senate March 3<sup>rd</sup>, 1863. Three key changes to the bill were made to assuage the worries of Senator Sherman and his faction. First, no engineer officer could be promoted to a field grade rank without passing an examination given by three senior engineering officers. If the officer failed he would be suspended for a year and then allowed to take the exam again. If he failed a second time he would be asked to leave the army. Since suspension in wartime was too a great a risk for ambitious engineers, Sherman hoped most engineering officers would remain captains and lieutenants. Second, the bill was only in effect during the rebellion, after which the number of engineers would be reduced by the president to the number authorized by law before the new act went into effect. The number would go from one hundred seven to fifty-five. Third, engineer officers promoted during the war would revert back to their prewar rank, or in the case of West Point graduates in the classes 1862-1865, to the rank of second lieutenant.<sup>7</sup>

With the act operational in early April, newly appointed commander of the Army of the Potomac, Major General Joseph Hooker, prepared for his spring offensive in northern Virginia. Hooker was ambitious, confident, and personable, although he had a political dark side. Lincoln had heard that when the army was under Burnside's command, Hooker was rather disingenuous

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<sup>5</sup> Hagerman, 239.

<sup>6</sup> Congressional Globe, 37<sup>th</sup> Cong., 3<sup>rd</sup> sess. Senate, 1305.

<sup>7</sup> Statutes at Large, 37<sup>th</sup> Congress, 3<sup>rd</sup> sess., chapter LXXVIII, "An Act to promote the Efficiency of the Corps of Engineers and of the Ordnance Department, and for other purposes," 743.

toward his fellow general, often trying to thwart him. Now Lincoln placed Hooker in charge, and in a letter to the general, the president was both sharp and direct. "I have heard, in such a way as to believe it, of your recently saying that both the Army and Government needed a dictator. Of course it was not for this, but in spite of it, that I have given you command. Only those generals who gain success can set up dictators. What I now ask of you is military success, and I will risk the dictatorship."<sup>8</sup>

Military success was not forthcoming. After launching an excellent plan to envelope Lee's army in the Fredericksburg area, Hooker lost his nerve. He held to a defensive position centered on Chancellorsville when "Stonewall" Jackson made his famous march onto the Union flanks and rolled up a portion of Hooker's army at the cost of Jackson's own life. The Army of the Potomac's engineers under new leadership did perform well building sixteen bridges over the Rappahannock River between April 28 and May 28 and then dismantling all of them. The two most difficult were at United States Ford, thirteen miles above Fredericksburg, and at Kelly's Ford, twenty-two miles above the same city.<sup>9</sup>

Brigadier General Henry Benham from Cheshire, Connecticut, was now commander of the Engineer Brigade. An 1837 graduate of the Military Academy, Benham had been in charge of superintending the fortifications in Boston and Plymouth harbor before being assigned to the Engineer Brigade. He was a skilled pontoon bridge builder, and part of his responsibilities included command of the engineer's depot in Washington, DC.

There were an estimated two hundred pontoons at the depot, some required repairs, and all of them needed to be arranged into bridge trains and made ready for delivery to places the commanding general designated. The new commander of the 15<sup>th</sup> New York was Major

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<sup>8</sup> Boatner III, 410.

<sup>9</sup> Thienel, *Mr. Lincoln's Bridge Builders*, 101.

Walter L. Cassin. Captain George H. Mendell, a former member of the topographical engineers, was now commanding the Army of the Potomac's Engineer Battalion having replaced Captain Duane who was re-assigned to the Department of the South after General McClellan's dismissal in November 1862.<sup>10</sup>

The chain of command among the engineers in the Army of the Potomac was awkward and confusing. The chief engineer for the army was Brigadier General of Volunteers Gouverneur Warren.<sup>11</sup> He had received his promotion in September 1862 and still retained the rank of captain of engineers. Benham technically reported to Warren. Benham, however, was promoted brigadier general of volunteers in August 1861 and retained the rank of major of engineers. On paper Benham outranked Warren. It was also made more confusing by the fact that both Colonel William H. Pettes, commander of the 50<sup>th</sup> New York, and Cassin outranked Mendell. Yet, the latter was a West Point graduate and a member of the prestigious corps of engineers: Pettes and Cassin were not.

Fortunately, as the army moved toward Gettysburg, the engineers' orders were direct: on June 17<sup>th</sup> the Engineer battalion and 250 men from the 50<sup>th</sup> New York were to place a pontoon bridge train in the Chesapeake and Ohio Canal at Georgetown and proceed to the area around Edwards Ferry on the Potomac River, thirty-two miles northwest of the capital. By the morning of June 21<sup>st</sup> the engineers built a 1,340-foot pontoon bridge with sixty-four boats, and three crib trestles.<sup>12</sup> By June 27<sup>th</sup> a second bridge was built and that evening the entire army of

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<sup>10</sup> *O. R.*, ser. 1, vol. XXVII, 226. The Engineer Battalion was the descendant of the regular army's First Engineer Battalion formed at the start of the Mexican-American War in 1846. A member of the army's Corps of Engineers commanded the battalion. The Engineer Brigade was made up of volunteer regiments (ten companies) and commanded by volunteer officers. Yet overall command of the brigade was given to a regular army engineer.

<sup>11</sup> Warren was originally designated Chief of Topographical Engineers for the Army of the Potomac, but after Senator Wilson's bill passed, Warren became Chief of Engineers.

<sup>12</sup> Thienel, *Mr. Lincoln's Bridge Builders*, 106.



90,000 soldiers, horses, artillery, cavalry, and supply wagons crossed the river in search of Lee's army.

The lead elements of General Robert E. Lee's Army of Northern Virginia were in Chambersburg, Pennsylvania before General Hooker's army had started over their pontoon bridges. Using the South Mountains as a screen, Lee's three corps were separated by thirty-two miles and the army was operating fifty-five miles from its supply base in Winchester, Virginia. Historians, and perhaps even General Lee, were not sure of a specific geographical objective. Nevertheless, if his army continued into Union territory and turned toward Philadelphia or Baltimore, Lee would have to require his engineers to maintain, repair, or build bridges across several major rivers.

There were several reasons why Lee was invading the North in the summer of 1863 and one of them was because the Confederate railroad system had failed the army in the winter of 1862-1863. That winter Lee was certain the Army of the Potomac was preparing to cross the Rappahannock and begin a major spring offensive toward Richmond. As he contemplated his own strategic options at Fredericksburg in January and February, his men and horses were starving. Supplies carried by trains on the Richmond, Fredericksburg & Potomac Railroad provided little food and forage. The reason for this was no central control of the railroads.<sup>13</sup> The Wilmington & Weldon Railroad, a single-track road, ran due north and connected at Weldon with the Petersburg Railroad. This railroad directly connected to the Richmond line and the R, F & P. The east coast of North Carolina constituted a critical wealth of corn, bacon, grain, and fish more than enough for Lee's army, but the wretched condition of the tracks and no cooperation or coordination between lines left the Army of Northern Virginia cold and hungry.

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<sup>13</sup> *O. R.*, ser. 1, vol. XXI, 1110.

Colonel William Wadley, Confederate coordinator of transportation, complained to James A. Seddon, the new Secretary of War, about the problems on the Wilmington & Weldon. The State of North Carolina owned a controlling interest in the road, so Seddon made known to Governor Zebulon Vance that Lee's army was starving and depended on supplies from his state. Seddon asked Vance if more could be done to assure a more efficient management of the railroad.<sup>14</sup> Wadley for his part recommended that mechanics be released from military service to work for the railroads, and that the government pass an act making it "obligatory upon the railroads of the country to perform promptly Government transportation. The law, without allowing men and supplies, will be of no use, for without these the roads cannot exist."<sup>15</sup> Wadley's frustration was palpable. To the highest ranking general in the Confederacy, Adjutant and Inspector General Samuel Cooper, he wrote, "In every direction there is an accumulation of freight that is being wasted or damaged for want of protection, and a number of Government agents and messengers accompanying it in the character of protectors and forwarders would, I have not the least doubt, form a full regiment."<sup>16</sup> Nothing resulted from his sarcasm or his appeal.

In March, Seddon admitted to Lee that the lack of supplies for the Army of Northern Virginia was due to railroads, which were "daily growing less efficient and serviceable."<sup>17</sup> In *Victory Rode the Rails: The Strategic Place of the Railroads in the Civil War*, historian George Edgar Turner summarized the Southern army's dilemma in the early spring of 1863: "They were within fifty miles of Richmond with a railroad actually within their lines. Richmond lay at the upper end of a railroad running the length of one of the most productive agricultural areas in

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<sup>14</sup> O. R., ser. 1, vol. XVIII, 873.

<sup>15</sup> O. R., ser. 1, vol. XXV, part 2, 610-611.

<sup>16</sup> O. R., ser. 1, vol. XXV, part 2, 610-611.

<sup>17</sup> O. R., ser. 1, Vol. XXV, part 2, 693.

the South, and was served by two other roads, which tapped country by no means short of supplies.”<sup>18</sup>

Desperate for food, in April, Lee sent General John Imboden’s cavalry on an expedition to destroy the Baltimore & Ohio Railroad in western Virginia and to bring in beef cattle for the army. Imboden was successful, but the sustenance was too late for Lee to launch an offensive before Hooker’s army struck him. The resulting battle of Chancellorsville led Lee to believe that a Union summer campaign in Virginia would place his army on the defensive, but a move north over the Potomac River might lure Hooker out of Virginia and present Lee with an opportunity to destroy the Army of the Potomac. A move north would pose a threat to Baltimore, Washington, and Philadelphia, provide much needed subsistence and forage, and allow farmers in the Shenandoah Valley a chance to harvest their crops free from interruption by military operations.<sup>19</sup> Finally, Lee believed the Peace Democrats in the North were gaining strength especially because the Emancipation Proclamation had uncorked racist emotions among Northern politicians and an invading army might agitate the malcontents, like Ohio congressman Clement Vallandigham, to further action.<sup>20</sup>

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<sup>18</sup> Turner, 268.

<sup>19</sup> Armistead L. Long, *Memoirs of Robert E. Lee* (New York: J. M. Stoddart & Company, 1886), 268. Sir Frederick Maurice, ed., *An Aide-de-Camp of Lee, Being the Papers of Colonel Charles Marshall, Sometimes Aide-de-Camp, Military Secretary, and Assistant Adjutant General on the Staff of Robert E. Lee, 1862-1865* (Boston: Little Brown, 1927), 185-186. Edwin B. Coddington, *The Gettysburg Campaign: A Study in Command* (New York: Simon & Schuster, 1968), 8. Thomas Lawrence Connelly and Archer Jones, *The Politics of Command: Factions and Ideas in Confederate Strategy* (Baton Rouge: Louisiana State University Press, 1973), 128.

<sup>20</sup> Turner, 272. Vallandigham publicly stated that men should not join the army, and as a result of this and other incendiary remarks he was arrested and the government suspended his right of *habeas corpus*. In May 1863 Lincoln ordered him deported to the Confederacy. That same month at a rally in Albany, New York Governor Henry Seymour inflamed the crowd by charging that Lincoln was practicing “military despotism.” The New York senate adopted a resolution issued by John V. L. Pruyn, which condemned the Federal government’s conduct toward the Ohio congressman. Pruyn was married to Harriet Corning Turner, niece of Erastus Corning and Pruyn would take the former’s seat in the U. S. Congress beginning in December 1863. Newark,

It was alleged that Vallendigham had encouraged Confederate President Davis and his cabinet to back Lee's plan to invade the North. In a *New York Times* editorial September 4, 1863, Henery Reinish stated that, according to reliable sources "Vallendigham...assured [Davis and his cabinet] that the North was ripe for revolution." He continued, "Mr. Vallendigham's representations were corroborated by the tone of the majority of the Northern journals, who surely would not denounce the Administration so boldly except by assurance of having the masses strongly in their favor."<sup>21</sup> These comments of Vallendigham might have reinforced Lee's belief that when his army marched through Maryland the countryside would greet him with open arms. Yet, to the general's surprise, they did not.

Confederate railroad management and transportation issues played a major role in Lee's decision to invade the North in the summer of 1863. The Confederate Congress and president finally attempted to address the transportation problem with a railroad regulation act in May giving the government authority to set through freight schedules and enforce them at the government's discretion.<sup>22</sup> In 1863 the law was never invoked perhaps because Congress adjourned until December and because individual rights and private enterprise trumped southern nationalism and military logistics.<sup>23</sup> President Davis did try to preserve a Railroad Bureau, however, by appointing Wadley's protégé, Frederick W. Sims.

Sims inherited from his retired predecessor little more than the framework for an organization. The Bureau had no control over quartermasters in the field, and both General Bragg's Army of Tennessee and General Joseph E. Johnston's army in Mississippi had their own

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New Jersey Governor Joel Parker condemned Vallendigham's arrest, and a protest meeting was held in Philadelphia. All of this action prompted Lincoln to write his famous letter to Erastus Corning June 12, 1863.

<sup>21</sup> Henery Reinish, editorial, *New York Times*, September 4, 1863.

<sup>22</sup> Richard D. Goff, *Confederate Supply* (Durham: Duke University Press, 1969), 195-196.

<sup>23</sup> Black III, *The Railroads of the Confederacy*, 164.

railroad bureau. The officer responsible for railroad traffic through Richmond, Major D. H. Wood, reported to the quartermaster general, and Sims and his bureau had no representative in the major railway hub of Atlanta.<sup>24</sup> The quartermaster bureau had eighty-eight clerks, the subsistence bureau thirty-six and ordnance had twenty-four, whereas the engineer bureau had three clerks and the railroad bureau had two.<sup>25</sup> Sims worked the bureaucratic system well, first, by getting his bureau transferred to the Quartermaster Department where he could better manage competition among staff officers for supplies. He could use the department to assist him in moving engines and rolling stock to the east from sections of Mississippi abandoned by the Confederate military. Yet even in his efforts to salvage this abandoned equipment, private railroad superintendents demanded the rescued trains. The Alabama & Florida secured a court injunction blocking any attempt by quartermasters to move three locomotives from their track. Eventually, the engines were released, but the delay only diminished the movement of supplies to Southern armies in the field.<sup>26</sup>

Sims continued to lobby for a more centralized bureau as his administrative skill and energy brought about some improvements to the railroad transportation system. Nonetheless, individual interests continued to work against him and damaged the Confederacy as much as Yankee guns and bullets. Army officers often seized rolling stock for their own purposes. In November 1863 at a major railroad convention held in Macon, Georgia, owners made clear that “the object of the meeting [was] for the purpose of considering the propriety of advancing the present rates paid by the Government for transportation.” Finally General Lucius B. Northrop, head of the Commissary Department, maintained his own railroad representatives in critical

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<sup>24</sup> *O. R.*, ser. 1, vol. XX, part 2, 445. Black III, 168.

<sup>25</sup> Goff, 5.

<sup>26</sup> Black III, 170-171. Sims managed to secure at least thirty engines and a significant number of cars.

areas of the Confederacy, and in August 1863 named the president of the Georgia Central Railroad as “independent transportation czar” over all southern Georgia.<sup>27</sup>

The question must be asked: If Lee’s army had been well fed in the winter of 1862-1863 would he have embarked on a move north to risk all in the spring?<sup>28</sup> Perhaps he would. We can only speculate, but we know for certain one of Lee’s major reasons for going on the offensive was to feed his starving men and animals. The Army of Northern Virginia’s march into Maryland and Pennsylvania in June 1863, therefore, uncovered a significant logistical problem faced by the Confederacy. This supply problem, however, was not the only one Southern armies confronted. Gettysburg revealed two other weaknesses operating against Lee’s army as it marched north: poor maps and poor engineering.

In February, Stonewall Jackson had asked his topographical engineer, Jedediah Hotchkiss, to prepare a small-scale map of northern Virginia, central Maryland, and south-central Pennsylvania. The map was also to include Baltimore, Philadelphia, and Washington, DC. When finished the map would encompass over 1,000 square miles of territory.<sup>29</sup> Yet because the scope of the project was so vast with Union territory the most significant portion, and time was limited, Hotchkiss had to rely on Pennsylvania county maps and a process of taking a 38-by-42 inch sheet of heavy watercolor paper and pencil in a grid consisting of thousands of square centimeters. He would then superimpose a similar pencil grid on the county map then transcribe

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<sup>27</sup> Black III, 172-174.

<sup>28</sup> The Battle of Gettysburg cost the Confederacy 3,903 killed, 18,735 wounded, and 5,425 missing or thirty-seven percent of its forces engaged. Lee’s army could ill afford to lose so many men. He had already lost 12,821 killed, wounded, or missing at Chancellorsville. This was twenty-two percent of his force. See Boatner, 140 and 339.

<sup>29</sup> Earl B. McElfresh, “Fighting on Strange Ground,” *Civil War Times*, August 2013, 31-37.

it on a smaller scale onto his own pencil-grid sheet. It was a long process and the project was incomplete at the time Jackson was mortally wounded at Chancellorsville.<sup>30</sup>

This incomplete map was the one General Lee used during the Gettysburg Campaign. The map itself was a work of art. On cream-colored paper, red pencil lines identified roadways, blue marked rivers and streams, and black, in impeccable handwriting, listed towns, mills, blacksmith shops, major topographical features, and every rural resident's name. More nuanced features such as mild declivities, small hillocks, woods, road surfaces, and fording sites did not appear. The salient and eventually famous landmarks of the battle—Seminary Ridge, Culp's Hill, Cemetery Hill, Little Round Top, also did not appear on the map.<sup>31</sup>

These omissions, as cartographer and map historian Earl McElfresh pointed out, were not a decisive factor in the outcome of the battle. He wrote, ““It was probably more like “windage”—the effects of wind that is just one of the factors a marksman has to take into account when aiming a rifle.””<sup>32</sup> These omissions, nonetheless, were a costly factor to Lee and his army. On July 1<sup>st</sup> two regiments were lost from Confederate Brigadier General Joseph R. Davis's brigade when his men jumped into an unknown twenty-foot deep railroad cut and were captured by Colonel Rufus R. Dawes's 6<sup>th</sup> Wisconsin Regiment.<sup>33</sup> As Lee planned to envelope Meade's left flank on July 2<sup>nd</sup>, his engineer Captain Samuel R. Johnston insisted that he had ridden to Little Round Top and found it unoccupied. In fact, the area was swarming with General John Buford's Union cavalry, so it was probable Johnston actually discovered Warfield or Houck's Ridge empty.

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<sup>30</sup> McElfresh, 32.

<sup>31</sup> McElfresh, 37.

<sup>32</sup> McElfresh, 37.

<sup>33</sup> Davis was the nephew of President Jefferson Davis and Dawes was the great grandson of William Dawes, one of several men to warn the “Regulars were coming” on the night of April 18, 1775.

When Johnston was ordered to guide Hood and McLaws's divisions to the southern end of the battlefield in preparation for the early afternoon attack on the Union left he had to backtrack and countermarch because he had no map and misunderstood the areas topographical features. Finally, the map of Gettysburg Hotchkiss made that accompanied Generals Lee and Ewell's written reports of the battle indicated a keen awareness of the ground north of the town, but to the south the map does not include accurate illustrations of the round tops or the undulating and wooded areas east from the Emmitsburg Road, including the terrain around Weikert and Trestle's farms, Rose's Woods, the Wheat Field, and the valley between Houck's Ridge and Little Round Top.<sup>34</sup>

The lack of adequate maps placed the Army of Northern Virginia at a distinct disadvantage especially when knowledge of local geographical features was so crucial to a movement's outcome. Perhaps Lee expected he would receive local intelligence to fill in whatever gaps there were in his maps. He had received this type of information in the past, but he had always fought in friendly territory. Gettysburg highlighted the need for an invading army to have technically skilled men and materials at a general's disposal. This explains why Lee's artillery chief said after the battle: "Not only was the selection of ground about as bad as possible, but there does not seem to have been any special thought given to the matter. It seems to have been allowed to select itself as if it were a matter of no consequence."<sup>35</sup>

The major boondoggle during the campaign, however, came when Lee's army, after the three-day battle, attempted to escape across the Potomac and back into Virginia. Complete failure in the river crossing would have cost Lee his entire army and the war. Disaster was barely averted, and the episode revealed the Confederacy's vulnerability when it came to engineering.

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<sup>34</sup> *Official Records Atlas*, plate 43, no. 2.

<sup>35</sup> McElfresh, 37.



Conflicting testimony made it difficult to determine exactly what happened at Williamsport and Falling Waters between July 4th and July 14<sup>th</sup>, yet evidence suggests that the operation to build a pontoon bridge over the Potomac River did not go well and left Lee frustrated with his engineers. On the night of July 6<sup>th</sup> General Lee learned from General Imboden, who was leading the army's wagon train and ambulances, and from General Stuart, whose cavalry was acting as a rear guard for the train, that Federal cavalry had partially destroyed the Confederate's unguarded pontoon bridge at Falling Waters. Moreover, the river at Williamsport had risen because of the unremitting downpours of the past several days, and was now unfordable.

There were about twenty engineer officers with Lee's army including members of his own staff, his corps commanders' staffs, and some divisional staffs. There were no engineer soldiers, and instead, men were detached as pioneers from brigades and regiments. Consequently, no one was responsible for the pontoon train once the Army of Northern Virginia had crossed the Potomac in June. When the bridge was disassembled it was left behind. Many of Lee's men had forded the river in June when it was only about three feet high in certain sections, and he fully expected his army would do the same on the return trip. The lack of concern about the pontoons also suggested that Lee believed his army could ford any river if and when they turned east toward Baltimore or Philadelphia.<sup>36</sup>

On the morning of the 7<sup>th</sup> Lee allegedly ordered Major John Harman, General Ewell's quartermaster, to begin work on the bridge. General Imboden, however, wrote that "General Lee expressed great impatience at the tardiness in building rude pontoons at the river," and

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<sup>36</sup> Krick, *Staff Officers in Gray*, 366-406.

frustrated, called in Major Harman to supervise the construction. That was July 9<sup>th</sup>.<sup>37</sup> Perhaps construction went so poorly on the 7<sup>th</sup> and 8<sup>th</sup> that General Lee decided to send Harman to the rescue. History does not record who might have been responsible for any blunders in the first attempt to build the bridge.

We know that one day after Harman arrived at Williamsport, Major John G. Clarke, Longstreet's chief engineer, a Captain Summerfield Smith assigned to Clarke, and his pioneers, Lieutenant Henry Herbert Harris and his pioneers, and Captain Justus Scheibert, a former engineer in the Prussian Army and a recent immigrant to America, were all ordered to Williamsport to work on the bridge.<sup>38</sup> Harris recorded in his diary that Major Clarke, Lieutenant Colonel William Proctor Smith, Lee's chief engineer, Captain Samuel Johnston, and Captain Henry T. Douglas of A. P. Hill's staff, consumed some time drawing the dimensions of the pontoons necessary to support the bridge. The effort was becoming a bridge by committee.<sup>39</sup>

Harris wrote that the work on the pontoons began in earnest on July 11<sup>th</sup>. Five days had passed since Lee ordered work begun on the bridge. The pioneers tore down warehouses along the canal in Williamsport, and a local sawmill and lumberyard were used to construct the boats. Finally, oakum picked from old ropes and forced into the seams of the pontoons, and hot tar from the quartermaster wagons used to caulk the boats, made them ready to float 6 miles to

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<sup>37</sup> John D. Imboden, "The Confederate Retreat from Gettysburg," in *Battles and Leaders of the Civil War: Retreat From Gettysburg* (New York: Castle Books, 1956), 428.

<sup>38</sup> The University Memorial Biographical Sketches of Alumni of the University of Virginia Who Fell in the Confederate War, "Summerfield Smith, MA, Captain 1<sup>st</sup> Regiment Engineer Troops," The University Memorial, vol. IV, 1864 at [www.fsu.edu/~ewoodwar/uva\\_mem.html](http://www.fsu.edu/~ewoodwar/uva_mem.html) (accessed July 15, 2013).

<sup>39</sup> Kent Masterson Brown, *Retreat from Gettysburg: Lee, Logistics, & the Pennsylvania Campaign* (Chapel Hill: The University of North Carolina Press, 2005), 321.

Falling Waters, the selected site of the bridge. Meanwhile, Harman supervised the operation of a flatboat guided by a wire stung across the river, to ferry the wounded and prisoners.<sup>40</sup>

By the 13<sup>th</sup> the twenty-six pontoons, at least fifteen new boats, and the others from the old train, were strapped together using trestlework. Heavy cables anchored the bridge on each shore, and wooden boxes filled with stones acted as anchors. The latter did not work well, as some were not heavy or stable enough to prevent the bridge from swaying.<sup>41</sup> Fortunately for Lee's army, the river level had begun to drop at Williamsport, from eleven feet to just over four feet, which made fording the river possible. The pioneers dug the approaches to the pontoon bridge and early on the morning of July 14<sup>th</sup>, the Army of Northern Virginia began its trek across the river to home. Longstreet's chief of staff, Colonel Moxley Sorrel wrote, "... Lee resuming the retreat, crossed on the bridge of boats that had been thrown over the river at Falling Waters by the engineers—and a crazy affair it was, too."<sup>42</sup> Colonel Alexander, Lee's artillery chief remembered, "At last, not long after sunrise, we came to the pontoon bridge. It had a very bad approach and on a curve—a bad location and several wagons, caissons, etc., had gone into the river during the night...."<sup>43</sup> Captain Smith was ordered to stay behind and breakdown the bridge, saving those sections that were serviceable and destroying the rest. Most of the bridge was destroyed.<sup>44</sup>

The need for well-trained engineer troops was evident to Lee both before and after the battle. Yet, Army regulations had made it clear that officers of engineers would not assume "nor

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<sup>40</sup> Brown, 321.

<sup>41</sup> Brown, 321. The University Memorial at [www.fsu.edu/~ewoodwar/uva\\_mem.html](http://www.fsu.edu/~ewoodwar/uva_mem.html) (accessed July 15, 2013).

<sup>42</sup> G. Moxley Sorrel, *Recollections of a Confederate Staff Officer*, ed., Bell Irwin Wiley (Jackson, TN: McCowat-Mercer Press, Inc., 1958), 165.

<sup>43</sup> Edward Porter Alexander, *Fighting for the Confederacy: The Personal Recollections of General Edward Porter Alexander*, ed., Gary W. Gallagher (Chapel Hill: University of North Carolina Press, 1998) 272.

<sup>44</sup> The University Memorial.

be ordered on any duty beyond the line of their immediate profession, except by special order of the president.” Adjutant General Samuel Cooper’s General Orders No. 60 dated June 26, 1863 went so far as to state the following: “Officers of engineers will not be required to give other supervision to the fatigue parties or laborers employed in the construction of works than is necessary to indicate, in a clear and distinct manner to those directing the labor, their plans and the character of the work to be done.”<sup>45</sup> The officers communicated their plans to the supervisors and then the officers could walk away. There was no room for improvisation and ingenuity unless the ideas came from the top. Engineering regulations in the Confederate Army stood in stark contrast to the *Manual for Engineer Troops* written by Captain Duane of the Union Army. Whereas Duane’s 265 page manual included sections on pontoon drill, rules for conducting a siege, school of the sap, military mining, and construction of batteries, Confederate regulations provided three pages on the construction of fortifications, a section on siege operations, and fifteen pages of report formats. In the section on fortifications commanders learned that dragging cannons across sidewalks was forbidden, and keeping grass mowed, wooden floors swept, and drawbridges cleaned and oiled was required.<sup>46</sup>

Before Gettysburg, Lee had received a directive from the War Department on May 22, 1863 that proposed uniting pioneer companies from various divisions and to form a permanent engineer regiment. After the Gettysburg Campaign, the army commander wrote to Secretary of War James A. Seddon that a “regiment of engineer troops would be very desirable to serve this army, but, from my experience of the past campaigns, I do not think that the duties specially assigned to such troops would authorize the withdrawal of so large a body of the best men from

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<sup>45</sup> O. R., ser. 4, vol. II, 609-610.

<sup>46</sup> J. Boone Bartholomees, Jr., *Buff Facings and Gilt Buttons: Staff and Headquarters Operations in the Army of Northern Virginia, 1861-1865* (Columbia, SC: University of South Carolina Press, 1998), 102. Confederate States of America War Department, *Regulations*, 1863, 366. Duane, *Manual for Engineer Troops*, 7-265.

the ranks of the army at this time.” Chancellorsville and Gettysburg had cost Lee 40,884 and engineer troops, he believed, would diminish the army’s fighting power. Unlike the First Michigan Engineers and Mechanics who fought at Murfreesboro, Lee believed it was impracticable to get an engineer regiment into combat.<sup>47</sup>

The thesis that limited manpower resources explained why the southern high command could ill afford to take men away from the front and assign them logistical support roles, however, did not take into account other factors. General officers had large personal staffs, Lee was an exception, the quartermaster and commissary departments were well staffed, and the government could have nationalized the railroads but chose not to do this. The corps of engineers was understaffed, first, because President Davis had the elitist notion that only West Point graduates could fill the role, second, because there were just not enough men who had developed engineering or mechanical skills before the war, and third, because it was not a priority. Fighting would determine the outcome of the war not logistics.

By the end of the summer, the 1<sup>st</sup> Regiment of Engineers did begin to take shape. Men conscripted into the army who possessed basic mechanical or trade skills were trained as pontoon bridge builders or instructed in making gabions and chevaux-de-frise. It was not, however, until March 1864 that the regiment was filled out because it was difficult to find men with mechanical ability and the construction of pontoon trains took time.<sup>48</sup> Therefore, Lee’s army continued to depend on pioneers carved from divisions, and on impressed slave labor. Virginia had passed impressment legislation in October 1862 and only then out of respect for states’ rights did the Confederate government develop an impressment policy in the spring of 1863. By November, backed by General Lee’s support, engineer officers could impress slaves to

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<sup>47</sup> *O. R.*, ser. 1, vol. XXVII, part 3, 1017.

<sup>48</sup> Bartholomees, Jr., 103-104.

work on engineering projects.<sup>49</sup> In spring 1864 the Engineer Bureau asked that the Conscription Bureau be made responsible for drafting into service a force of 20,000 slaves, which the Engineer Bureau organize into “gangs” of one hundred, “groups” of eight gangs, and “directorates” of three groups. The plan was implemented allocating quotas by states.<sup>50</sup>

The attempt to establish an engineer regiment, the difficulty of building a pontoon bridge at Falling Waters, poor maps, and the chaos and obstructions faced by the Railroad Bureau in moving vital supplies to the front, contrasted significantly with Union railroad and engineering operations in the spring, summer, and fall of 1863.

When Union General George G. Meade replaced General Hooker as commander of the Army of the Potomac on June 28<sup>th</sup>. Union supply lines supporting his 90,000 men were in a precarious state. Ewell’s corps had torn up track from Harrisburg to Carlisle and Stuart’s cavalry had destroyed bridges and rails along the north and south running Northern Central Railroad, the Baltimore & Ohio to Frederick, Maryland, the Columbia-Wrightsville railroad bridge over the Susquehanna River, and track west of York and east of Hanover Junction, Pennsylvania. Now in order for Meade’s army to avoid delay in pursuing Lee, before the Army of Northern Virginia crossed the Susquehanna at Harrisburg, leaving Meade trapped behind the river and Lee free to move on Philadelphia, a steady flow of supplies had to continue to reach the Army of the Potomac from Baltimore.

Herman Haupt with authority extended by the War Department to manage all railroads in Maryland and Pennsylvania, determined to use the twenty-nine mile long Western Maryland Railroad running from Baltimore to Westminster, Maryland. The decision by the War Department to allow Haupt complete control of the operation was a critical one. Railroad

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<sup>49</sup> Bernard H. Nelson, “Confederate Slave Impressment Legislation, 1861-1865,” *Journal of Negro History*, vol. 31, no. 4 (October 1946): 398-400.

<sup>50</sup> Nichols, *Confederate Engineers*, 38-39.

presidents, generals, quartermasters, and ordnance officers all answered to Haupt. Even if the South had a man with Haupt's abilities that person never would have been given the authority to conduct such an operation.

Haupt analyzed the problem, studied the maps, and determined that from the terminus of the railroad in Westminster, wagon roads would connect with Union troop locations in Taneytown, Uniontown, Union Mills, Littletown, and Manchester.<sup>51</sup> Yet, the single track was abraded and without sidings, water stations and turntables. It had no telegraph lines and could only run three or four trains a day. Haupt would need to run thirty trains a day.<sup>52</sup>

Haupt who had already built railroad bridges, designed ferries to carry rolling stock and engines from Washington to the docks at Aquia Creek, Virginia near the mouth of the Potomac River, and organized the Construction Corps, was asked to open a vital supply line for Meade's army in its desperate struggle with the invading Confederates. First, from Baltimore, Haupt wired Adna Anderson, chief of railroads in Virginia, who arrived within a day of receiving the telegram with 400 members of the Railroad Construction Corps. Anderson was one of Haupt's protégés, and he did not hesitate to call upon Anderson for assistance. Second, Haupt ordered essential supplies. Trains to Baltimore brought tools, equipment, lanterns, water buckets, and split wood.

Anderson dispatched repair teams to open the North Central to Hanover Junction as the fighting began at Gettysburg. Haupt ran trains in convoys to Westminster and by July 3<sup>rd</sup> the Western Maryland was moving 1,500 tons of supplies daily, and returning trains were bringing

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<sup>51</sup> *O. R.*, ser. 1, vol. XXVII, part 3, 67. Turner, 278.

<sup>52</sup> Herman Haupt, *Reminiscences of General Herman Haupt* (Published by the author, 1901), 236.

out thousands of wounded to Baltimore hospitals. By late in the afternoon of July 4<sup>th</sup> the Northern Central from Baltimore was opened to Hanover Junction.<sup>53</sup>

The 50<sup>th</sup> New York Engineers and Engineer Battalion had been detailed to build pontoon bridges over the Potomac during the army's initial entry into Maryland. They had dismantled the bridges and sent two of them back to Washington while the other pontoon bridge followed the army north near Gettysburg. During the battle the engineers were used to guard the railhead at Westminster, escort the wagons to and from Gettysburg, and march prisoners to the provost guard's collection point.

The Union army's effort in general, and Haupt and Anderson's in particular, to establish a supply line during the battle of Gettysburg proved vital to the success of the campaign. The greatest logistical challenges, however, for the Army of the Potomac, the Army of the Tennessee, and Army of the Cumberland, were ahead.

After Gettysburg, southern strategy shifted to the defensive: hold on for as long as possible, and do the most damage possible. If major transportation and commercial hubs, like Petersburg, Atlanta, Charleston, and Wilmington could remain in Confederate hands until November 1864, then a war weary northern public might give the White House to a Democrat, who would recognize the Confederacy. Confederate independence could still be won. President Lincoln was aware of this possibility as early as the summer of 1863, and for the President and his commanders, the only strategic solution was now to take the war to the South and destroy the southern people's will to fight. To execute this strategy engineers would be required to open roads and build bridges deep in enemy territory, and others would need to repair and keep the railroads in operation over extended supply lines. After Gettysburg while two great armies recovered from the devastation and slaughter that would be hereafter known as the slaughter

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<sup>53</sup> Turner, 279.



pen, the peach orchard, and the valley of death, Union hopes would turn west to General William Rosecrans and his Army of the Cumberland.

After the battle of Stones River in late December 1862, which pushed the Confederates south out of Tennessee, and fired northern hope that victory could be won in the western theater, Major General William Rosecrans's began organizing for a major offensive into northern Alabama and Georgia. Rosecrans, however, would prepare very slowly and deliberately frustrating everyone in Washington.

Rosecrans's major fault was that he lacked political acumen. The occasional sarcastic remark that appeared in his correspondence with General Halleck was not appreciated by the chief-of-staff. Rosecrans, a former engineering officer who much like General McClellan, did have a keen mind and considerable skill when it came to organizing his army and thinking imaginatively about logistics. For the first six months of 1863, under his leadership, the Army of the Cumberland adopted new techniques and innovative practices, which would benefit not only his army but also those of General George Thomas, and General William T. Sherman in their 1864 and 1865 campaigns. Between January and June 1863 Rosecrans's engineers and pioneers would develop new mapping technology, design a new pontoon system, and introduce the use of fabricated truss bridges to rest on original masonry piers. Historian Philip L. Shiman argued that it was Rosecrans who institutionalized his innovations establishing a foundation for "the continuing development of his organizations and technology."<sup>54</sup>

In early January 1863 along the Nashville & Chattanooga Railroad at Murfreesboro, Rosecrans ordered a forward supply base built large enough to withstand a siege of at least sixty thousand men. With depots for the commissary, quartermaster, and ordnance departments,

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<sup>54</sup> Philip L. Shiman, "Engineering and Command: The Case of General William S. Rosecrans 1862-1863," 109.

Captain Morton's pioneers constructed warehouses, a sawmill, blockhouses, redoubts, and mutually supporting lunettes called Fortress Rosecrans.<sup>55</sup> Once the fortification was completed and his supply lines secure, Rosecrans believed his army was capable of greater movement toward Chattanooga and Tullahoma, Tennessee where Braxton Bragg's Confederate army was lurking. Halleck was anxious for Rosecrans to attack Bragg because the Union War Department was fearful that Bragg's army would be sent to rescue Pemberton at Vicksburg. Nonetheless, Rosecrans was deliberate in his preparations, which angered Halleck.

While Fortress Rosecrans was under construction, Rosecrans asked Captain William E. Merrill, of the Corps of Engineers, to reorganize the army's topographical department because Rosecrans gave top priority to mapmaking. Merrill, different from his predecessor, Captain Nathaniel Michler, and other corps members such as Captain J. C. Duane, did not resent volunteer engineers and believed that the northern war effort depended upon the abilities of these civilians. Consequently, Merrill began to detail volunteer officers from various brigades and divisions to his topographical staff, and with prismatic compasses and portable drafting kits, he trained these men in the rudimentary art of mapmaking.<sup>56</sup>

Merrill then devised a process in which topographical information was managed. Mapmakers assigned to brigades sketched out areas and then passed their information on to division topographers who compiled the data with their own information, and then transmitted the material to corps topographers who eventually passed it to army headquarters. Moreover, Merrill adopted a system designed to create "information maps" where individual topographers would take county maps and add to them additional geographic information, which was then

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<sup>55</sup> Shiman, 95. See also James St. Clair Morton, *Memoir Explaining the Situation and Defense of Fortress Rosecrans* (Fortress Rosecrans, TN: Pioneer Press, 1863), copy enclosed in Morton to Totten, June 24, 1863, M4345, Chief Engineer, Letters Received, National Archives, Washington DC.

<sup>56</sup> Shiman, 97.

forwarded to headquarters where they would revise existing maps and reissue the new information to general officers. The challenge here was to print and to disseminate the new maps in a timely manner.<sup>57</sup>

The army first used photography as a means of reproducing maps, yet photography proved problematic. The photographic equipment was bulky, lenses were inadequate to take sharp and clear pictures at a close distance, and sunlight was needed to develop the photograph. After studying this problem, Merrill then procured lithographic presses and the results were clear, legible maps. The image of the map was traced on a flat specially prepared stone that was then inked and pressed onto the paper. A topographical clerk could revise a map by drawing directly on the stone.<sup>58</sup> The drawback to this method was that maps were difficult to produce in the field because the stones were heavy and the preparation process cumbersome.

The most ingenious technique for reproducing maps was devised by Captain William Margedant of the Tenth Ohio Infantry. An experienced photographer before the war, Margedant was serving with Rosecrans during the western Virginia campaigns in 1861, when Margedant demonstrated how to copy maps using photographic chemicals. So perhaps at Rosecrans's suggestion Merrill adopted this creative method. A map was drawn on tracing paper in black ink on top of a piece of chemically treated paper. In the sunlight the treated paper stayed white under the black ink, while the remainder of the treated paper turned black from the sunlight. The resulting black maps, as they were called, had white rivers hand colored in blue, and white roads colored in red to avoid confusion. These maps had the benefit of quick revision, and the equipment used to make the maps could be transported quite easily anywhere

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<sup>57</sup> William Merrill, "The Engineer Service in the Army of the Cumberland," in Thomas B. Van Horne, *History of the Army of the Cumberland*, 2 vols. (Cincinnati: Robert Clarke, 1885), 2:456.

<sup>58</sup> Shiman, 99.

forward of headquarters. Merrill institutionalized this mapmaking technique, and it proved valuable to the entire Union army throughout the last twenty-two months of the war.<sup>59</sup>

During the Tullahoma Campaign between June 23<sup>rd</sup> and June 28<sup>th</sup>, Rosecrans skillfully maneuvered Bragg's Army of Tennessee into a precarious position with its back to the Elk River. Only Forrest's Confederate cavalry prevented the Army of the Cumberland from springing the trap by blocking northern mounted infantry from destroying the bridge on which Bragg would escape. As a result Bragg managed to slip across the river and destroy all bridges over the Elk, setting the stage for the Chickamauga Campaign. The topographical maps produced by his engineers enhanced Rosecrans's operation around Tullahoma. Yet during the heavy rains that highlighted the six days of complex flanking movements around Bragg's army, Rosecrans observed that his engineers and pioneers had a miserable time trying to move the pontoon train through muddy, viscid, and narrow roads. The Army of the Cumberland used Russian-type canvas pontoons. The canvas was stretched over a wooden frame lashed in the center then wrapped around the stern and bow, pulled tightly and lashed down again. The wooden frames were not as heavy as the Army of the Potomac's French pontoons, but they were cumbersome and required special wagons. Rosecrans had designed a prototype that his engineers built which had two sections that would be joined together by pins. Unfortunately, he did not have the facilities to make a number of frames so he established an engineer shop in Nashville that would eventually build what became known as Cumberland pontoons.<sup>60</sup>

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<sup>59</sup> McElfresh, *Maps and Mapmakers of the Civil War*, 71. Larry J. Daniel, *Days of Glory: The Army of the Cumberland, 1861-1865* (Baton Rouge: Louisiana State University Press, 2004), 389.

<sup>60</sup> William P. Loughlin, "Detached Service," *History of the Ninety-sixth Regiment, Illinois Volunteer Infantry*, ed. Charles Addison Partridge (Chicago: Brown, Pettibone, 1887), 630. James R. Willett, *Rambling Recollections of a Military Engineer* (Chicago: Illinois Commandery, Military Order of the Loyal Legion of the United States, 1888), 9-10.

With Bragg's army in Georgia, Rosecrans hesitated to pursue the enemy until his supply line back to Murfreesboro was secure, which meant rebuilding the turnpike and railroad bridge across the Elk River. John B. Anderson's civilian construction corps, Morton's pioneers, fatigue parties drawn from infantry divisions and the Michigan Engineers were available to do the work. The latter were assigned the railroad bridge. The stone piers were intact so the 470-foot-long span contained at least twenty bents and made use of the three existing stone abutments. Timber for the bents and stringers were cut from the surrounding woods, but nails, railroad spikes and rails, and sawed planks for the flooring had to be hauled in from Nashville.<sup>61</sup> The span was more than 50 feet high, and the portion over the river was built in five feet of water. The first tier of trestle was built level with the tops of the three abutments, at least 30 feet above the water.<sup>62</sup> Because of the delay in receiving nails and other materials it took the engineers six days to build the bridge, one day less than it took Lee's engineers to build a pontoon bridge across the Potomac.

Rosecrans recognized that the makeshift railroad over the Elk River could collapse if a thunderstorm suddenly dropped three or four inches of rain and produced freshets in the rapidly running river. Thus, early in the year Rosecrans had contracted with the Covington & Cincinnati Bridge Company to build a railroad bridge near Murfreesboro, and after the Michigan Engineers completed the bridge at the Elk River, the commanding general hired the bridge company to manufacture some bridge sections in Ohio and ship them disassembled to the front for installation of a bridge over the Tennessee River near Bridgeport, Alabama.<sup>63</sup> The practice of building bridge sections off sight and moving them to the proper locations was in its infancy, but

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<sup>61</sup> Hoffman, 157. A bent is part of the framework of an overall structure, which includes rafters, joists, posts, and pilings. Bents are the building blocks that define the shape of a structure.

<sup>62</sup> Hoffman, 157.

<sup>63</sup> Shiman, 103.

nonetheless, still a remarkable technological achievement. In May 1862, Herman Haupt had experimented with prefabricated truss structures called shad belly trusses. He had made spans sixty feet long and approximately 1,000 feet of bridge was prepared. Now Rosecrans was asking private companies to do the same.<sup>64</sup>

Unlike the administration of military railroads in northern Virginia, however, the operation of the railroads in Tennessee lacked leadership and centralized control. John Anderson had clashed on numerous occasions with Colonel Innes over the use of civilian repair crews, the usage of trains, and on who should first get replacement parts for track repairs. In August, the ambitious Innes finally got himself appointed military superintendent of all military railroads within the department. He was now in charge of all aspects of running the railroads including setting passenger and freight rates, repairs, and expenditures. Yet, unlike the Virginia theater where Daniel McCallum and Herman Haupt spent over eighteen months building a management system, which included a civilian construction corps with divisions and subdivisions based on specializations necessary to operate a railroad, Innes's work force consisted of civilian employees, pioneers, and regular army officers, all of whom reported to

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<sup>64</sup> Haupt's prefabricated trusses were designed so the top frame or chord of the bridge was straight, but the lower chord was shaped like the arc of a circle. The shad belly truss got its name because the arches in the bridge made it look like a fish.

See Herman Haupt, *Military Bridges: With Suggestions of New Expedients and Constructions for Crossing Streams and Chasms* (New York: D. Van Nostrand, 1864) at <http://archive.org/details/militarybridges00hauptgoog> (accessed January 5, 2014). Private bridge building contracts were highly competitive and lucrative. In September 1863 General Rosecrans notified the president of the Louisville & Nashville Railroad, James Guthrie, that a contract had been made "with the McCollum Bridge Company" to build a bridge across the Tennessee River at Bridgeport, Alabama. This company was no doubt USMRR superintendent D. C. McCallum's company, which he established in 1858. See *O. R.* ser. 1, vol. 30, part 3, 297. John A. Roebling, who owned a wire manufacturing company, worked for the Covington & Cincinnati Bridge Company, and he designed and built the Covington to Cincinnati Bridge, and it was at the time it was finished in 1866 the largest suspension bridge in the world.

different people.<sup>65</sup> Colonel Charles R. Thompson and his Twelfth Regiment United States Colored Troops (USCT) also reported to Innes and they performed admirably in the face of racist comments and unfriendly behavior.

The operation of the railroads was not Innes's only headache. Bridge building continued unabated as Rosecrans's army readied itself for the September offensive against Bragg and the Michigan men now had to get the Army of the Cumberland across the Tennessee River. First the engineers had to select the best places to cross the river, and then they had to gather the material and build the bridges to make the actual crossings. The four sites selected were at Bridgeport, Shellmound (east of Bridgeport), Battle Creek (north of Bridgeport), and Caperton's Ferry (south of Bridgeport).<sup>66</sup> Pioneers attached to various divisions built two of the bridges and one ferry. At Shellmound Major General Joseph Reynolds's Fourth Division constructed a floating bridge with captured boats and bridge building material. Brigadier General John Brannan's Third Division pioneers built rafts to ferry men over the river, and Brigadier General Jefferson C. Davis' First Division built a pontoon bridge at Caperton's Ferry.<sup>67</sup>

At Bridgeport, a detachment of Michigan engineers under the command of Lieutenant Colonel Kinsman Hunton, and men from Morton's Pioneer Brigade, had the most difficult task among the four sites because they had only about sixty-two pontoons and 1,200 feet of river.<sup>68</sup> Hunton's companies started work on a trestle bridge from the west bank of the river to an island, and the pioneers built a pontoon bridge from the island to the east bank. The evidence is not clear, however, whether material arrived from the Covington & Cincinnati Bridge Company to aid in the construction.

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<sup>65</sup> Hoffman, 160-161.

<sup>66</sup> Thienel, *Mr. Lincoln's Bridge Builders*, 137-138.

<sup>67</sup> Thienel, *Mr. Lincoln's Bridge Builders*, 138.

<sup>68</sup> *O. R.*, ser. 1, vol. XXX, part 1, 52 and *O. R.*, ser. 1, vol. XXX, part 3, 187, 203, and 235.

The timber for the trestle bridge was cut by infantry working in nearby woods, cut planks for flooring were delivered by train to Bridgeport from army run saw mills, and additional flooring was secured by stripping area barns and houses. The lumber might have come from a captured sawmill at Scottsboro, twenty-eight miles west of Bridgeport, that the pioneers operated, and from a sawmill at Anderson, Tennessee, or perhaps from the Ohio bridge company. Within a day the engineers had anchored the trestles one-third of the distance, and stringers and planks were laid as quickly as possible. Men worked through exhaustion so that in four days the entire bridge was finished, but the problems were not. In the middle of the afternoon on September 2<sup>nd</sup>, as General Philip Sheridan's infantry and artillery crossed the Tennessee, part of the bridge collapsed throwing supply wagons and animals into the river. The tired engineers waded into the river, and over the next six hours, made repairs to the bridge. Wagons continued to cross, but close to mid-night seven bents fell as a result of wash at the bottom of the piles and the bridge was closed.<sup>69</sup> Working twelve hours the following day to correct the problem, the engineers finished their work, and the remainder of Sheridan's wagon train and cavalry crossed the river.

Rosecrans was relieved his army was on the eastern bank of the Tennessee, but not satisfied that in the unfortunate circumstance of a retreat, the Bridgeport Bridge would carry a large portion of his army back to the western side of the river. So he ordered the Michigan engineers to remain at Bridgeport to construct more than fifty pontoons, and with them, build a second bridge parallel and close to the existing one. In hot and humid weather, men in long sleeve cotton shirts wearing a variety of hats to protect them from the sun, toiled another week to finish the bateaux and begin construction on the bridge. Rosecrans understood the demands he placed on the Wolverine regiment, and he understood that more engineer soldiers were

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<sup>69</sup> Hoffman, 164. *O. R.*, ser. 1, vol. XXX, part 3, 299, 304, 326.



needed to carry out the multiple tasks essential for the Army of the Cumberland's operations against Bragg's army. These responsibilities included corduroying roads, building supply warehouses, repairing track, and constructing pontoon trains. In addition, the engineers were conducting reconnaissance, making and reproducing maps, and operating engineer shops in Nashville, and sawmills throughout southeastern Tennessee. The Pioneer Brigade, under the command of Captain Morton, theoretically provided additional manpower, yet the structure of this organization made the pioneers an unreliable resource. Most corps and division commanders resented the Pioneer Brigade, and many men detached with the pioneers resented the assignment.

Men on pioneer duty were not under the control of their division or brigade commanders, they did not have to drill, they were careless with their tools, and they did not maintain the same discipline enjoyed when they were part of their regiments or brigades. Brigadier General William B. Hazen bitterly complained to headquarters, "The whole pioneer concern [is] a stench in everybody's nostrils, and no one seems disposed to use them." He continued, "As it is now, the pioneers get no drill, very little control, no sympathy, but the contempt of everybody."<sup>70</sup>

A pioneer soldier, for his part, was seldom promoted because as historian Philip Shiman pointed out, "his services were rarely observed by his own regiment's officers [who were responsible for pay and promotion] and because the colonels did not want to waste a promotion on a soldier who was for all practical purposes permanently separated from his regiment."<sup>71</sup> Furthermore, Morton had been granted permission from Rosecrans to give officers

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<sup>70</sup> William B. Hazen, *A Narrative of Military Service* (Boston: Ticknor, 1885), 407-408.

<sup>71</sup> Shiman, 104.

“acting” ranks in the pioneers, yet these men were paid according to their official infantry rank. This led to anger and antipathy on the part of some pioneer officers.<sup>72</sup>

Throughout the summer and early fall Rosecrans implored the Engineer Bureau and Congress to transform the Pioneer Brigade into an official organization. Captain Merrill, Rosecrans’s chief engineering officer asked the Federal army’s chief engineer, Brigadier General Totten, to consider the Army of the Cumberland’s proposal. Merrill wrote, “We have now the means of doing everything that can be called for in the line of Engineering, and all we ask from Washington is a little help in carrying through a necessary measure which we cannot effect ourselves.”<sup>73</sup> During Rosecrans’s tenure as commander of the Army of the Cumberland, Totten and Congress would not authorize a permanent Pioneer Brigade until the spring of 1864. Meanwhile, with his army southeast of Chattanooga, Rosecrans would attack Bragg’s army, seeking the great victory for which Lincoln, Halleck, Stanton, and the northern public were hoping.

The Confederate high command did not want to wait for Rosecrans to attack. Beauregard, Johnston, Bragg, and Lee agreed that the fastest way to bring peace and an independent Confederacy was to bring the Yankees to the negotiation table. To do this a decisive “Napoleonic victory” followed up by another invasion north would bring about the desired results. The question that remained was where to concentrate manpower for the decisive blow? Lee, a powerful voice among the president’s military advisers, suggested to Davis another move north in the fall of 1863 confident that given a second chance he would

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<sup>72</sup> Shiman, 104. Morton to Totten, February 16, 1863, M4251, Chief Engineer, Letters Received, National Archives, Washington, DC.

<sup>73</sup> Merrill to Totten, August 30, 1863, M4424 and September 1, 1863, M4425, Chief Engineer, Letters Received, National Archives, Washington, DC. See also Philip Shiman, “Engineering Sherman’s March: Army Engineers and the Management of Modern War, 1862-1865 (Ph.D. diss., Duke University, 1991), 159-163.

defeat the cautious George Meade. This time, however, Davis rejected Lee's suggestion, and feeling pressure from what historians Thomas Lawrence Connelly and Archer Jones described as the Western Coalition, decided that Bragg's Army of Tennessee would be reinforced and defeat Rosecrans in northern Georgia.<sup>74</sup> This would be followed up by a move against Grant's communications network. General Beauregard, the most vocal supporter of the plan to strike Rosecrans, reasoned that troops from both Mississippi and Virginia could reach Chattanooga within five to seven days. Bragg also had an excellent supply line along the Western & Atlantic directly to Atlanta.<sup>75</sup> After two weeks of mulling over his options, Davis agreed to send Bragg assistance and two divisions from James Longstreet's corps were selected for the journey south. It was 500 miles by rail via Lynchburg and down the Tennessee Valley over the Virginia & Tennessee Railroad, and Longstreet was confident he could do it in four to five days.<sup>76</sup>

Quartermaster General Andrew R. Lawton and Major Frederick W. Sims, chief of the Confederate Railroad Bureau, were in charge of moving Longstreet's men, horses, artillery pieces, and equipment. Historian George Edgar Turner described the mission as "an immense, laborious and vexatious piece of work."<sup>77</sup> The amount of work required to transport men from Lee to Bragg's army became even more arduous when it was discovered that Union General Ambrose Burnside entered undefended Knoxville, Tennessee on September 3<sup>rd</sup>, and as a result, blocked Longstreet's intended route. With the Knoxville road cut, Sims decided the only alternative was a circuitous 1,000-mile route using at least ten different poorly maintained railroads.<sup>78</sup> Part of Longstreet's two divisions would travel to Raleigh, Charlotte, and Branchville,

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<sup>74</sup> Members of this informal, yet politically powerful group included Joseph Johnston, Kirby Smith, Braxton Bragg, Pierre G. T. Beauregard, William Hardee, and Leonidas Polk.

<sup>75</sup> Turner, 283.

<sup>76</sup> Turner, 283.

<sup>77</sup> Clark, Jr., *Railroads in the Civil War*, 92.

<sup>78</sup> Turner, 283.

South Carolina, before heading east to Atlanta. Others would move due south through Goldsboro, Wilmington, Charleston, and Savannah before moving northwest to Atlanta. The new routes required eight separate transfers because of unconnected track, incompatible gauges, and deteriorated tracks.<sup>79</sup> G. Moxley Sorrel, Longstreet's chief of staff, said: "Never before were so many troops moved over such worn-out railways, none first-class from the beginning. Never before were such crazy cars—passenger, baggage, mail, coal, box, platform—all and every sort, wobbling on the jumping strap-iron—used for hauling good soldiers."<sup>80</sup>

Notwithstanding the fact that Sims often had to cajole railroad presidents for the use of their engines and rolling stock, and despite soldiers having to offload freight, move it to a connecting line, and reload it, men from Longstreet's two divisions were delivered to Bragg in time to participate in the battle of Chickamauga. Only five of the general's ten brigades, however, made it in time to participate in the fight. Longstreet's artillery, under Colonel E. P. Alexander, arrived in Dalton, Georgia, twelve miles from Chickamauga, early in the morning on September 25<sup>th</sup>, five days after the battle was over.<sup>81</sup>

Although only half of Longstreet's infantry and none of his artillery arrived in time for the battle, the transfer of Longstreet's men from Virginia to Georgia was the most successful Confederate railroad operation of the war. Yet, it highlighted, once again, the Confederacy's lack of managerial coordination, poor railroad maintenance, and few men available with the skills necessary to repair track, bridges, and engines. So on September 19<sup>th</sup> as Longstreet leaped from the halted train at a little flag station called Catoosa Platform and rode off to find Bragg, he did not realize, nor did anyone else, perhaps with the exception of Moxley Sorrel, that he had just

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<sup>79</sup> Black III, *Railroads of the Confederacy*, 186.

<sup>80</sup> Sorrel, *Recollections of a Confederate Staff Officer*, 189.

<sup>81</sup> E. P. Alexander, *Memoirs of a Confederate*, 449. See also Thomas Lawrence Connelly, *Autumn of Glory: The Army of Tennessee, 1862-1865* (Baton Rouge: Louisiana State University Press, 1971), 152.

been a part of the Confederacy's greatest railroad operation of the war. Instead, he was excited to get his men into the battle, which had already begun, and bring about a crushing blow to Rosecrans's army.

At Chickamauga, Rosecrans was both unlucky and lucky. Unlucky because Rosecrans's misunderstanding as to the location of his units among the thick woods led him to order the unnecessary realignment of troops. Instead of strengthening his defensive line, which was the intended consequence of his order, he inadvertently created a huge gap and Longstreet hit the exact point left open by the Federal army's mistake. As Confederate infantry rushed through the hole created by the miscommunication, the Army of the Cumberland's right wing feared being enveloped, panicked and fled back toward Chattanooga.

Fortunately for Rosecrans, his left wing, under the command General George Thomas, remained on the field, and anchoring around Snodgrass Hill, held fast to his embattled position until nightfall. After dark, Thomas and his weary but stalwart soldiers, pursued by Bragg's Confederates, followed the rest of the Union army back to Chattanooga. Now it was the South's turn to besiege a Union army, forcing it to surrender or starve to death. Bragg's men occupied the heights surrounding three sides of the city, and they blocked access to the Tennessee River north. The Army of the Cumberland's only available supply route for its 51,000 tired and hungry men was over crude wagon roads to Bridgeport, Alabama, sixty-miles away. Under the best of circumstances this would have been an undesirable connection to the supply base, but with numbers of horses and mules weakening and dying by the day the situation was untenable.

At the War Department in Washington the telegraph clicked and clattered out an ominous message from Assistant Secretary of War Charles A. Dana: the Army of the Cumberland had been driven from the field at Chickamauga and was now besieged by Confederate forces in Chattanooga. Dana's telegram made it clear: "No time should be lost in rushing twenty to

twenty-five thousand efficient troops to Bridgeport.”<sup>82</sup> It was a bold suggestion, but Stanton convinced the President, Halleck, and several cabinet secretaries that it could be done. It was agreed that the Eleventh and Twelfth Corps of the Army of the Potomac would be sent south under General Joseph Hooker. Next, President Lincoln immediately issued a blanket order authorizing Hooker to take military possession of all railroads and their equipment, “which may be necessary to the execution of the operation.”<sup>83</sup>

The next morning Stanton’s transportation advisers, Samuel M. Felton, Thomas Scott, John W. Garrett, and William P. Smith poured over maps, timetables, and equipment availability to recommend a feasible route for Hooker’s two corps. These four men wielded enormous power in the railroad industry, and each had important contacts with other railroad executives in the North. Stanton had chosen wisely.<sup>84</sup> They agreed to divide the operation into three sections: D. C. McCallum would be responsible for the initial stage supervising Hooker’s embarkation from his base in Culpeper, Virginia, to Washington. From there Garrett would manage the two corps’ movement west to Jeffersonville, Indiana. Scott would oversee the final leg of the trip from Jeffersonville to Louisville, and then along the Louisville & Nashville Railroad to Stevenson and Bridgeport, Alabama. Two days after Dana’s telegram arrived in Washington, two trains, fifty-one troop cars, and another four cars carrying field artillery, rumbled through the nation’s capital on its way to relieve Rosecrans’s starving and demoralized soldiers.

The War Department made it clear in a directive to everyone from lowly civilian station managers to powerful generals, that the army would not tolerate interference of any kind in this critical transportation operation. So along the route, when General Carl Schurz, discovered he

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<sup>82</sup> Turner, 287. Collected papers of Edwin M. Stanton (Library of Congress), September 1863.

<sup>83</sup> *O. R.*, ser. 1, vol. XXIX, part 1, 151.

<sup>84</sup> Turner, 289. Felton was president of the Philadelphia, Wilmington & Baltimore Railroad. Scott was vice president of the Pennsylvania Railroad, Garrett was president of the Baltimore & Ohio, and Smith was master of transportation for the B & O.

was well behind elements of his Third Division of the Eleventh Corps and he wired ahead telling a station agent to hold up his men's train so he could catch-up to it, the agent ignored Schurz's message. The agent sent the train on its way without waiting for the imperious general. When Schurz arrived and discovered the agent had disobeyed the general's order, Schurz broke out in a rage and threatened to bring the agent up on charges. Instead, Stanton reprimanded Schurz telling him that if the major general attempted to interfere in the operation of military railroads he would be arrested and removed from command.<sup>85</sup>

On the 1,200-mile trek they used approximately 400 miles of track that had been severely damaged by Lee's army or Morgan and Forrest's cavalry, and subsequently repaired by Haupt's Construction Corps or the First Michigan Engineers and Mechanics. The first trains rolled into Bridgeport nine days after departing Washington DC. Hooker's entire force of approximately 16,000 men, ten batteries, 1,000 horses and mules, and additional equipment and wagons, completed the journey in eleven and a half days.<sup>86</sup> It was an incredible feat of railroad management supported by skillful repair work to tracks and bridges, as well as, a tactical victory for the Union army during the siege of Chattanooga. Hooker's men could guard the Nashville & Chattanooga Railroad from Confederate saboteurs. At least now the Army of the Cumberland was assured that supplies would get from Nashville and Murfreesboro to Bridgeport unmolested.

Yet, Hooker could not move on to Chattanooga because he barely had enough food and fodder for his own men and animals, and they, too, would starve inside the city just like the Army of the Cumberland was starving. So before any attempt was made to reestablish the

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<sup>85</sup> Turner, 292.

<sup>86</sup> Turner, 292-294. Numbers can be misleading. Several historians put the number of men sent to Bridgeport at approximately twenty-five thousand. This estimate is accurate if you include Sherman and Hurlburt's corps from Vicksburg. Otherwise about 16,000 men from the 11<sup>th</sup> and 12<sup>th</sup> Corps were sent to rescue Rosecrans.

initiative and drive Bragg's army off the mountains surrounding the city, a new supply line had to be opened. The army needed an alternative to the treacherous sixty-miles of roads through narrow mountain passes and ankle deep mud contested by Rebel sharpshooters who killed exhausted and frightened horses and mules trying to haul wagons. The situation was desperate. Yet, like the canal dug around Island No. 10, the bridges built during the Peninsula Campaign, and the floating roads and bridges built on the Mississippi River floodplain at Vicksburg, northern ingenuity and innovation would turn the tide at Chattanooga. Historian James McDonough would write of the Chattanooga Campaign that "once in a great while, and perhaps when least expected, the awful drama of war narrows to a very small focus, to a relatively handful of men, and the story of a great struggle takes a decisive turn through the execution of a simple, daring plan—and the fearful momentum of war begins to swing from one army to the other. So it was at Brown's Ferry."<sup>87</sup>

Inside Chattanooga, Rosecrans had ordered the Michigan engineers to start building pontoons. With typical ingenuity they used an old steam engine that had been found, and after getting it to run, created a makeshift sawmill, which cut timber found in town and logs obtained from across the river. Couriers on horseback brought in supplies of nails, and cotton was used as caulk.<sup>88</sup> Rosecrans also requested from the War Department that he be allowed to convert some of his infantry regiments into engineers under a law authorizing the formation of "veteran volunteer engineers." The War Department did not respond.<sup>89</sup>

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<sup>87</sup> James L. McDonough, *Chattanooga: A Death Grip on the Confederacy* (Knoxville: University of Tennessee Press, 1984), 76.

<sup>88</sup> Daniel, 346.

<sup>89</sup> *O. R.*, ser. 1, vol. XXX, part 4, 102, 207, 244, 307, 361, 415, 435; General William F. Smith to General Reynolds, November 5, 1863, vol. 106, Records of the Chief Engineer, Depart of the Cumberland, Record Group 393, National Archives, Washington, DC.



Charles Dana was concerned, however, that Rosecrans was both micro-managing everything, and that he would try to pull his army out of Chattanooga over the sixty-mile wagon road instead of trying to work to open a second supply route and break the siege. Dana wrote Stanton, "...General R[osecrans] insists on personally directing every department, and keeps every one waiting and uncertain till he himself can directly supervise every operation." Then regarding a pull out of Chattanooga, he warned Stanton that the conditions of the road for the only way out were almost impassable. Dana continued, "The returning trains [supply wagons] have now for some days been stopped on this side of the Sequatchie, and a civilian who reached here last night states that he saw fully five hundred teams halted between the mountain and the river, without forage for the animals and unable to move in any direction.... And if the army is finally obliged to retreat, the probability is that it will fall back like a rabble...."<sup>90</sup>

Halleck, Stanton, and Lincoln were disturbed by this news, and consequently, felt the only way to extricate the Army of the Cumberland from the hazardous predicament it was in was to remove "Old Rosy" before the army collapsed. Halleck issued an order on October 16<sup>th</sup>, which created the Military Division of the Mississippi, and General Grant was made its commander. Grant's first decision was to replace Rosecrans with General George Thomas.

Meanwhile, the situation in Chattanooga continued to deteriorate. Colonel Francis T. Sherman described the scene: "The present ration issued officers and men alike is a half pound of hard bread, a quarter ration of sugar, a quarter ration coffee, and a full ration of salted fresh beef—only about a third [of the] ration allowed by law. It is piteous to see the men half fed and half clothed, with keen appetites and no way to satisfy the cravings of the stomach."<sup>91</sup>

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<sup>90</sup> *O. R.*, ser. 1, vol. XXX, part 1, 219-220.

<sup>91</sup> Daniel, 347. See also Peter Cozzens, *The Shipwreck of Their Hopes: The Battles for Chattanooga* (Urbana: University of Illinois Press, 1994), 22; *O. R.*, ser. 1, vol. XXX, part 1, 167-168.

Rosecrans may have had a plan to establish a second supply route, the “Cracker Line,” but to Grant’s puzzlement, did not carry it out.<sup>92</sup> Historian Albert Castel argued that on the same day Rosecrans’s new chief engineer, Brigadier General William “Baldy” Smith suggested laying a pontoon bridge at Brown’s Ferry, Rosecrans received word he was relieved of command, and consequently, did not have the opportunity to approve or execute Smith’s plan. Perhaps this was true, yet if so, it took Rosecrans almost five weeks, from September 24<sup>th</sup> when the siege began, to October 19<sup>th</sup> when he was fired, to develop some attempt to break off the Confederate strangle hold. Smith claimed that when he arrived on October 10<sup>th</sup> he tried unsuccessfully to convince Rosecrans that the army simply could not exist unless the river [Tennessee] was opened.<sup>93</sup>

For the officers and men the waiting and suspense was terrible. Captain Alfred L. Hough wrote to his wife in early October: “To live, and to go to sleep knowing that a hundred or so cannon are looking one another in the face, and may at any moment open on each other, that is our daily life. But it must soon end, a fight or a fall back by one side or the other must take place before many days.”<sup>94</sup> Yet, Grant showed no signs of waiting. Prepared both to open the Tennessee River and fight the Rebels, he rode, with his staff and cavalry escort, the sixty-mile Walden Ridge and Sequatchie Valley roads in driving rain and perilous conditions to arrive at Thomas’s headquarters on October 23<sup>rd</sup> in the late evening. Everyone on Thomas’s staff knew that Grant had been thrown from a horse weeks before and had badly sprained his angle. So

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<sup>92</sup> Crackers or hardtack, a staple food in both armies, was made of flour, water, and salt. It was easy to carry, and it would stay eatable for a very long time. During the siege of Chattanooga, to demonstrate their incessant hunger, Union soldiers on fatigue duty would shout to their officers, “crackers!” Thus, when a final plan was adopted to open a new supply line it was given the sobriquet the “Cracker Line.” See Grant, *Personal Memoirs*, 329.

<sup>93</sup> Herbert M. Schiller, ed., *Autobiography of Major General William F. Smith, 1861-1864* (Dayton: Morningside, 1990), 72.

<sup>94</sup> Alfred L. Hough, *Soldier in the West: The Civil War Letters of Alfred Lacy Hough* (Philadelphia: University of Pennsylvania Press, 1957), 153.

with the injury and miserable weather they were shocked when Grant, wet and cold, limped through the doorway of the house Thomas used as his command post, refused dry clothes, and immediately asked to hear about plans to open the Cracker Line. Grant's demeanor signaled that he was there to manage the situation rather than allowing the situation to manage him.<sup>95</sup>

The scene was tense. Grant and Thomas had a cool relationship with each other. Perhaps it was because after Shiloh, when Grant was demoted to second in command behind Halleck, Thomas was given temporary command of the Army of the Tennessee, and Grant suspected Thomas had something to do with the change. Whatever the feelings both men acted as professionals, and Grant listened intently as Baldy Smith presented his idea (with Thomas's approval) of opening a supply line that would avoid Confederate artillery atop Lookout Mountain, and the Southern sharpshooters at the Raccoon Mountain bend in the Tennessee River.<sup>96</sup> Smith proposed floating pontoons from the city south toward Chattanooga Creek and then around the "U" shaped bend in the river north to Brown's Ferry about two and a half miles from Lookout Mountain, where a bridge would be constructed. Now supplies could be transported by river to Kelley's Ferry, hauled by wagon through a pass in Raccoon Mountain to Brown's Ferry, on to Moccasin Point, and over another pontoon bridge into Chattanooga. Simultaneously, Hooker would move his two corps along the Nashville & Chattanooga Railroad into Lookout Valley and then tie into the Brown's Ferry position.<sup>97</sup> The following morning Grant scouted Brown's Ferry, and then he approved the plan.

After Grant had listened to Smith's ideas the previous evening, the commanding general also sent word over the telegraph wires calling for General Sherman to leave Iuka for Nashville and then to move rapidly into Chattanooga. With Sherman was General Grenville Dodge's 2<sup>nd</sup>

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<sup>95</sup> Horace Porter, *Campaigning with Grant* (New York: The Century Company, 1897), 8.

<sup>96</sup> Daniel, 363.

<sup>97</sup> Schiller, 75-76; Grant, *Personal Memoirs*, 411.

Division of the XVI Corps. Grant grasped quickly that with additional manpower from Hooker and Sherman, and the likelihood he would need to supply Burnside's command in East Tennessee, a single-track railroad was not optimal. Remembering Dodge was a railroad builder before the war, Grant sent a second message to Sherman ordering him to halt Dodge and his 8,000 men at Athens, Alabama, to repair the Central Alabama Railroad below Nashville, extend it to the Tennessee River at Decatur, then repair the Memphis & Charleston between Decatur and Stevenson, giving the army two roads as far as Stevenson over which to run supplies.<sup>98</sup>

Dodge first assigned men to guard against Confederate raiding parties, and then others gathered food and forage from the surrounding countryside. Once these detachments started their work, Dodge recruited blacksmiths from the men in the ranks, and assigned them to set up portable blacksmith shops to make the tools necessary in railroad and bridge building. Axmen were put to work cutting timber for bridges and fuel for locomotives, and mechanics worked to repair whatever engines and cars could be found. To support Dodge's efforts, Grant ordered General McPherson to send eight engines and rolling stock from Vicksburg to Nashville. He arranged to have rails taken from track not in use and other inactive locomotives and cars sent to Nashville. John Anderson, who succeeded his former replacement, Colonel Innes, was also directed to furnish rolling stock and as much bridge material as possible.<sup>99</sup>

In forty days, Dodge and his men were to lay or repair 102 miles of track and rebuild 182 bridges and culverts. This was northern ingenuity at its finest. Now, like the military railroad management system McCallum and Haupt developed in Virginia, and acumen displayed by Stanton's transportation board in moving Hooker's army south, Grant, Dodge, and Anderson

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<sup>98</sup> Grant, *Personal Memoirs*, 339.

<sup>99</sup> Grant, *Personal Memoirs*, 340.

had serendipitously established the foundation for the efficient management of military railroads in the western theater of operations.

Dodge, however, was not the only one with a unique engineering story to tell during the siege. In Bridgeport, Alabama, after Hooker's arrival in early October, Captain Arthur Edwards, an assistant quartermaster from Detroit, and before the war, a shipbuilder from Lake Erie, prepared to convert a scow into a steamboat.<sup>100</sup> The scow, mounted with an engine, boiler, and stern-wheel, would carry and tow supplies to Kelley's Ferry nine miles west of Chattanooga. Here the food and forage would be unloaded and transported overland to the city. The captain retained the services of a master mechanic named Turner and a number of carpenters who framed the boat and then set it on blocks about six feet above the water level of the Tennessee.<sup>101</sup>

Suddenly the water began to rise in the river. Before the planking was finished, and the caulk and pitch applied to the bottom, the water was within sixteen inches of the planks. Using pig iron left behind by Confederates, Turner started to weigh down the hull to prevent it from being swept off the blocks and being broken apart by the current. Another quartermaster, Lieutenant Colonel William Gates Le Duc, suggested to Turner and Edwards that carpenters cross-timber the blocks, but Edwards pointed out the futility in trying to keep pace with the rise in water level. Le Duc reminded Edwards that Thomas's starving soldiers needed the steamboat, and that if the planking got wet it would be another two to four weeks before the planking

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<sup>100</sup> The scow was a flat bottom boat with a broad shallow hull, and this design made them perfect for hauling freight.

<sup>101</sup> William G. Le Duc, "The Little Steamboat that Opened the 'Cracker Line,'" in *Battles and Leaders of the Civil War: Retreat from Gettysburg* (New York: Castle Books, 1956), 676.

would dry and the caulk and pitch applied. Edwards understood the predicament, yet believed nothing could be done except wait for the river to run her course.<sup>102</sup>

Le Duc had an idea. Using extra pontoons floated along side the steamboat, carpenters bored two-inch holes in the bateaux gradually filling them with water. When the pontoons rode low enough they were pushed under the steamboat as the blocks were hammered out. As soon as the steamboat was secure atop the several pontoons, the carpenters plugged the holes and other men began to bail the water out. Within six hours of starting the steamboat was safely riding on the top of the rising water. The hull was caulked and pitched and three weeks from the start of the project the *U. S. S. Chattanooga* was launched. On October 30<sup>th</sup> the steamboat, under the direction of Le Duc and a soldier named Williams, who had steered on a steam-ferry running between Cincinnati and Covington, (in the years before Roebling's suspension bridge was completed) landed at Kelley's Ferry with 40,000 rations and 39,000 pounds of forage.<sup>103</sup>

Meanwhile back in Chattanooga, immediately after Grant approved "Baldy" Smith's plan to build a pontoon bridge at Brown's Ferry, Smith spoke with Captain Perrin V. Fox of the 1<sup>st</sup> Michigan Engineers and Mechanics. Fox was told that the army needed fifty pontoons in two days. Already, the Wolverines had built most of the boats from unseasoned lumber and with a limited supply of nails. He now needed to collect equipment and tools, assemble a bridge team train because infantry would ride in the pontoons, and he had to make 250 oars and rowlocks. Regular army engineer Lieutenant George W. Dresser scavenged train car wheels from the railroad shop, and these would be used as anchors. All was completed with dispatch and late on

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<sup>102</sup> Le Duc, 677. Le Duc had attended the Lancaster (Ohio) Academy with William T. Sherman. He was a successful railroad developer and after the war, assisted in perfecting the Remington typewriter and was United States Commissioner of Agriculture under President Rutherford B. Hayes.

<sup>103</sup> Le Duc, 678.

the night of October 26<sup>th</sup> Perrin, his men, and members of the assault team, set off across Moccasin Point, over difficult roads, to within 1000 feet of the bridge site.<sup>104</sup>

The assault team was made up of hand picked men from the brigades of Brigadier General William Babcock Hazen and Brigadier General John Basil Turchin, a.k.a. Ivan Vasilevitch Turchininoff.<sup>105</sup> At 3:00 A. M. the pontoons were loaded with twenty-five men and five oarsmen each, and they quietly pushed off gliding over the water so as not to be heard by Confederate pickets lining the western bank of the river. The river, approximately two and a half football fields wide, and heavy with fog, provided the cover the Union force needed. Then at around 4:30 A. M. signal fires were lit on Moccasin Point to orient the boats to their position. With stealth and speed the men sprang onto the western shore taking Confederate pickets by complete surprise.<sup>106</sup>

Infantry on Moccasin Point were ferried across the river to support the initial assault wave, and once the west bank was secured Fox's men began building the 870 foot-long bridge. It took fewer than eight hours to complete. Reinforcements were moved across the new bridge to protect the bridgehead from Confederate counterattacks, one led by Colonel William C. Oates of the 15<sup>th</sup> Alabama, who four months earlier had fought tenaciously to capture Little Round Top at Gettysburg. General Longstreet, in overall command of Confederate forces at the bridge could only muster 4,000, while at the same time 5,000 bluecoats had established firm control of the area. Longstreet, at the battle of Wauhatchie in Lookout Valley, would also try to stop

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<sup>104</sup> Hoffman, 181.

<sup>105</sup> Hazen was an outspoken character that was known to speak his mind to anyone including a superior. Turchin, a Russian by birth, graduated from the St. Petersburg Artillery School and was on the staff of the Imperial Guards. He and his wife, who was raised in the Russian Army in her father's regiment and married one of his subalterns, John (Ivan), moved to Chicago before the war. John worked in the railroad business before the war and in 1861 joined the Union army. The soldiers affectionately called his wife, Madame Turchin, and she kept an extensive diary of the war including the battles she participated in such as Chickamauga.

<sup>106</sup> Hoffman, 181.

Hooker's two corps from linking up with the Army of the Cumberland at Brown's Ferry, and he failed. As Captain Alfred Hough would write to his wife regarding the operation at Brown's Ferry, "It was as fine a thing as was ever done."<sup>107</sup>

With the Cracker Line opened, supplies flowed into Chattanooga, and Grant once again took the strategic initiative culminating in late November at the battles of Missionary Ridge and Lookout Mountain. Bragg's Army of Tennessee was driven from Chattanooga, and this would set the stage for the start of Sherman's Atlanta Campaign in the spring of 1864. From December 1863 to March 1864, both in the eastern and western theater, Union armies prepared for major offensives. Grant was called to Washington in March where he received his commission as the army's only lieutenant general and became commander-in-chief of the United States Army.<sup>108</sup> After deciding to operate his headquarters in the field along side the Army of the Potomac, he promoted Sherman to command the three army groups of the Division of the Mississippi: Thomas's Army of the Cumberland, McPherson's Army of the Tennessee, and John Schofield's Army of the Ohio.

Perhaps because he learned from Rosecrans the importance of engineering, Thomas would take the time between Chattanooga and Atlanta to refurbish his combat engineer organization. In May 1864, Congress would authorize Thomas's Pioneer Brigade into an official engineer unit, and would create the First U. S. Veteran Volunteer Engineers. Merrill, Thomas's chief engineer, trained soldiers from each brigade in the army as mapmakers, made sure the engineer shops in Nashville were building railroad cars, repairing locomotives, producing

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<sup>107</sup> Sword, 121.

<sup>108</sup> George Washington was the army's first officer to receive the rank of lieutenant general. In 1976, Washington was posthumously promoted to General of the Armies. Winfield Scott was brevetted lieutenant general after the Mexican-American War. After the Civil War, Grant was promoted to General of the Army (four stars). In today's army the four star general is the highest rank possible. In wartime, Congress does have the authority to award a fifth star.



portable sawmill's to cut lumber at bridge sites, and build a new lighter pontoon. The original idea was Rosecrans's, but the improved design was Merrill's. Instead of using pins to hold sections together, Merrill substituted hinges so that the frame folded and did not come apart. Each corps would carry a train sufficient to bridge a nine hundred foot river.<sup>109</sup>

Because of the daunting task facing the Michigan engineers of repairing railroads and building a backup line to transport supplies to Nashville, the Engineer Regiment of the West consolidated with the 25<sup>th</sup> Missouri Infantry to form the 1<sup>st</sup> Missouri Engineers. The new regiment would construct the Nashville and Northwestern Railroad, and at one point build the track over a ravine 1,200 long and 800 feet deep.<sup>110</sup> Another bridge over Running Water Ravine was built to complete the direct line from Bridgeport to Chattanooga. A pioneer company from the 59<sup>th</sup> Illinois Infantry under the command of First Lieutenant Chesley A. Mosman, built the bridge. Trestles, sixteen feet high and layered atop each other, rose from the riverbed, until four tiers 116 feet high completed the 780-foot long structure. During the construction Mosman wrote, "I have a hundred men at work on the bridge, mostly soldiers from Colonel William Grose's brigade who get one dollar a day extra. Two more bents (poles) were erected today. The pioneers have rigged up a windlass, a device for raising or hauling objects. With a windlass and tackle they raise bents in place."<sup>111</sup>

Sherman's offensive into Georgia required that railroads and bridges be in sound condition. When he finally began his campaign against Confederate General Joseph Johnston's army, Sherman's initial point of contact with the enemy would be three hundred miles from his main supply base, and it would grow longer as Sherman's three armies, comprised of over

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<sup>109</sup> Shiman, 107. W. E. Merrill, "The Engineer Service in the Army of the Cumberland," 2:439-458.

<sup>110</sup> Thienel, *Mr. Lincoln's Bridge Builders*, 151.

<sup>111</sup> Arnold Gates, ed., *The Rough Side of War: The Civil War Journal of Chesley A. Mosman, First Lieutenant, Company D, 59<sup>th</sup> Illinois Volunteer Infantry Regiment* (Garden City, NY: The Basin Publishing Company, 1987), 140-156.

110,000 soldiers, moved farther southeast toward Atlanta. Therefore, David McCallum was called to Nashville to assess the condition of the railroads, and he determined that an insufficient number of cars and locomotives existed for such an ambitious operation. Furthermore, he reported that track conditions were poor. John Anderson was relieved from command of military railroads, and in his place Adna Anderson was appointed general superintendent of transportation and maintenance, and W. W. Wright chief engineer of construction in the military division of the Mississippi.<sup>112</sup>

Adna Anderson was replacing Herman Haupt who resigned from the military railroad department in September.<sup>113</sup> Fortunately for the Yankees, Anderson was an excellent railroad engineer, a skilled manager, and he inherited a remarkable operation. The Construction Corps, now a permanent organization, was well organized into five divisions: bridges and carpentry, track, water stations, masonry, and train crews. New types of interchangeable bridge trusses were stockpiled, and a simple ark had been made for transporting eight loaded freight cars by

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<sup>112</sup> *O. R.*, ser. 1, vol. XXXII, part 2, 73, 365, 372. The telegram giving McCallum authority to make the necessary changes to his department was sent January 12, 1864 and was another example of efficient management. Halleck wrote Thomas: "Your telegram of yesterday was shown to the Secretary of War, who says that Colonel McCallum has full authority to immediately adopt any measures he may deem necessary to put the railroad in efficient running order. He has authority to make any changes he may deem proper in its management. It is not necessary that he should make any previous explanations to the War Department. Tell him to go right ahead, and he will be sustained by the Secretary."

<sup>113</sup> Haupt had refused the appointment of brigadier general in September 1862. He preferred to serve without rank or pay because he did not want to limit his freedom to continue his private business interests. In September 1863 Secretary of War Stanton again offered him a generalship. Haupt told Stanton that he would consider the promotion if Stanton agreed to establish the USMRR bureau (eventually Stanton did agree) and if the secretary promised to grant considerable authority to the bureau chief. Stanton did not want to negotiate with Haupt over a generalship, and so he refused Haupt's requests. Haupt then resigned his services. After this, Haupt continued to serve as chief engineer or general manager for various railroads, and he invented a drilling machine. He died while traveling, appropriately enough, on a train in New Jersey on December 14, 1905.

water.<sup>114</sup> Under Anderson's leadership the United States Military Railroad in the western theater would develop into an even larger organization, just as resourceful and proficient as that of the operation in the eastern theater.

During January and February 1864, both Union and Confederate soldiers huddled by campfires, wrote long letters home, and tried to recover from emotional and physical wounds sustained in the hard fighting of the past year. Generals sat in their headquarters reorganizing their division and corps commanders, contemplating their next move and that of their enemy. In Richmond, the Davis government continued to wrestle with railroad presidents and states' rights governors about the use of railroads for military purposes, and engineers continued to direct slave labor in building fortifications in northwestern Georgia, Atlanta, and around Petersburg and Richmond, Virginia. Conversely, the Army of the Potomac and the Military Division of the Mississippi prepared to go on the offensive. Union engineers would play a major role, as they did at Vicksburg and Chattanooga, in determining the outcome of those operations. Moreover, Union engineers, pioneers, Construction Corps workers, and sometimes details of infantry, readied the rails for the big push to come. Locomotives were collected and repaired; rolling stock was gathered and made, and supplies were stockpiled. As men from both sides drilled, stood guard, played dice and cards, they thought of some of their dead comrades and wondered if they would be alive the same time next year. The waiting and guessing were about to end. The cars were about to leave the station.

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<sup>114</sup> Turner, 312.

## CHAPTER 9

### RED RIVER, PETERSBURG AND ATLANTA

**We cannot train them for every possible encounter...because we cannot anticipate what those encounters will be like. Instead we have to develop them to be the kind of people who can sort it out for themselves once they get there.**

**Colonel Barney Forsythe on the Cadet Leadership Development System,  
In David Lipsky's *Absolutely American: Four Years at West Point***

At the corner of Third Street and Vines sat the majestic Burnet House, Cincinnati's handsomest hotel. The *Illustrated London News* called the neoclassical styled golden domed, five-story building "the finest hotel in the world."<sup>1</sup> There in March 1864, generals Grant and Sherman met to plan the spring campaigns, which they believed would finally bring the Confederacy to its knees. Sitting in Parlor A, Grant revealed to Sherman his strategy, which called for simultaneous Union offensives along the entire Confederate line. The Army of the Potomac would attack Lee's army in northern Virginia, Sherman would strike at General Joseph Johnston's forces along the Chattanooga-Atlanta corridor, the newly formed Army of the James, under Ambrose Burnside, would pressure Lee from the south or shift their concentration to coastal North Carolina, and Nathaniel P. Banks's Department of the Gulf would prepare a combined operation with the navy to capture Mobile, Alabama.<sup>2</sup>

While Grant and Sherman worked to ready their forces for a coordinated pincer movement against the Confederacy's two major armies, Union forces under Nathaniel Banks, in the Department of the Gulf, had launched a successful campaign against Southern fortification along the southeast coast of Texas with the hope of threatening the French in Mexico. In March,

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<sup>1</sup> American Guide Series on Waymarking. Com, "Site of the Burnet House—Cincinnati, Ohio," at [www.waymarking.com/waymarks/WM3NVN](http://www.waymarking.com/waymarks/WM3NVN) (accessed August 5, 2013). Today the PNC Annex sits on the site of the old hotel.

<sup>2</sup> U. S. Grant, *Personal Memoirs of U. S. Grant* (New York, 1885), 364-373.

Banks was fully engaged with Confederate forces from the Trans-Mississippi region for control of the Red River, the wealthy cotton plantations along the river, and the Trans-Mississippi Department's headquarters at Shreveport, Louisiana.

During the Texas coast operations, Bank's engineers were the 1<sup>st</sup> and 2<sup>nd</sup> Regiment, Engineers, Corps d'Afrique. Formed from the Louisiana Native Guards, the Corps d'Afrique was made up of property owning freeborn creoles and blacks, and later freedmen from refugee camps. Much of the work done by the engineers included building fortification and digging trenches and latrines. It was the hard backbreaking work that white soldiers preferred not to do. Banks demanded that white troops respect the work of his soldiers of color, and he also believed that black soldiers were better at performing the hard duty of "throwing up defensive earthworks...unwillingly performed by white troops." A captain of the 53<sup>rd</sup> Massachusetts wrote to his wife about the black engineers, "The[y] can be put into the unhealthy localities in the department and not suffer like white men."<sup>3</sup>

This, of course, was not true. During the siege of Port Hudson in the summer of 1863, Corps d'Afrique troops died at an alarming rate as a result of typhoid and dysentery. The engineers' presence, however, aided in the capture of this Confederate stronghold. The 3<sup>rd</sup> Regiment, Engineers, had built a bridge over the Tunica River at Bayou Sara Road, which allowed Banks's forces to approach Port Hudson from both the north and south. On May 27<sup>th</sup>, the First and Third engineers participated in the first assault on the city and lost 37 killed, 155 wounded, and 116 captured. The First's regimental commander, Captain Andre Cailloux, one of the first black officers in the Union army, was one of those killed.<sup>4</sup> Incidentally, Confederate Major

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<sup>3</sup> James G. Hollandsworth, *The Louisiana Native Guards: The Black Military Experience During the Civil War* (Baton Rouge: Louisiana State University Press, 1998), 97.

<sup>4</sup> Technically the 1<sup>st</sup>, 2<sup>nd</sup>, and 3<sup>rd</sup>, regiments were designated Native Guards until after the capture of Port Hudson when their named changed to Corps d'Afrique. BlackPast.org,

General Franklin Gardner had no engineers available inside the fortifications so he promoted Private Henry Glinder to lieutenant of engineers because Glinder had been a member of the Coast Survey before the war.

In the months following the Port Hudson and Texas coast operations, a number of soldiers in the Corps d’Afrique deserted. Poor treatment by the white soldiers and officers, and cruel conditions under which they lived, were the primary reasons for their actions.

Furthermore, by the fall Banks had purged the corps of all the black officers and their white replacements acted the role of overseers and martinets. The Bureau of Colored Troops, established May 22, 1863, under the command of Major Charles W. Foster, a Lincoln Republican from Ohio, attempted to recruit other soldiers, but most of the regiments remained under strength. Two additional engineer regiments, the Fourth and Fifth, were organized in time for the Red River Campaign. The Fourth would be stationed in New Orleans, and the Fifth Regiment would join the Third engineers and take part in two of the most remarkable and least remembered engineering feats of the war.

In brief, in the spring of 1864, General Banks had intentions of capturing Mobile Bay, closing off the Confederacy’s last major port in the Gulf of Mexico. His plans, however, were interrupted when General Halleck insisted Banks move along the Red River and defeat Lieutenant General Richard Taylor’s trans-Mississippi forces.<sup>5</sup> Grant was promoted to lieutenant

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Remembered & Reclaimed, “1<sup>st</sup> Louisiana Guard,” USA/Corps d’Afrique (1862-1863) at [www.blackpast.org/?q=aah/1st-louisiana-native-guard-usa-corps-d-afrique-1862-1863](http://www.blackpast.org/?q=aah/1st-louisiana-native-guard-usa-corps-d-afrique-1862-1863) (accessed August 9, 2013).

<sup>5</sup> Taylor was the son of Zachery Taylor, twelfth president of the United States, Mexican War hero, a strong supporter of the Union, demonstrated by his position on California statehood. General Taylor was Ulysses S. Grant’s idol. Zachery Taylor cut a military figure diametrically opposite the other famous general of the Mexican War, Winfield Scott. Scott, referred to by his men as “Old Fuss and Feathers,” took the pomp and pageantry of military decorum and regalia to a whole new level. Conversely, Taylor, nicknamed Old Rough and Ready,” looked like a sack of flour sitting upon a horse. His uniform was wrinkled and dirty, and the only difference between

general and given command of all Union armies after the Red River Campaign commenced. Grant agreed with Banks that Mobile Bay, not Taylor's army should be the focus, but out of deference to Halleck, the commanding general did not call off the Red River effort. Nonetheless, he did give Banks a time limit—either Banks complete his objectives by April 25<sup>th</sup> or the campaign would be halted. This time constraint placed additional pressure on Banks, which almost led to a disaster, averted only by the creative skill of the engineers.

Banks's plan called for three movements. First, the general's army, elements of Thomas Edward Ransom's XIII Corps, William Buel Franklin's XIX Corps, a cavalry division, and four infantry regiments of the Corps d'Afrique, would march northwest along Bayou Teche, and Vermillion Bayou to Alexandria.<sup>6</sup> From the confluence of the Mississippi and Red River to Alexandria was at least seventy river miles. McPherson would send a detachment of soldiers from Vicksburg down the Mississippi, join Admiral Porter's fleet (13 ironclads and seven light-draught gunboats) at the Red River and move to Alexandria. General Frederick Steele, operating in Arkansas, would send forces from Little Rock. All three groups would converge at Shreveport. The 3<sup>rd</sup> and 5<sup>th</sup> Regiment Engineers, Corps d'Afrique built pontoon bridges both at Vermillion Bayou and Cane River as Banks made his way north.

At Alexandria the problems began. Low water made it just possible, taking ten days, for the fleet to pass the double rapids above the city. Then moving forward, Banks's men clashed

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his attire and that of privates was the rank insignia worn on his shoulders. Grant admired the general's strength and simplicity. During the Civil War, Grant often wore a simple uniform and carried little baggage with him into the field. During the Vicksburg Campaign after leaving Bruinsburg and his army's supply base along the Mississippi, he ordered officers, especially generals, to travel with limited personal baggage. For his part, Grant carried with him several changes of underwear and a toothbrush. The historian Shelby Foote described Grant most succinctly: "A dust covered man on a dust covered horse."

<sup>6</sup> Before the war Banks was president of the Illinois Central Railroad and served as governor of Massachusetts. Franklin graduated first in his West Point class of 1843 and was a member of the Corps of Engineers, and Ransom was a civil engineer before the war.

with Confederates in the first major engagement of the campaign at Sabine Cross-Roads (April 8), where Banks was driven south toward Pleasant Hill, suffering a significant loss of men and material. After another fight the following day at Pleasant's Hill, Banks decided to abandon his attempt to capture Shreveport. Confederate partisans, 1,000 cavalry, obstructions in the river, demanding terrain, and Steele's failed attempt to pressure Shreveport made the conclusion an easy one, but getting Porter's fleet safely back to Alexandria represented a monumental undertaking. The water level of the Red River continued to drop. Taylor divided his forces between harassing Banks in Alexandria and obstructing the river twenty-five river miles south of the city at Snaggy Point.

By April 25<sup>th</sup> Banks's situation was dire. His twenty-five thousand man force could fight its way back to the Mississippi, but Porter's fleet, twelve ironclads and six gunboats were trapped above Alexandria, and the prospect of losing all of them, along with the valuable cotton they carried, to a small Confederate force was both real and alarming.<sup>7</sup> Just as the hopes of the Federal government and nation rested on the spring offensives of Grant and Sherman, the announcement that the navy lost twenty ships and the army was soundly defeated by a smaller force in the Red River Campaign, would devastate Union morale and boost their enemies. Furthermore, members of Lincoln's own party, led by the politically ambitious and untrustworthy Secretary of the Treasury Salmon P. Chase, were attempting to win the Republican nomination for president in the fall election. An overwhelming loss in Louisiana would be a severe blow to Lincoln's re-election efforts.

On April 25<sup>th</sup>, Colonel Joseph Bailey, acting chief engineer for General Franklin's Nineteenth Corps, suggested a unique plan for rescuing Porter's ships. Colonel Bailey was born

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<sup>7</sup> Both the ironclad *Eastport* and the gunboat *Champion 5* were sunk. The former struck a mine ("torpedo"), and the latter by was hit by multiple shots from shore batteries at the junction of the Cane and Red Rivers.



in Ohio, received a common school education, and was employed as a civil engineer and lumberman before the war. Remembering a technique used by his fellow Wisconsin lumberman to funnel logs down river to mills, he proposed to build wing dams, both to deepen the water and shoot the boats over the rapids. Porter's flotilla needed seven feet of water to prevent grounding, and the water over the rapids was three feet deep. Franklin, thought the idea impractical, but the fleet was still 300 miles from the Mississippi, and Banks's army had just three weeks of half rations remaining and virtually no forage for the animals. Franklin conferred with Banks, and the latter gave Bailey permission to begin.<sup>8</sup>

What happened next lent some controversy to Bailey's project. In the colonel's report dated May 17, 1864, he mentioned the technical aspects of the dams, the regiments involved in constructing the dams, and as if it were an afterthought, he wrote: "In addition to the dam at the foot of the falls, I constructed two wing-dams on each side of the river at the head of the falls."<sup>9</sup>

There were two dams built. The first one was constructed above the second set of rapids, closest to Alexandria where the river was 758 feet wide and the current at ten miles an hour. The left dam was built of felled trees laid in the river with the current, their branches locked and trunks tied together. The right dam consisted of a crib filled with stones and scrap iron, and placed in a way that there was a 150-foot gap between the two wings. Finally, transport barges filled with rubble were sunk in the gap. It took eight days and nights to complete the dam and everything was ready for May 8<sup>th</sup>. The idea was that the barges would be hauled away and the rising water behind the dam would explode through the opening with such force and enough water to funnel Porter's ships through. Sailors stripped side armor from the

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<sup>8</sup> *O. R.*, ser. 1, vol. XXXIV, part 1, 402-404.

<sup>9</sup> *O. R.*, ser. 1, vol. XXXIV, part 1, 402.

boats and brought ashore anchors, chains, ammunition, and guns to be transported by wagons downstream to reunite with their ships later.

The water pressure, however, was too much for the sunken barges as they were pushed aside by the great weight of the water sending ships behind the dam bouncing, dipping, scraping, and skating into the river with enough water to float them into the deeper part of the river. It was a great success, but ten boats, not yet ready for the break in the dam, remained upstream beyond the first set or upper falls. It was for this reason Bailey wrote that another dam was built.

Bailey thanked a number of officers for their determination and zeal working on the dams, including Colonel George Dorgue Robinson, commander of the 97<sup>th</sup> Regiment Colored Troops, and Lieutenant Colonel Uri Balcom Pearsall's 99<sup>th</sup> Regiment Colored Troops. Before April 4<sup>th</sup> these units had been designated the 3<sup>rd</sup> Regiment, Engineers, Corps d'Afrique and the 5<sup>th</sup> Regiment, Engineers, Corps d'Afrique. They remained engineer troops by a different name. Others mentioned by Bailey included the 29<sup>th</sup> Maine, 116<sup>th</sup> New York, 24<sup>th</sup> Iowa, 16<sup>th</sup> Ohio, 27<sup>th</sup> Indiana, and the 19<sup>th</sup> Kentucky.<sup>10</sup> He received the Thanks of Congress and a presentation sword from the Navy Department for his engineering feat that saved the fleet during the Red River Campaign.<sup>11</sup>

Colonel George D. Robinson, commanding the 97<sup>th</sup> Regiment, U. S. Colored Troops (3<sup>rd</sup> Regiment, Engineers), however, reported a slightly different version of Bailey's story. Immediately after Bailey received permission to begin his dam project, Robinson, an 1861 graduate of the University of Michigan, was ordered to meet with Bailey. Along with Lieutenant Colonel Pearsall, commander of the 99<sup>th</sup> Regiment, U. S. Colored Troops (5<sup>th</sup> Regiment,

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<sup>10</sup> *O. R.*, ser. 1, vol. XXXIV, part 1, 404.

<sup>11</sup> Benjamin W. Bacon, *Sinews of War: How Technology, Industry, and Transportation Won the Civil War* (Novato, CA: Presidio Press, 1997), 123.

Engineers), the three men walked to the river bank and discussed where to build the dam.<sup>12</sup>

Pearsall suggested building two dams, at both set of rapids, but Bailey insisted that a dam at the lower rapids was sufficient. Robinson then set his men to work removing barricades from the town, cutting timber, and constructing a battery for six guns along Bayou Rapids Road. When the upper dam was built, Robinson mentioned that it was Pearsall's idea, and the men of the 97<sup>th</sup> and 99<sup>th</sup> who built it.<sup>13</sup> Robinson wrote: "The plan for building two dams across Red River, which from necessity was finally adopted, was originally proposed by him [Pearsall], and the success of the dam was in my opinion, mainly due to his efforts."<sup>14</sup>

Pearsall, in his report, was more emphatic. During the building of the first dam, it was the men of the 97<sup>th</sup> and 99<sup>th</sup> that built the crib section, and the men of the 29<sup>th</sup> Maine, 110<sup>th</sup> and 161<sup>st</sup> New York, and the XIII Corps' pioneer brigade that built the log section. Then, when the center section gave way on May 9<sup>th</sup>, Bailey told Pearsall, who had already suggested a second dam, to build a dam at the upper rapids. The upper dam that saved ten gunboats and ironclads in Porter's fleet was Pearsall's idea, and built primarily by U. S. Colored Troops.

Pearsall was familiar with wing dams. Born in Owego, New York, Pearsall attended common schools and Oxford Academy in Owego, and worked for his father, who built the first dam on the Susquehanna, in the lumber business. At sixteen years old, Pearsall moved to Wisconsin to work for his uncle in the same trade. Now at twenty-four, he would use his knowledge and creativity to save more than half of Porter's boats. His men built two-legged trestles for a "bracket dam." Because of the swift current, "Some pieces of iron bolts (size one-half inch) were procured and one set into the foot of the legs of each trestle; also one in the cap

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<sup>12</sup> Technically, Robinson commanded both the 97<sup>th</sup> and 99<sup>th</sup> in what was designated the Engineer Brigade.

<sup>13</sup> *O. R.*, ser. 1, vol. XXXIV, part 1, 248-253.

<sup>14</sup> *O. R.*, ser. 1, vol. XXXIV, part 1, 253.

pieces at the end resting on the bottom up stream.... The trestles were fastened as soon as they were in position by means of taking ""sets"" and driving the iron bolts above referred to down into the bottom." The conditions were dangerous. Some men standing in four feet of water were swept away only to be rescued down stream. Finally, however, planks were placed horizontally on the trestles to form the dam, and the design worked as imagined. The remaining boats in the fleet were pulled through the funnel on May 12<sup>th</sup>, and the entire armada was safely below Alexandria.<sup>15</sup>

Colonel Bailey deserved credit for originally suggesting the idea of the wing dams to Franklin and Banks, and for the design of the lower dam. He was also responsible for the entire operation. In addition, on May 18<sup>th</sup> as the Union army approached Simsport near the Mississippi River, Taylor's Confederates threatened to catch Banks's troops with their back to the river.<sup>16</sup> To his sole credit, Bailey came to a unique solution. Mooring twenty-two steamboats side by side, and then nailing planks over the bow of each, Bailey built a floating bridge. During the next two days, the army, and its wagon train crossed unimpeded. There was an encomium of praise for Bailey. Wickman Hoffman, an adjutant with General Franklin wrote, "We crossed the Atchafalaya by a novel bridge constructed of steamboats. This, too, was Bailey's work."<sup>17</sup> John Merwin of the 161<sup>st</sup> New York recorded in his diary, "May 19<sup>th</sup>...No bridge, but Colonel Bailey is equal to the occasion once more, and has lashed twenty-two steamers together bows on and

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<sup>15</sup> *O. R.*, ser. 1, vol. XXXIV, part 1, 255.

<sup>16</sup> Simsport rested on the south bank of the Atchafalaya River five miles north of the town of Red River. The town of Red River was on the Mississippi.

<sup>17</sup> Wickman Hoffman, *Camp Court and Siege: A Narrative of Personal Adventure and Observation During Two Wars* (New York: Harper & Brothers, 1877), 103.

using the boat bridges or gang planks has formed a bridge that covers the muddy waters from shore to shore, over which we cross in safety.”<sup>18</sup>

There was no doubt during the Red River campaign that Bailey performed at a high level of efficiency, and he was responsible, on two occasions, for contributing to the army’s salvation. He deserved praise. The historian for the XIX Corps, Richard Irwin, summed up how most white soldiers and sailors felt about Bailey: “At Simmesport [sic] the skill and readiness of Bailey were once more put to good use in improvising a bridge of steamboats across the Atchafalaya.”<sup>19</sup> It was not surprising then, that a recommendation from a former politician like Banks combined with support from the Department of the Navy earned Bailey a “Thanks of Congress.” It was also not surprising given the treatment of black soldiers by their white comrades, and the disparity in the military between white officers and white officers commanding black soldiers, that with the exception of Bailey’s brief comments, Robinson and Pearsall’s efforts went unrecognized.

Many white officers would have been scornful and cynical of the white men leading black troops, but it did not stop Pearsall and Robinson from expressing their opinions. Pearsall thought it was incredible that naval authorities reported that Bailey was the only person who believed the dam project practicable. Pearsall wrote that he had suggested the idea of wing dams days before Bailey when the army was in Grand Ecore. He continued, “I beg leave to state that the project of building a dam across Red River, although difficult, could never have been pronounced impracticable by any man who followed a similar avocation [lumbering] in civil life.”<sup>20</sup>

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<sup>18</sup> John W. Merwin, *Roster and Monograph, 161<sup>st</sup> Reg’t, New York State Volunteer Infantry* (Elmira, NY: Gazette Print, 1902), 130.

<sup>19</sup> Richard B. Irwin, *History of the Nineteenth Army Corps* (New York: G. P. Putman’s Sons, 1893), 346-347.

<sup>20</sup> *O. R.*, ser. 1, vol. XXXIV, part 1, 256.

Colonel Robinson was more direct: "If the thanks of Congress are due to any one for the final success of this dam I believe they are due to him [Pearsall] as much as to any one else." He also did not equivocate when he spoke of his men. "In conclusion, I would say that the organization of colored engineers is regarded as a complete success by all who have witnessed their operations."<sup>21</sup>

In the Union army as blacks and whites attempted to work out a cooperative relationship in their fight for the common cause of victory, the Confederate army and government made it perfectly clear that there would be no such co-dependent relationship in their armed forces. In the spring of 1864 when Colonel Thomas M. R. Talcott, commander of the newly formed 1<sup>st</sup> Confederate Engineers, proposed that free blacks be impressed to form pioneer companies, Secretary of War James A. Seddon reminded Talcott that free blacks and slaves worked on projects as impressed laborers not as soldiers.

There were a number of slaves and free blacks who had developed technical skills before the war. Slaves, on large plantations, had learned blacksmith and carpentry skills, and many could operate and repair machinery. Free blacks also worked as carpenters, ironworkers, and toolmakers, and could have been important additions to repair the dearth of engineer troops. In the months before Grant's Overland Campaign and Sherman's Atlanta Campaign, the Confederate military attempted to strengthen its engineering organization. There was isolated success, yet for the most part little was accomplished. The Confederate army had skilled engineers, and they did well with what they had on hand. Some of the men in the ranks also made good engineer soldiers and pioneers. They were, however, not enough.

As the war progressed and the value of engineers became apparent, the South simply did not have the skilled manpower to meet the army's needs. Brigadier General E. P. Alexander,

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<sup>21</sup> *O. R.*, ser. 1, XXXIV, part 1, 253.

for example, was jealous of the size and quality of the Army of the Potomac's engineer units. He believed they were worth the equivalent of a corps to Grant and Meade.<sup>22</sup>

By the spring of 1864 the Army of Northern Virginia did have a functioning engineer regiment, although it was a meager asset. The 1<sup>st</sup> Confederate Engineers commander was Colonel Talcott, a railroad engineer before the war. The second in command was Lieutenant Colonel William W. Blackford. Blackford had studied engineering at the University of Virginia, served briefly as a civil engineer, and then joined the army as a cavalry lieutenant. Both men were good engineers, but recruiting and training additional officers was a significant problem. Whatever was learned was from the few military engineers in the regiment or from books such as *A Treatise on Field Fortifications* by Dennis Hart Mahan, and the *Manual for Engineer Troops* by Captain J. C. Duane.<sup>23</sup>

Some of the men recruited were among the veteran infantry, but because division and brigade commanders were reluctant to give up their experienced soldiers, some of the engineer troops were conscripts. The training the men underwent was not rigorous. In the Civil War diary of Lieutenant Henry Herbert Harris, he recorded how the engineers guarded Yankee prisoners and worked on repairing corduroy roads. It was not until April 19<sup>th</sup> that companies began pontoon drill on a millpond. Two days later he wrote: "Took the company out near the pond where two other companies were pontooning and looked on for a while." The next day he "...went out to see the pontooners exercise...Hunted two ducks without killing either and fished a while without getting...a nibble. In the afternoon I busied myself on the company clothing

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<sup>22</sup> Hess, 12. See also Gary Gallagher, ed., *Fighting for the Confederacy: The Personal Recollections of General Edward Porter Alexander* (Chapel Hill: University of North Carolina Press, 1989), 370.

<sup>23</sup> Harry L. Jackson, *First Regiment Engineer Troops P. A. C. S.: Robert E. Lee's Combat Engineers* (Louisa, VA: R. A. E. Design and Publishing, 1998), 24.

account, which occupied me until nearly ten o'clock...."<sup>24</sup> There was no school for pontooniers in the Confederate army. In comparison, the Army of the Potomac did have a school near Belle Plain, Virginia in 1862. General Benham, who established the school, reported on January 25, 1864 that it made a vast difference in the engineer troops of the Union army. Practice was constant. For example, on March 6, 1864 the Volunteer Engineer brigade received the following general order: "The Ponton [sic] drills of this command will be resumed at once. These [sic] will be a drill by successive Pontons on Monday, Wednesday & Friday mornings.... On Tuesday & Thursday...there will be pontoon drill by battalion under the direction of a Field Officer of each regiment when practicable...."<sup>25</sup> Virtually every company in a regiment could maintain a bridge and install one.<sup>26</sup> Only five companies from the eleven company 1<sup>st</sup> Confederate could build a bridge.<sup>27</sup>

Also in April, Colonel Talcott ordered all company commanders to classify "...as artificers those that they know to be such."<sup>28</sup> This was done to identify those men in the regiment who demonstrated ability as skilled craftsmen and artisans. According to the regimental roster one soldier in ten was promoted to artificers. This did not compare favorably with the 15<sup>th</sup> New York Engineers where one in four was similarly ranked.<sup>29</sup>

The Engineer Bureau attempted to recruit the 2<sup>nd</sup> Confederate Engineers but only two companies were raised—G and H. As it turned out the Second, as a separate command did not

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<sup>24</sup> W. Harrison Daniel, ed., "H. H. Harris' Civil War Diary," in *The Virginia Baptist Register* 35 (1996): 1885.

<sup>25</sup> Philip Katcher, *Building the Victory: The Order Book of the Volunteer Engineer Brigade Army of the Potomac* (Shippensburg, PA: White Mane Books, 1998), 40.

<sup>26</sup> Jackson, fn 7, 159.

<sup>27</sup> Companies B, C, F, H, and I were capable of "throwing a bridge." See Daniel, ed., 1885.

<sup>28</sup> Jackson, 27.

<sup>29</sup> For the roster of men in the 1<sup>st</sup> Confederate Engineers and their ranks, see Jackson, 167-185. For the 15<sup>th</sup> New York's roster see *Roster of the 50<sup>th</sup> and 15<sup>th</sup> Regiment New York State Volunteer Engineers, Army of the Potomac* (New York: Union and Advertise Press, 1894).



exist. It had no commanding officer and G and H companies were placed under the command of the First engineers. An additional eight undersized companies were formed and spread throughout the southeast reporting to local commanders.<sup>30</sup> Finally, the 3<sup>rd</sup> Confederate Engineers was raised and served with the Army of Tennessee for the remainder of the war. After the 4<sup>th</sup> Confederate Engineers were organized in late 1864 they were scattered over the expansive Trans-Mississippi Department until General Kirby Smith surrendered to Union forces on June 2, 1865 in Galveston, Texas, the last major Confederate army to do so.<sup>31</sup>

In the spring of 1864 before Grant's Overland Campaigns began, Lee appointed Major General Martin Luther Smith as chief engineer, Army of Northern Virginia. An 1856 graduate of West Point, Smith served as a topographical engineer before resigning his commission to join the Confederate army. In 1863 he had supervised the Vicksburg defenses, and now on Lee's staff would be instrumental in laying out the fortifications around Petersburg and Richmond. In Richmond, Captain Alfred L. Rives was appointed acting head of the Engineer Bureau in Jeremy Gilmer's absence. Rives was a skilled engineer, and he served as department head for the rest of the war. Despite the shortage of equipment and money, and a lack of centralized control, Rives managed well with what he had. During the Petersburg Campaign, in cooperation with the Railroad Bureau, he assigned engineers to repair forty miles of track destroyed by Union cavalry, along the Richmond & Danville Railroad. This was a crucial line connecting Lee's army with essential supplies from North Carolina and South Carolina. In addition, at Burkesville the line connected with the Southside Railroad, the latter running east to Petersburg.

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<sup>30</sup> Jackson, fn 31, 164.

<sup>31</sup> Jackson, 3-5, 10-13, 15-17, 30; Nichols, 93-95; C. B. Denson, "The Corps of Engineers and Engineer Troops," in *Histories of the Several Regiments and Battalions from North Carolina in the Great War, 1861-65*, ed. Walter Clark (Goldsboro, NC: Nash Brothers, 1901), 412-413, 426; T. M. R. Talcott, "Reminiscences of the Confederate Engineer Service," in *The Photographic History of the Civil War*, ed. Francis Trevelyan Miller (New York: Review of Reviews, 1911), 258.

In perhaps the apex of Confederate railroad engineering, men took up rails from the York River Railroad and forwarded them to the construction sites, while others, according to Corporal Charles Venable “began cutting hewing and delivering the cross ties as rapidly as possible. The road bed was gone over and prepared so that track laying would be practicable, and by judicious distribution of our forces we soon had the repairs well in hand.”<sup>32</sup> Colonel Rives wrote to his wife July 24<sup>th</sup> and told her that a large crew was working hard and that “We hope to have the trains running again & the road better than ever in a fortnight.”<sup>33</sup> Unfortunately, the success enjoyed by the engineers in July would not be repeated, and for the rest of the war Confederate railroad operations steadily declined.<sup>34</sup>

Local carriers refused to lend their skilled workers to the army. State railroad companies had the manpower and not the iron, and the Confederate Railroad Bureau had some iron, but not the workers. Disintegrating tracks, cars, and engines and increasing demands by the government to use the railroads did not elicit assistance from private companies. Furthermore, since the government had no central control of the lines and equipment some private companies increased their fares and decreased their service. Sly business deals made some railroad companies a fortune, while Confederate armies operated with tenuous supply lines. Historian Robert C. Black, III wrote “many bondholders of the Alabama & Florida Railroad...after 1863...deliberately withheld coupons due and payable in Confederate money. Not until 1865 did they present them, for payment *in the currency of the United States*.”<sup>35</sup>

Although the Confederate railroad network collapsed the fortifications Confederate engineers designed and built during Grant’s Overland Campaign and around Richmond and

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<sup>32</sup> *O. R.*, ser. 1, vol. XL, part 2, 699.

<sup>33</sup> *A. L. Rives Paper*, Virginia Historical Society, Richmond, Virginia, file no. MSS1 R5247, 13-81.

<sup>34</sup> Black, III, 215.

<sup>35</sup> Black, III, 220.

Petersburg were effective in extracting a high price from the Yankees in human life and in frustrating Grant's efforts to draw Lee's army out into the open.<sup>36</sup>

From his headquarters in Culpeper County, Virginia, in early 1864 General Grant had started to prepare for his spring offensive against the Army of Northern Virginia, which he hoped would end the war.<sup>37</sup> His plan was to move South outflanking Lee's army. The Corps of Engineers also began preparations for the campaign under new leadership. Brigadier General Totten, stricken with pneumonia in the early spring, died at the age of seventy-six on April 22, 1864. His replacement was the sixty-six year old Richard Delafield, who prior to his appointment, supervised harbor fortifications for the City of New York. Delafield was a part of the first class in West Point history (1818) to be assigned class ranks. He graduated first in his class and then went on to a distinguished career in the engineers including an assignment given by then Secretary of War Jefferson Davis, to observe the operations of European armies in the Crimean War.<sup>38</sup>

Delafield proved to be a competent chief engineer, but like several of his colleagues, he was too old for fieldwork. Fortunately, of the eighty-six officers in the regular corps of engineers,

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<sup>36</sup> The Overland Campaign was made up of the following engagements: The Wilderness (May 4-7), Spotsylvania (May 8-21), New Market (May 15), Drewry's Bluff (May 16), North Anna River (May 23-26), and Cold Harbor (June 3).

<sup>37</sup> The Army of the Potomac remained under the command of George Meade, but Grant attached his headquarters to the field army, and ostensibly dictated strategic and tactical policy. Meade understood his relationship with commander-in-chief, and for this reason, although Meade occasionally complained to his wife, tension between the two men was limited.

<sup>38</sup> The other two observers sent to the Crimean were George McClellan and Alfred Mordecai. Mordecai, born and raised in North Carolina, resigned his commission in the army at the commencement of the war. His family and friends desperately wanted him to join the Confederate army, yet his son had joined the Union. Rather than suffer bewilderment and guilt from making such a painful decision, he chose not to fight.

Grant had twenty-four officers at his disposal whereas Sherman only had nine.<sup>39</sup> Two of the oldest engineer officers with Grant were forty-year-olds James C. Duane, chief engineer, and Nathaniel Michler, chief of mapping, both with the Army of the Potomac. Others like Cyrus B. Comstock and John Parke, were in their thirties, and several such as Francis U. Farquhar, George L. Gillespie, and Peter Smith Michie were recent graduates of West Point.<sup>40</sup>

Thirty-three year-old James St. Clair Morton, who commanded General Rosecrans's Pioneer Brigade the previous year, was appointed chief engineer of Major General Ambrose Burnside's IX Corps, which until May 24<sup>th</sup> was formally part of the Army of the Ohio, and thus reported to Grant rather than Meade. In a similar fashion, Grant created the Army of the James, which also reported to him and operated with the Army of the Potomac, under the command of Benjamin F. Butler. Farquhar and Michie, served with this army, but all the engineers in Grant's combined forces operating against the Army of Northern Virginia and Richmond reported to Major General John Barnard, who Grant appointed to his headquarters' staff and named Chief Engineer of the Armies in the field.<sup>41</sup>

The United States Engineer Battalion was now under the command of Captain George H. Mendell, and Brigadier General Henry W. Benham directed the Volunteer Engineer Brigade, made up of the 50th New York Engineers, eight companies of the 1st New York Engineers, and the 15<sup>th</sup> New York Engineers.<sup>42</sup> In the spring of 1864, the Fifteenth Engineers were detached to

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<sup>39</sup> Hagerman, 237. *O. R.*, ser. 1, vol. XXXVIII, part 1, 127-139. See also Earl J. Hess, *Trench Warfare under Grant & Lee: Fortifications in the Overland Campaign* (Chapel Hill: The University of North Carolina Press, 2007), 1.

<sup>40</sup> Farquhar graduated in 1861, Gillespie in 1862, and Michie in 1863.

<sup>41</sup> Boatner, *The Civil War Dictionary*, 45.

<sup>42</sup> Mendell graduated from West Point in 1852, and Benham graduated from the academy in 1837. Four reasons for Benham's assignment to the Volunteer Brigade and not to the U. S. Engineer Battalion were possible. First, he was a skilled engineer and bridge builder, and he would see that things were done right. Second, Benham had been court-martialed in 1862 for disobeying orders. Eventually, the charges were dropped, but Grant did not tolerate

the Engineer depot in Washington, DC to repair and build pontoons. Benham, because of his demonstrated bridge building skills, was detached from the army in the field to supervise construction work at the depot. Consequently, because of his new assignment, Ira Spaulding commander the Fiftieth, and Edward W. Serrell, commander of the First, reported directly to Duane rather than Benham.

Duane divided the 50<sup>th</sup> New York into three units of three companies each, and he designated two companies, under the command of Ira Spaulding as a reserve. Each unit carried fourteen pontoons, except the reserve unit, which carried twenty-four, and each were assigned to a corps. Only on rare occasions, and only for several days, was Mendell's regular engineer battalion attached to a corps.<sup>43</sup>

As the engineers continued to gather equipment and train for the up coming offensive, Grant collected several thousand wagons to carry vast quantities of supplies necessary to press the attack against Lee. The depots in Washington and Alexandria shipped supplies by train along the Orange & Alexandria Railroad to Culpeper. Then Grant's plan was to cross the Rapidan River and establish bases on the river, which would allow him to operate on Lee's right flank.

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troublemakers or those who had demonstrated the potential for trouble. The third possible reason was the awkward command structure. Duane, a major, was chief engineer of the Army of the Potomac, and Benham, a major of engineers (brigadier general of volunteer infantry), commanded the Volunteer Engineer Brigade. Benham was eleven years older than Duane, and he was promoted major of engineers two years ahead of his chief. Furthermore, Mendell, a captain, commanded the more prestigious regular army engineer battalion, whereas Benham, a major, commanded volunteers. By sending Benham to Washington, Grant temporarily solved his chain of command problem. Finally, and perhaps the real reason for the assignment combined Benham's skills, the army's chain of command, and the undersized 15<sup>th</sup> New York regiment. In late summer of 1863 many soldiers' three-ear enlistments ended, and as a result, the fifteenth lost seven companies or about 700 men. Now in the spring of 1864, the 15<sup>th</sup> New York under the command of Colonel Clinton G. Colgate, had added two additional companies, D and E, to reach battalion strength. Companies D and E were originally recruited in November 1863 to form the 2<sup>nd</sup> New York Volunteer Engineers. This new regiment never mustered more than two companies so they were transferred into the 15<sup>th</sup>.

<sup>43</sup> Hess, 10.

With water borne supplies Grant would not have to worry that Rebels would cut the O & A. Unlike Sherman, whose lifeline was the railroad, Grant anticipated that his wagon trains would be more than adequate for his movements.<sup>44</sup>

Grant was tenacious at attacking Lee during the Overland Campaign, but at every turn, especially at Spotsylvania and Cold Harbor, the Army of Northern Virginia had anticipated the Federal's movements and the results were Union frontal assaults with ghastly consequences, earning Grant the sobriquet "the Butcher." Grant's lost 55,000 men killed, wounded, or missing, and it was too much. He needed to move on Lee's flank before the southern general had time to prepare strong defensive positions. "Without greater sacrifice of human life than I am willing to make all cannot be accomplished that I had designed outside the City [Richmond]," Grant wrote.<sup>45</sup> Yet, how would Grant quietly disengage his 110,000 men from Lee's forces and transfer his army south to seize Petersburg and then turn north to operate against Lee's remaining rail line into Richmond?

The plan Grant decided upon was both bold and complex because it required crossing his army over the James River and doing so undetected. First, Grant's army would extricate itself from the Army of Northern Virginia by a wheeling maneuver in which units on the right flank would pull out successively and march across the rear of adjacent units to the roads by which they were to move toward their respective bridges assigned for their crossing. The length of the army trains, which included 2,800 cattle, was sixty-two miles long. That meant that a bystander watching the trains pass would see the tail pass thirty-one hours after the head.<sup>46</sup> Second, to move the entire army across the James River, the engineers would first have to

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<sup>44</sup> Turner, 337-338.

<sup>45</sup> Hess, *Trench Warfare under Grant & Lee*, 202.

<sup>46</sup> James A. Huston, "Grant's Crossing of the James with the Longest Ponton Bridge Ever Built," *The Military Engineer* 45 (January-February 1953): 18; Warren T. Hannum, "The Crossing of the James River in 1864," *The Military Engineer* 15 (May-June 1923): 237.

bridge the Chickahominy River. That job would fall to the 50<sup>th</sup> New York Engineers and Lieutenant Colonel Ira Spaulding.

There were sixty wooden pontoons and sixteen canvas pontoons travelling with the Army of the Potomac.<sup>47</sup> Lieutenant Colonel Ira Spaulding of the 50<sup>th</sup> New York Engineers was placed in charge of the Chickahominy crossing, and on June 12<sup>th</sup> he selected three sites: Long Bridge, fifteen miles southeast of Cold Harbor, Jones's Bridge, five miles east of Long Bridge, and Windsor Shades, four miles east of Jones' Bridge.

Major George W. Ford commanded the engineers responsible for the bridge at Long Bridge. Accompanied by the V Corps, Ford quickly discovered that the bridge had burned and little was left of it. He would need to clear the debris off the remnants of the old bridge and cut down the abutments. Broad swamps bordered the approaches, and it was necessary to place the new bridge near a narrow passage formed by the roadway to the old bridge. Ford, with a cavalry escort, then crossed the river only to realize that the land mass he saw standing on the river bank was actually an island between the main channel 100 feet wide and the south branch of the river 60 feet wide. To make matters more troubling, Confederate pickets opened fire at the engineers and cavalymen from the south bank, killing one engineer. The Confederate soldiers were soon driven off and in three hours the two pontoons were completed, the V Corps crossed, and by 5:30pm on the 13<sup>th</sup>, the engineers had dismantled the bridge and started moving toward the James.<sup>48</sup>

At the same time Major Ford's engineers were working at Long Bridge, Major Edmund O. Beers moved his pontoon trains to Jones' Bridge. Here, as at Long Bridge, there were two branches of the river to be bridged, the island between being about 800 feet wide. Lieutenant

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<sup>47</sup> Sixty wooden pontoons and sixteen canvas pontoons represented about 1,400 feet of bridge.

<sup>48</sup> Huston, 19.

Mahlon B. Folwell's company built a canvas pontoon bridge over each branch, and Captain Asa C. Palmer bridged both branches with wooden pontoons. The bridges over the north branch were sixty feet in length, and those over the south branch forty feet. The following day Beers and his men constructed a permanent bridge over both branches and by 10:00am on June 14<sup>th</sup> the VI and IX Corps crossed.<sup>49</sup>

The final bridge built over the Chickahominy was a testament to northern engineering and innovation. Captain Walter V. Personius and his Company G were headed for Windsor Shades when Colonel Spaulding found the marshes and swamps in the area too extensive to construct the proper approaches. The next closest potential place to cross was at Cole's Ferry, ten miles southeast of Windsor Shades. Topographical engineers had scouted the area ahead of the bridge builders and discovered an old farm road led to the disused Cole's Ferry. The final alternative to cross the Chickahominy was at Barrett's Ferry, twenty-five miles south of Cole's Ferry and a mile and a half from the James River well south of the site picked to cross the James.<sup>50</sup>

The lower Chickahominy flowed through flat bottomlands and in mid-June considerable rain had raised the water level, which widened the river at Cole's Ferry to 1,200 feet. This presented a considerable problem for Captain Personius because he did not have enough pontoons for a bridge that long. Early on June 14<sup>th</sup>, a messenger was sent to find Major Duane

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<sup>49</sup> *O. R.*, ser. 1, vol. XL, part 1, 297.

<sup>50</sup> *Atlas to Accompany the Official Records of the Union and Confederate Armies* (1891-1895; repr., New York: Barnes & Noble Publishing, Inc., 2003), plates 16, 17, and 92. Lieutenant Peter Michie suggest three possible sites for the James River crossing: A) At Fort Powhatan where the width of the river was 1,250 feet and the eastern approaches over a marsh 1,000 yards wide. B) One-quarter mile north of Fort Powhatan where the marshes were only 800 yards wide, but the river 1,570 feet wide. C) Three-quarters of a mile north of Fort Powhatan, where the approaches required clearing trees, and the river was 1,992 feet wide. General Weitzel, chief engineer of the Army of the James selected Location C and Grant approved the choice on the same day, June 13<sup>th</sup>. See Hannum, 234.



and report on the precarious situation faced by Captain Personius. When Duane received the news he ordered Colonel Spaulding to collect sufficient material, ride to Cole's Ferry, and get the work done.<sup>51</sup>

Meanwhile, Personius, following the army maxim, "he succeeds who hustles while he waits," began to build a wharf of boats on each side of the river and a large pontoon raft, which ferried squads of cavalry and wagons to the south bank of the river. Other men built rafts, of four boats each, with material on each for making connections when the additional pontoons arrived.<sup>52</sup>

Major Beers arrived from Jones' Bridge at 1:00pm and immediately began unloading his equipment to aid in constructing the bridge of rafts begun by Personius. In addition, Captain Peirce, assistant chief quartermaster, and men from the U. S. C. T. started to build a timber approach of about 250 feet in length on the north shore. By 5:00pm, after a twelve mile march from Charles City Court House, Major Ford arrived on the south bank of the river, bringing together all the "land pontoons" the army had in its possession with the exception of eight canvas pontoons, which Lieutenant Folwell had with General Phil Sheridan's cavalry, and those were on their way to Cole's Ferry, as well. This was tuning into a remarkable operation, which required ingenuity, teamwork, cooperation, and deft management.<sup>53</sup>

Two of Ford's captains, James H. McDonald (Company K) and Asa C. Palmer (Company D), started working on different sections of the bridge. McDonald constructed the south abutment and his men tacked on their pontoons to those already placed by Personius's men.

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<sup>51</sup> *O. R.*, ser. 1, vol. XL, part 1, 298.

<sup>52</sup> *O. R.*, ser. 1, vol. XL, part 1, 298.

<sup>53</sup> At the same time Colonel Spaulding and company were building the bridge at Cole's Ferry, the regular engineer battalion and the 15<sup>th</sup> New York Engineers were building a 2,200 foot long bridge over the James River using pontoons floated down the river from Fort Monroe. This was why Spaulding referred to the boats at Cole's Ferry as land pontoons.

Palmer set to work, with another detail of U. S. Colored Troops, on a 200 foot raised corduroy approach road over wetlands. With the arrival of Captain Von Brocklin's eight canvas boats attached to McDonald's pontoons, and at nightfall, Lieutenant Folwell's eight canvas pontoons added to the rafts from the north end, all the material was used and the bridge was still short in the middle by thirty feet. Personius and Folwell had attempted to lengthen the spans with additional balk, but this still left the bridge short in the center of the river.<sup>54</sup>

It was a wild situation. Darkness fell. Men slept standing. Mosquitoes bit. Soldiers cursed. Some urinated in the river. All drank its water. Major Ford, taken sick at Long Bridge, was too ill to walk. Fourteen miles south lead elements of Grant's army were about to cross the James River. Yet, waiting impatiently to first cross the Chickahominy before moving to the James was the Army of the Potomac's sixty-two mile long wagon train, 2,800 head of cattle, and an army division of about 5,000 men. Nerves were on edge.<sup>55</sup>

The engineer officers all agreed that it would be necessary to detach the bridge from the north shore and connect it to the southern section. Then the men set to work constructing additional cribs and corduroy to make up the thirty-foot difference. They did it by 3:00am on June 15<sup>th</sup> and the bridge was opened to traffic. The total length of the bridge was 1,240 feet, and the length of the timber and corduroy approaches was about 450 feet, and the engineers had completed the bridge in an impressive fourteen hours. By late on the 16<sup>th</sup> the trains, men, and

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<sup>54</sup> O. R., ser. 1, vol. XL, part 1, 298. The balk was a twenty-seven foot long board, which served to hold two pontoons together. The balks had cleats and were locked into the gunwales of the pontoons creating a frame of timber, upon which the chess (flooring) was laid. Under normal circumstances the pontoons floated twenty feet apart, but in the case of the Coles' Ferry operation the space was expanded. This required additional balk to help compensate for a more frail structure. Finally, in Lieutenant Colonel Ira Spaulding's report he mistakenly listed William H. Pettes as the captain of Company D. Colonel Pettes was commanding officer of the 50<sup>th</sup> New York and his officers referred to him as "Mr. God Damn You Sir." See Wesley Brainerd, *Bridge Building in Wartime: Colonel Wesley Brainerd's Memoir of the 50<sup>th</sup> New York Volunteer Engineers*, ed. Ed Malles (Knoxville: The University of Tennessee Press, 1997), 25.

<sup>55</sup> O. R., ser. 1, vol. XL, part 1, 298-299.

cattle had crossed without delay or incident, the bridge was then dismantled and towed to the James River where the pontoons met up with the wagons, which had gone overland.<sup>56</sup>

Three days before army wagons started across the bridge at Cole's Ferry, General Godfrey Weitzel, chief engineer, Army of the James, directed his assistant, Lieutenant Peter S. Michie to reconnoiter specific sites for the crossing of the James River. The site chosen was at Douthart's house, midway between Wilcox's Landing and Wyanoke Landing, on a neck of the river, which ran north to south. The bridge would hit the opposite shore between Windmill Point and Fort Powhatan. The site was well beyond the observation of Confederate cavalry out trying to discover the location of Grant's army, and constructing the approaches would not require the same man hours necessary as would be required over extensive marshlands at the two other possible sites. The difficulty would come in the actual bridge building. The width of the river was close to 2,000 feet, the currents were strong here where the tides rose and fell about four feet, and because the army wanted to keep the area open to river traffic, a draw would need to be built into the center of the bridge where the water in the main channel, reached depths of eighty to ninety feet.<sup>57</sup>

On June 13<sup>th</sup>, without official approval from Grant's headquarters, Weitzel sent Michie back to the site to begin work on the approaches and by nightfall a detail of soldiers had cut and trimmed 1,200 feet of timber in logs averaging six inches in diameter and twenty feet in length. On the southwestern shore above Fort Powhatan, the engineers cut 3,000 feet of timber, formed rafts, and floated them to the bridge site. Cypress logs, almost three and a half feet in diameter, were used in building approaches in the shallow part of the river. By mid-morning on June 14<sup>th</sup> the approaches on both sides of the river were completed—on the southwestern side

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<sup>56</sup> Huston, 21.

<sup>57</sup> Huston, 21.

a ramp was built, ruts and gullies filled over, and a roadway constructed to connect with Petersburg and City Point Road. On the northeastern side of the river, trees were cleared and a 150-foot pier over a small marsh was finished. At the same time Grant had approved the location of the bridge, and he directed General Benham at the engineer depot at Fort Monroe, to send Grant all the available pontoons as quickly as possible to the bridge site. Finally, the regular battalion of engineers was ordered to the site on the 14<sup>th</sup> to construct the bridge, under the direction of Major Duane.<sup>58</sup>

The following morning, June 14<sup>th</sup>, Weitzel paced the riverfront waiting anxiously for the pontoons Benham promised, to arrive. Finally, after his patience was worn thin by the delay and the recognition that Grant's lead elements were due to appear anytime, Weitzel sent a dispatch boat down the river to look for the steamer towing the pontoons. At noon, after being en route for twenty-two hours, travelling three miles per hour, they arrived, approximately 155 pontoons enough for 3,100 feet of bridge.<sup>59</sup> Now there was excitement and chaos at the bridge site. Pontoons were taken off their towlines and bobbed freely in the river. Men from Captain George Mendall's United States Engineer Battalion jumped into the four foot high water trying to push some of the boats on shore, while other men, slipping on underwater rocks and getting their feet encased in ooze and mud, started building an abutment that reached out into deeper water.

Once Duane established control over the chaos of the unmoored pontoons he ordered Mendall's men to steer fifty boats to the south bank of the river, while members of the 15<sup>th</sup> New

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<sup>58</sup> Thienel, *Mr. Lincoln's Bridge Builders*, 172-173.

<sup>59</sup> On June 12<sup>th</sup> Benham reported that although he had 155 pontoons available for use, he only had enough flooring (chesses) for about 1,540 feet of bridge. He ordered troops from the 15<sup>th</sup> New York back at the Engineer depot in Washington, to cut more chess. This was done, and the material arrived with the rest of the equipment on the June 14<sup>th</sup>. *O. R.*, ser. 1, vol. XXXVI, part 3, 772; *O. R.*, ser. 1, vol. XL, part 1, 210-211.

York who had arrived with the pontoons from Fort Monroe, and the 50<sup>th</sup> New York, except Major Wesley Brainerd's battalion, were assigned building the pontoon bridge from the north side. Brainerd was instructed to report to II Corps headquarters to support General Hancock's separate movement across the James. Grant anticipated that at least seventy-two hours would be required to get his entire army across the James River, and by then Lee might learn of Grant's grand flanking movement and beat him to Petersburg. It was decided, therefore, that Hancock's II Corps would not wait for the pontoon bridge to be completed, but instead, would have his men ferried across the river. The operation began on the 14<sup>th</sup>, yet by late afternoon that day, the landing was progressing at a painstakingly slow pace. A wharf would help matters, and an old one, nearly destroyed by fire, was found.<sup>60</sup>

Sometime after 7:00pm, Brainerd was summoned to the headquarters of Third Division commander Major General David B. Birneys, and the general informed the engineer that he could have all the men he needed to rebuild the wharf to speed up the ferry crossings. Orders went out and soon men began tearing down neighboring barns for timber and then hauled the planks to the riverbank. Brainerd and his engineers worked on the pilings. The old ones that had not rotted out needed additional support, and the new ones were difficult to sink two feet beneath the riverbed. By three o'clock in the morning on the 15<sup>th</sup> some progress was made, but Brainerd believed it would be at least another nine hours before the wharf was finished.<sup>61</sup>

Progress on the pontoon bridge, however, developed with alacrity. After the 50<sup>th</sup> New York Engineers worked ten hours on the structure, by eleven o'clock in the evening the remarkable bridge was finished. Because the current flowed in both directions at different times during the day, the pontoons had to be anchored both upstream and downstream. To provide

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<sup>60</sup> *Bridge Building in Wartime: Colonel Wesley Brainerd's Memoir of the 50<sup>th</sup> New York Volunteer Engineers*, ed. Ed Malles (Knoxville: The University of Tennessee Press, 1997), 243-244.

<sup>61</sup> *Colonel Wesley Brainerd's Memoir*, 244.

anchorages in the main channel, the pontoons were fastened by guy wires running from each boat to one of three schooners anchored above the bridge, and to one of three schooners anchored below the bridge. To permit passage of vessels up and downstream, a draw section made up of rafts 100 feet in length was built into the 2,200 foot long bridge, and at 1:00am June 15<sup>th</sup> Benham received word from Meade to open the bridge to traffic.<sup>62</sup>

Twenty minutes later, Meade countermanded the order. His stated reason was to wait for the big supply train lumbering up from Cole's Ferry "to get nearer to us." Meade did allow Benham to send over the bridge trains and surplus artillery of three corps perhaps thinking he was carrying out Grant's earlier order to Meade stating that one corps was to remain on the east side of the river "until the artillery and wagons were well over."<sup>63</sup>

Meantime, someone at the James River Bridge thought of Brainerd. At 3:00am a transport towed a half dozen extra pontoons to the wharf. Brainerd thought it was "Providential Interference." Within three hours, using the boats in place of the pilings, the wharf was completed. Brainerd wrote: "Soon after, General Hancock came over in a transport and seemed much pleased with the undertaking. Then the troops began to pour over by Regiments, Brigades and Divisions. The transports came up to the wharf and soon the Troops were off while the boats went back for another load."<sup>64</sup>

Back at the bridge at six o'clock in the morning of the 15<sup>th</sup> the men of the Army of the Potomac began to cross—the V, VI, and IX Corps, the 3<sup>rd</sup> Cavalry Division, the Army Headquarters, and finally the sixty-two mile long wagon train. The combat units crossed in fifteen hours.<sup>65</sup> Astonishingly, the only snafu came three hours after the bridge was open to

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<sup>62</sup> Thienel, 174.

<sup>63</sup> Thienel, 177.

<sup>64</sup> *Colonel Wesley Brainerd's Memoir*, 245.

<sup>65</sup> Horace Porter, *Campaigning with Grant* (New York: The Century Company, 1897), 137.

infantry traffic. An upstream schooner slipped her anchor, drifted into the bridge and carried away a part of it. The damaged section was restored in several hours, and the march of Grant's army continued.<sup>66</sup>

Eyewitnesses to the movement of the army across the James River were mesmerized by the sight. Private John H. Westervelt, 1<sup>st</sup> New York Volunteer Engineers observed: "This is the first time I have seen anything like an army cross a pontoon bridge and I can assure you it is well worth seeing. From sunrise till 12M it was one steady stream tramp, tramp an a roar like a R road train all the time."<sup>67</sup> A correspondent of *Harper's Weekly* reported: "As we approach the pontoon bridge we see distinctly huge bodies of infantry, cavalry, horses, artillery, and wagons moving across the bridge. They extended across the entire length of the bridge, and can be seen wending along from far away up the east bank of the James, enveloped in a dense cloud of dust, while on the western bank is a part of the great body which has already effected its crossing."<sup>68</sup>

When the last animals crossed the bridge in the early evening of June 18<sup>th</sup> General Benham "breathed free again." Finally feeling a sense of great accomplishment, he wrote, "...The most successful effort on a large scale with pontoon bridging that has ever occurred in our country, if it does not rival those in any other land."<sup>69</sup> Benham's praise was merited.

The engineers had taken Grant's vision of a never before attempted grand turning movement and made it a reality. Unfortunately, costly mistakes on the eastern outskirts of Petersburg and skilled Confederate generalship by P. G. T. Beauregard prevented the advance elements of Grant's army from capturing Petersburg in June 1864, and instead, began a siege

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<sup>66</sup> *O. R.*, ser. 1, vol. XL, part 1, 301.

<sup>67</sup> *Diary of a Yankee Engineer: The Civil War Story of John H. Westervelt, Engineer, 1<sup>st</sup> New York Volunteer Engineer Corps*, ed. Anita Palladino (New York: Fordham University Press, 1997), 142.

<sup>68</sup> *Harper's Weekly*, vol. 8, no. 392, 392 and 419.

<sup>69</sup> *O. R.*, ser. 3, vol. IV, 796-797.

that would last until April 1865. Before the work of laying out and building fortifications and trenches began, army engineers had built 8,678 feet of bridges. Now beginning in July the Army of the James, which occupied the northern portion of the siege lines deployed troops from Richmond to Petersburg from its position on the Bermuda Hundred peninsula. The army's tactical movements required the engineers to build a number of bridges on the James and Appomattox Rivers, including a 1,320 foot pontoon bridge across the James at Aiken's Landing built by the 1<sup>st</sup> New York Engineers. The engineers even attempted to dig a canal at Dutch Gap similar to the one dug around Island No. 10, but heavy Confederate shelling made it impossible to complete the canal.<sup>70</sup>

In the months after the army crossed the James the siege of Petersburg required the engineers to build signal towers, make abatis, gabions, and fraise, build magazines and bomb-proofs, construct parapets, lunettes, revetments, and platforms for guns, make maps, and draw plans for forts.<sup>71</sup> A significant amount of time was also spent corduroying roads and making covered ways. The latter were sunken roads wide enough to allow the passage of wagons and

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<sup>70</sup> *O. R.*, ser. 1, vol. XXXVI, part 1, 315-316; *Diary of a Yankee Engineer*, 170; Thienel, 182; *O. R.*, ser. 1, vol. XLII, part 1, 661; *O. R.*, ser. 1, vol. XLVI, part 2, 1169; Atlas, plate 67 and plate 76. Although this study does not concern itself with the actual fighting at Petersburg, a synopsis of the campaign should help the reader gain a basic understanding of its complexity. After Grant's failed attempt to capture Petersburg from the east, he attempted to disrupt the Confederates' Weldon Railroad supply line south of the city. He was stopped by A. P. Hill near the Jerusalem Plank Road. Next, the Union army attempted to explode a mine beneath the Confederates at Pegram's Salient, and this too failed. In mid-August, another effort was made to cut the Weldon Railroad, and this time they succeed in addition to extending their siege lines southwest below the city. In late September, the first attempt to cut the last rail line to Petersburg (Southside Railroad) was executed, and although blocked from his objective, after fierce fighting around Peebles' Farm, Grant's army were able to extend their lines farther southwest of the city. Again in late October, Federal forces tried to reach the Southside Railroad and were stopped at Burgess Mill. This ended the major offensives for 1864.

<sup>71</sup> Abatis consisted of felled trees stripped of their leaves, with branches sharpened, laid side by side on the ground sloping away from a ditch in front of a basic field fortification. Fraise were sharp ten to twelve foot long solid tree branches anchored into a ditch serving as an obstacle against attacking soldiers.



artillery to connect two or more fortifications.<sup>72</sup> Yet, of all the work engineer soldiers did during the eleven-month siege, the efforts that became most daring, and very dangerous, was mining. Both sides employed this tactic during the siege yet neither side enjoyed the success hoped for, although the first attempt made by the Federals might have worked had it not been for a mismanaged assault.

Lieutenant Colonel Henry Pleasants of the 48<sup>th</sup> Pennsylvania Infantry believed he and his men, many of them professional miners, could dig a mine beneath the 125 yards of soil separating Union from Confederate soldiers. By doing so he would punch a gaping hole in the Confederate trenches, which would then be exploited by thousands of Union infantry. With this break in the trenches the entire Confederate line would collapse and lead to a crushing Confederate defeat and an end to the war. Approval for the mine had to work its way up the army's chain of command, and as it did, Pleasants started the work. Sergeant Henry Reese of Company F was named foreman of the project, and improvisation and hard work were the essential tools used to tunnel under the unsuspecting but slightly suspicious Confederates.<sup>73</sup>

Army pioneer companies had adequate numbers of picks and shovels for building fortifications, trenches, and roads, yet since the flukes on the picks were too wide for swinging in confined spaces, they were inadequate for mining operations. Consequently, the men filed down the flukes and made them more suitable for digging underground. Next, wheelbarrows were unavailable so hardtack boxes, reinforced with iron bands taken from pork barrels were jury-rigged to haul dirt from the tunnel.<sup>74</sup>

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<sup>72</sup> *O. R.*, ser. 1, vol. XLII, part 1, 163-165.

<sup>73</sup> Earl J. Hess, *Into the Crater: The Mine Attack at Petersburg* (Columbia: The University of South Carolina Press, 2010), 11.

<sup>74</sup> Hess, *Into the Crater*, 11. The fluke was the horizontally flat iron surface of the pick.

Pleasants wanted to be certain he had the correct distance from the mine entrance to the Confederate lines, and to accomplish this he triangulated using a theodolite. Historian Earl J. Hess explained the work: "His crew laid out short lines at five different locations within the Union position and created the other two sides of an imaginary triangle from each end of these lines to Pegram's Salient. The degrees of the angles at the sides were noted and the distance to the salient deduced from this and the length of the third, base line." Confederate guns were 133 yards from the Union front line.<sup>75</sup>

For ventilation, first the miners dug vertically from the gallery to the surface, twenty-two feet tall. Next the men constructed a square wooden pipe and laid it along the base of the tunnel with a small iron furnace added to the bottom of the shaft. Finally, the partition, with a door, was build along the outside edge of the shaft so fresh air entered the wooden pipe and exited deep within the gallery, then the heat from the furnace drew the exhaled carbon dioxide up the shaft. To make sure Confederates observing Union line did not detect unusual activity, several campfires were maintained as decoys to draw attention away from the mineshaft.<sup>76</sup>

By the end of June, Pleasants had the mine ready. His men had dug two wings each about thirty-six feet long and packed these chambers with a total of 8,000 pounds of explosives. The tunnel was 510 feet long, and although Southern soldiers had dug two countermines to determine if rumors about a Yankee mine were true, most Confederates had no idea what was about to happen. At about 4:45am on June 30, 1864 the mine exploded leaving a hole in the ground 200 feet long, 60 feet wide, and 30-feet deep. The blast and killed or wounded more

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<sup>75</sup> Hess, 14; *O. R.*, ser. 1, vol. XL, part 1, 566-567. A theodolite was an optical instrument consisting of a small mounted telescope, which could rotate both in horizontal and vertical planes, and was used to measure angles in surveying.

<sup>76</sup> Hess, 15.

than 300 men. John Haley of the 17<sup>th</sup> Maine wrote, "Earth and heaven were rent by an explosion that would have done credit to several thunderstorms."<sup>77</sup>

What happened next, however, was the result of incompetence. Instead of pouring through the breach as planned, Union soldiers got to the crater carved out by the explosion and just stopped. They were uncertain as to what to do next largely because their commanding officer, General James Ledlie, was sitting in a bombproof shelter drunk, and the soldiers had not been trained. A black regiment had prepared to attack after the explosion, but General Meade replaced them with white soldiers at the last minute. Confusion ensued as Union reinforcements, including the African-American troops originally trained for the assault, rushed to the Crater. By this time Confederate Brigadier General William Mahone managed to regroup his forces, stem the Union assault, and bottle up several thousand northern soldiers inside the crater. By the time the fighting ended the South suffered 1,491 casualties and the North, which lost a golden opportunity to break the Confederate lines, had 3,798 killed, wounded, or missing.<sup>78</sup>

After the mine explosion at Pegram's Salient both sides mined and countermined throughout the remainder of the campaign with no success. Confederate engineers Hugh T. Douglas and W. W. Blackford led efforts to dig mines under Federal lines. For example, on August 5<sup>th</sup> a mine was detonated under Gracie's Salient to no effect because the explosive charge was only 850 pounds of powder and because it exploded short of Union lines. Many Northern commanders could not figure out the purpose of the mine. Douglas wrote that the mine was intended to break up the earth to prevent the Federals from tunneling under their works. Lieutenant Colonel Blackford believed the mine was intended to stop a sap and sap-

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<sup>77</sup> Kevin M. Levin, " 'The Earth Seemed to Tremble,' " *America's Civil War*, May 2006, 24.

<sup>78</sup> Levin, 25.

roller, and General Beauregard reported that it was a successful experiment in innovative mine design and digging.<sup>79</sup>

The most creative devise used to assuage Confederate soldiers' beliefs that the ground was about to erupt was a simple earth auger with which two men could bore a hole about three and a half inches in diameter to a depth of twenty feet. The holes were filled with water, which the clay soil retained, and if the water disappeared everyone would know that the Yankees were beneath them.<sup>80</sup>

As Southern soldiers continued to resist assaults above and below ground from Grant's massive army, they clung to the belief that Southern independence was still possible. The Richmond *Sentinel* reported that "the war has continued for more than three years, the United States being weaker today than when hostilities commenced while the Confederate States are infinitely better prepared than ever before to resist the attacks of the enemy."<sup>81</sup> Perhaps if the war could be prolonged by forestalling Union offensives around Petersburg and Northern Georgia, even with the loss of Mobile Bay to the Union navy on August 5<sup>th</sup>, it might be possible that the Northern public would grow tired of the slaughter and elect someone to the White House in November who would be willing to negotiate a peace with slavery intact. Certainly Lincoln thought this was distinctly possible. On August 23<sup>rd</sup> the President wrote: "This morning, as for some days past, it seems exceedingly probable that this Administration will not be re-elected. Then it will be my duty to so co-operate with the President elect, as to save the Union

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<sup>79</sup> Jackson, 82-83.

<sup>80</sup> Nichols, 108.

<sup>81</sup> Levin, 28.

between the election and the inauguration; as he will have secured his election on such ground that he can not possibly save it afterwards.”<sup>82</sup>

Despite the President’s dour prediction, in the summer of 1864 there was still time to bring about the victory the citizens of the United States needed to persuade them that the war was worth continuing, and that Lincoln was the man to continue to lead them. With Grant bogged down in Virginia, the best hope was for Sherman to take Atlanta, a difficult enterprise. It was a formidable task to move 100,000 soldiers and fight through the mountains of northern Georgia, with a dangerous enemy blocking their way. Furthermore, the army’s supply line was along a single-track railroad from Nashville to the front lines.

For two years of war Union engineering and railroad management had helped accelerate the advance made by northern forces as they cut their way into Tennessee, Mississippi, Alabama, and Louisiana. Looking back, delays at Forts Henry and Donelson, Nashville, Island No. 10, Vicksburg, and the loss of an army at Chattanooga and a flotilla at Red River, all would have had a significant effect on the country’s morale just as Sherman was prepared to launch the Atlanta Campaign.

Instead, skillful and innovative engineering, the development of sound railroad management and policy, along with determined generalship and fine soldiers, brought the Military Division of the Mississippi to the gates of northern Georgia. Beginning on May 7, 1864 when Sherman’s forces broke winter camp and started toward Dalton, Georgia, again the Federal’s formula for success would have to be innovative engineering, skilled generalship, and determined soldiers.

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<sup>82</sup> Memorandum on Probable Failure of Re-election, Washington, DC, August 23, 1864, in *Lincoln: Speeches, Letters, Miscellaneous Writings, Presidential Messages and Proclamations, 1859-1865*, ed. Don E. Fehrenbacher (New York: The Library of America, 1989), 624.

Sherman faced the most difficult logistical challenge because he would need to rely on single-track railroads extended over 300 miles, for his sole source of supplies for his 100,000 men. His goal was to move 130 cars carrying supplies to the front daily. When Colonel McCallum arrived in Nashville to head railroad operations he discovered that the fifty locomotives and 537 cars available were woefully inadequate to meet Sherman's needs. McCallum estimated that the campaign would require 200 locomotives and 3,000 cars along with sophisticated maintenance and construction facilities. The line itself would require constant attention because the track, according to McCallum, "was laid originally on an unballasted mud road-bed in a very imperfect manner, with a light U-rail on wooden stringers, which were badly decayed and caused almost daily accidents by spreading apart and letting the engines and cars drop between them."<sup>83</sup>

McCallum first set about recruiting able assistants: Adna Anderson, superintendent of the transportation and maintenance department, and William W. Wright, chief engineer in charge of the Construction Corps. Then with authority from Secretary of War Stanton and General Sherman, McCallum made the chain of command clear to both men. Anderson and Wright would report directly to McCallum, but in the latter's absence, they would take orders only from Sherman or his corps commanders, McPherson, Schofield, and Thomas.

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<sup>83</sup> *United States Military Railroads: Report of Bvt. Brig. Gen. D. C. McCallum*, 15. The USMRR was actually responsible for a much more extended supply route than the one from Nashville to the front lines in northern Georgia. The focal point of army supplies in the western theater was Louisville. All the war material from the agricultural areas of the mid-west and manufacturing centers of the east came to the city by railroad or the Ohio River. Then the Louisville & Nashville Railroad transported provisions to Nashville, which was the main supply depot for the Military Division of the Mississippi. In Nashville, the engineers had built warehouses that covered entire city blocks and several acres of corrals and stables. From Nashville supplies travelled along the Nashville & Chattanooga Railroad or Cumberland River to Chattanooga, and then on the Western & Atlantic Railroad. By early July 1864, Sherman had his engineers build an advanced depot at Ringgold, Georgia. Along the railroads, detachments stockpiled repair equipment: spikes, bridge timbers, cross ties and rails.

The organizations established under Anderson and Wright were derived from the blueprint Herman Haupt had drawn in the eastern theater in 1862, but they were expanded to address the scope and complexity of railroad operations in five states: Mississippi, Alabama, Kentucky, Tennessee, and Georgia. The management structure for Anderson's transportation department consisted of masters of transportation who moved over certain sections of road to "see that the employees [sic] attended properly to their duties while out with their trains." At stations a dispatcher made sure locomotives were in good order, the superintendent of repairs maintained the roads, and the master machinist managed repairs of locomotives. Each manager was independent of each other and reported directly to the general superintendent.<sup>84</sup>

Wright's Construction Corps was organized into six divisions, and each division was made independent and equipped with tools, camp equipage, and field transportation. The division was under the command of a civilian engineer and was divided into sections, the largest of which was comprised of the track layers and bridge builders. There was a foreman for each fifty men (a gang), and a sub-foreman for each ten men (a squad).<sup>85</sup>

Once Anderson and Wright started to build their respective work forces and requisition tools from the quartermasters, McCallum turned his attention to finding additional locomotives, cars, shops, and machine tools necessary to sustain the planned spring offensive. To add gravitas to this endeavor, the secretary of war, on behalf of President Lincoln, wrote to every locomotive manufacturer in the country requesting/ordering their assistance. Stanton wrote: "In order to meet the wants of the military departments of the Government you will deliver to his [McCullum's] order such engines as he may direct, whether building under orders for other parties, or otherwise the Government being accountable to you for the same." Stanton

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<sup>84</sup> McCallum, 18.

<sup>85</sup> McCallum, 18.

reminded the railroad presidents that the need to supply the army in Tennessee was urgent, and it rendered “the engines indispensable for the equipment of the lines of communication, and it is hoped that this necessity will be recognized by you as a military necessity, paramount to all other considerations.”<sup>86</sup>

The Union government’s approach to the problem of acquiring additional locomotives and the private sector’s response to the government’s request stood in stark contrast to how private companies in the South had responded to the Confederate government’s needs. In places such as Taunton, Massachusetts (Mason Machine Works), Philadelphia, Pennsylvania (Norris Locomotive Works), and Manchester, New Hampshire (Manchester Locomotive Works), fifty-three engines and hundreds of cars were built at a startling rate and then driven to Nashville. General Superintendent Anderson ordered under utilized locomotives and cars operating around Memphis transferred to the Atlanta operation. In April fifteen engines and 120 cars were taken from the Louisville & Nashville Railroad, and in May, two engines and sixty-eight cars were impressed from the Kentucky Central Railroad.<sup>87</sup> By June seventy-seven additional locomotives and 1,051 cars brought the totals to 124 engines and 1,488 cars available for supplying Sherman’s armies. Furthermore, extensive machine and car shops were built at Nashville and Chattanooga, the former large enough to hold 100 locomotives and 1,000 cars at once.

This incredible effort on the part of northern railroad manufacturers and the centralized authority of the railroad bureau was the precursor to the efforts made by Boeing aircraft,

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<sup>86</sup> McCullum, 21.

<sup>87</sup> Report of Adna Anderson, General Superintendent, U. S. Government Railroad, Military Division of the Mississippi for the year ending June 30, 1864 in RG 92, Office of the Quartermaster General. Military Railroads, Unclassified Correspondence, Box 10, Entry 1525, National Archives, Washington, DC. See also McCullum, 22; Clark, Jr., 210-211; *O. R.*, ser. 3, vol. V, 996-998.



General Motors, Chrysler, Rheem and Kaiser Corporations, in 1942, to produce rapidly the materials necessary for World War II on a smaller scale, railroad companies in 1864 demonstrated the industrial capacity of the United States even in its infancy. Moreover, whereas American industry in the 1930s had time to prepare for expansion since the war began in 1939 and our entry was not until December 1941, and management systems were already in place, the situation in 1864 was entirely different. In 1864 the railroad industry was only twenty-five years old, and the management system for such an elaborate operation was less than two years old.

So as bacon, pork, salt beef, bread, flour, corn meal, peas, hominy, mixed vegetables, coffee, sugar, and vinegar were loaded onto cars each day the Construction Corps repaired, maintained, or rebuilt track to carry the supplies that sustained 100,000 men and 50,000 horses. To put things in perspective, if Sherman had to depend upon animal drawn wagon trains, he would have needed approximately 39,000 wagons and 220,000 horses to haul the supplies necessary twenty miles a day. It would have been impossible.<sup>88</sup>

The Nashville & Chattanooga Railroad, 151 miles long, was Sherman's main artery. About 115 miles of track were re-laid, and sidings were put in at intervals of eight miles.<sup>89</sup> Each siding built could hold eight car long freight trains. Eventually, nineteen miles of new sidings were added to the road, and forty-five new water tanks were built.<sup>90</sup> A string of blockhouses were also constructed to guard against enemy cavalry and partisan raiders.<sup>91</sup>

Three other railroads would serve as auxiliary lines during the campaign, and in the early spring also needed the attention of the Construction Corps and army pioneers. The first was the

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<sup>88</sup> Thienel, *Mr. Lincoln's Bridge Builders*, 186.

<sup>89</sup> Sidings were short stretches of track used for parking rolling stock or enable trains on the same line to pass.

<sup>90</sup> McCallum, 24.

<sup>91</sup> Turner, 326.

line between Nashville and Decatur, completed by General Dodge, which connected with the Memphis & Charleston east of Stevenson. Next, was the newly built military track running west from Nashville to the Tennessee River at Johnsonville. Finally, the East Tennessee and Georgia Railroad, from Chattanooga to Knoxville, was opened after the construction corps built the Tennessee River bridge at Loudon.<sup>92</sup>

The maintenance of all these single-track lines would determine how quickly Sherman could press his offensive against Johnston's army defending northern Georgia, and ultimately the grand prize, Atlanta. By the end of April everything was ready. Quartermaster General Meigs reported to Sherman that there was enough food accumulated at Nashville to feed 200,000 soldiers for four months, and sufficient grain to feed 50,000 animals for the rest of the year.<sup>93</sup> On May 4, 1864, General Thomas's Army of the Cumberland, the center of Sherman's three-prong attack, marched out from Ringgold, Georgia prepared to begin the most arduous and arguably the most critical campaign of the war.<sup>94</sup>

Sherman's new chief engineer, Captain Orlando Metcalfe Poe, had spent most of his time before the campaign restructuring the army's engineer organization, which he deemed was inadequate to meet the demands of 100,000 men moving in three separate armies. Poe was an interesting fellow. He graduated sixth in his 1856 West Point class and originally wanted to be an artillery officer. He believed that in a system where promotion came through seniority only,

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<sup>92</sup> McCallum, 25.

<sup>93</sup> *O. R.*, ser. 1, vol. XXXII, part 3, 434.

<sup>94</sup> Called the Atlanta Campaign, operations lasted one hundred seventeen days and included seventeen battles. The battles are divided into two categories: Sherman vs. Johnston and Sherman vs. John Bell Hood. Battles between Sherman and Johnston were the following: Rocky Face Ridge (May 7-13); Resaca (May 13-15); Adairsville (May 17); New Hope Church (May 25-26); Dallas (May 26-June 1); Pickett's Mill (May 27); Operations around Marietta (June 9-July 3); Kolb's Farm (June 22); Kennesaw Mountain (June 27); Battle of Pace's Ferry (July 5). The following battles were fought with Hood in command of the Army of Tennessee: Peachtree Creek (July 20); Atlanta (July 22); Ezra Church (July 28); Utoy Creek (August 5-7); Dalton (August 14-15); Lovejoy's Station (August 20); Jonesborough (August 31-September 1).

his best chance of promotions was in the artillery. He soon learned, however, that artillery openings were limited, so the young second lieutenant decided to switch to the topographical engineers.

After his graduation, he worked for three years with then Captain George Meade doing survey work in the Great Lakes Region. Meade admired the lieutenant's determination and creativity, and by 1860 Poe completed several projects, which included building nineteen weather stations on the five Great Lakes.<sup>95</sup> When the war began, Poe served on George McClellan's staff organizing the defenses around Washington, DC, commanded the 2<sup>nd</sup> Michigan Infantry, and he led his regiment at Fair Oaks and Second Bull Run. Unfortunately, Republicans did not look upon the apolitical Poe favorably because of his connection with McClellan. Consequently, in the spring of 1863 when Poe had been recommended for a brigadier generalship of volunteers, Congress never confirmed the appointment. After the Emancipation Proclamation and fearing Democratic Party fallout, the Radicals were intent on purging the military of political generals who were also strong Democratic voices. Poe was unknowingly considered connected with these men because of his association with McClellan.

So Poe went from being an unconfirmed brigadier general of infantry back to a lieutenant of engineers in the Regular army. Yet, his reputation among his fellow officers and the men in his command was solid, and soon he was made a captain of engineers for the Army of the Ohio. He was serving in this position when Sherman made him chief engineer.

Poe's performance throughout the summer of 1864 only confirmed the faith others had placed in him. In readjusting the engineer organization, he first took stock of what he had. The huge Army of the Cumberland had two field-tested engineer units, the First Michigan Engineers

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<sup>95</sup> Paul Taylor, *Orlando M. Poe: Civil War General and Great Lakes Engineer* (Kent, OH: The Kent State University Press, 2009), 26.

and Mechanics and the First Missouri Engineers. The Michigan boys, after building a magazine in Chattanooga seventy by one hundred feet with twenty foot high walls, and a railroad spur to the magazine, were assigned the critical task of building railroad blockhouses to help prevent Confederate cavalry and partisan raiders from destroying track and most especially, bridges. The blockhouses, designed by Captain William Merrill, chief engineer of the army, with the help of Lieutenant Colonel Kinsman Hunton of the Michigan engineers, were two stories high. The first story walls were forty inches thick, and the second story, set diagonal to the ground floor, was made twenty inches thick for better stability. Each blockhouse could hold a garrison of twenty men.<sup>96</sup> The First Missouri were currently focused, along with McCallum's Construction Corps, on completing the newly built military railroad running west from Nashville to the wharves on the Tennessee River at Johnsonville.<sup>97</sup>

Thanks to the efforts of General William Rosecrans the year before, the Army of the Cumberland had a regiment of volunteer engineers made up of enlisted men who had served with the army's Pioneer Brigade. These men from the 13<sup>th</sup>, 21<sup>st</sup>, and 22<sup>nd</sup> Michigan Infantry regiments, and the 18<sup>th</sup> Ohio Infantry had worked extensively on building blockhouses, operating sawmills, and building field works around Chattanooga. Captain Merrill, who was commissioned a colonel, led the First Veteran Volunteer Engineers.<sup>98</sup> The army also had a pontoon train made of the new Cumberland "hinged" bateau, with additional pontoons and equipment held in reserve in Nashville.

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<sup>96</sup> Hoffman, 196-199.

<sup>97</sup> Turner, 326.

<sup>98</sup> The Volunteer Regiment was known by several names including the United States Veteran Volunteers, 1<sup>st</sup> Regiment Engineers, and if you were from Ohio, the 1<sup>st</sup> Ohio Veteran Engineers. Major Patrick O'Connell commanded the Ohio battalion within the regiment. See Hoffman, 214; Civil War Index at [www.civilwarindex.com/armyoh/1st\\_oh\\_veteran\\_engineers.html](http://www.civilwarindex.com/armyoh/1st_oh_veteran_engineers.html) (accessed August 27, 2013).

Colonel George P. Buell and the 58<sup>th</sup> Indiana Infantry were placed in charge of bridging operations. The Indianans, Michiganians, and Ohioans, were typical infantry regiments in the Union Army, many of the enlistees had mechanical and carpentry skills acquired before the war. With the shortage of engineer troops, these men were transferred to the engineers to perform the vital tasks of building roads, bridges, and fortifications critical for the success of Sherman's campaign. Both the Army of the Tennessee and the Army of the Ohio also faced a shortage of engineer troops and they, too, would turn to infantry units for help.<sup>99</sup>

The Army of the Tennessee, with the exception of a well established pioneer organization and a pontoon bridge train, had no engineer troops so upon Poe's suggestion, Sherman transferred the First Missouri Engineers to the army. Conversely, the Army of the Ohio had an Engineer Battalion, which had been established at Chattanooga when Grant was planning a move on Knoxville and East Tennessee.<sup>100</sup> Poe also had nine regular army engineers attached to the various field armies who were responsible for laying out fortifications for strategic points, conducting topographical surveys, and reconnoitering the enemy positions.<sup>101</sup>

Sherman invaded Georgia in the late spring and summer of 1864 He planned to use a series of flanking maneuvers to force Confederate General Joseph E. Johnston to abandoned fortified positions and withdraw toward Atlanta. These movements would require maintaining a supply line over a tenuous single-track railroad from his advance positions to Chattanooga and

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<sup>99</sup> Taylor, 149.

<sup>100</sup> *O. R.*, ser. 1, Vol. XXXVIII, part 1, 128. Captain Charles E. McAlester from Flint, Michigan commanded the battalion. Before this McAlester was a company commander in the 23<sup>rd</sup> Michigan Infantry.

<sup>101</sup> Taylor, 149. The nine Regular engineer officers under Poe's command were the following: Captains Merrill, Barlow, McAlester, Reese and Twining and lieutenants, Ernest, Ludlow, Damrell, and Wharton. Both Merrill and Wharton served with the Veteran Volunteer Engineers, and consequently, Merrill was commissioned colonel of volunteers, and Wharton was commissioned lieutenant colonel of volunteers. As was the tradition, when their command of the volunteers ended their ranks reverted back to those of the Regular Army.

Nashville. It would also require crossing more than 100,000 soldiers over three major rivers: the Oostanaula, the Etowah, and the Chattahoochee.

The first of Sherman's flanking movements came in mid-May when the general's engineers determined that enemy forces were stretched across the Western & Atlantic Railroad, four miles northwest of Dalton, Georgia, on a north/south axis along Rocky Face Ridge. The Confederate commander hoped the Yankees would launch a frontal assault against a strong position, but Sherman would not oblige. Instead, he planned to have Thomas and Schofield demonstrate against Johnston's front, while McPherson's Army of the Tennessee would move twenty-five miles southeast through Snake Creek Gap, and occupy the area around Resaca and hold the railroad and telegraph. This forced the Confederates to abandon their stronghold on Rocky Face Ridge, and move into their defenses north and east of Resaca, north of the Oostanaula River.<sup>102</sup>

Buell's pontoon train had covered approximately fifty miles from Chattanooga through Snake Creek Gap in about forty-eight hours, and had stopped to eat and rest for no more than three hours during this grueling and often up hill march. Now in a valley east of Horn Mountain, and west of Resaca, the men of the 58<sup>th</sup> Indiana had finally halted and started to settle in for a longer break when orders arrived to get the pontoons to Lay's Ferry on the Oostanaula. Exhausted and ornery, Buell's command then spent four hours moving about in dense thickets

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<sup>102</sup> The Atlanta Campaign was a series of seventeen battles beginning on May 7, 1864 and ending on September 1, 1864. The order of battles between Sherman and Johnston were the following: Rocky Face Ridge (May 7-13), Resaca (May 13-15), Adairsville (May 17), New Hope Church (May 25-26), Dallas (May 26-June 1), Pickett's Mill (May 27), Operations around Marietta (June 9-July 3), Kolb's Farm (June 22), Kennesaw Mountain (June 27), Pace's Ferry (July 5). Battles between Sherman and Hood: Peachtree Creek (July 20), Atlanta (July 22), Ezra Church (July 28), Utoy Creek (August 5-7), Dalton (August 14-15), Lovejoy's Station (August 20), and Jonesborough (August 31-September 1).

on unidentified roads until they reached the east bank of Snake Creek, one mile from where it flows into the Oostanaula.<sup>103</sup>

Sherman had attempted to get around Johnston's right flank with no success and on May 15<sup>th</sup> decided to gain a lodgment on the eastern bank of the river with the hope of cutting off the expected Confederate's retreat from Resaca. Brigadier General Thomas Sweeny of County-Cork, Ireland, and a regular army officer, were selected by McPherson to establish the bridgehead. Sweeny's soldiers described the hot-tempered general as speaking three languages, "English, Irish-American, and Profane," and claimed he was most eloquent in the last.<sup>104</sup> Now with an infantry escort, Buell's men assembled the Cumberland pontoon boats and after stretching on the canvas covers, paddled them down Snake Creek to the Oostanaula and Lay's Ferry. Eventually, two pontoon bridges were built to accommodate Sweeny's division, and McPherson's Corps, and allowed these forces to gain the Confederate's flank. This forced Johnston to evacuate his formidable defensive position and move further south toward Atlanta.

Colonel Buell's 58<sup>th</sup> Indiana Infantry, with pontoon train in hand, conducted a similar amphibious operation like the one at Lay's Ferry on July 8<sup>th</sup> when the regiment launched their canvas pontoons filled with infantry, down the Soap Creek into the Chattahoochee River, debarked the soldiers to establish a bridgehead, and then Buell's men threw two pontoon bridges over the river so the entire Army of the Ohio could cross. The 58<sup>th</sup> Indiana then took up the pontoon bridge and the Engineer Battalion built a more permanent trestle bridge to replace it.<sup>105</sup> In his official report Poe noted, "that whenever it was deemed necessary to use a bridge for a greater length of time than forty-eight hours the pontoon bridges were invariably replaced by

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<sup>103</sup> John J. Hight, *History of the Fifty-eighth Regiment Indiana Volunteer Infantry* (Princeton, IN: Press of the Clarion, 1895), 290 and 293-296.

<sup>104</sup> Albert Castel, *Decision in the West: The Atlanta Campaign of 1864* (Lawrence, KS: University Press of Kansas, 1992), 162.

<sup>105</sup> Thienel, *Mr. Lincoln's Bridge Builders*, 194-195.

wooden trestle bridges constructed from materials at hand, either by engineer troops or the pioneer forces.”<sup>106</sup>

One pioneer force that performed admirably throughout the campaign, yet received little recognition in Poe’s reports, was that of the Army of the Tennessee under the command of Captain William Kossak, an aide-de-camp to Sherman turned engineering officer. Perhaps because both Sherman and Grant admired Kossak’s skill and work, and because he was not a West Pointer, petty jealousy prevented Poe, or other members of the Corps of Engineers, from publically acknowledging Kossak’s efforts. Kossak was born in Prussia and immigrated to the United States in 1848. When the war began he joined the 5<sup>th</sup> Missouri Infantry as a lieutenant, and by 1863 he was a member of Sherman’s staff at Vicksburg. Prior to becoming chief engineer of the XVII Corps during the early stages of the Atlanta Campaign and an engineer on Sherman’s staff, Kossak had demonstrated his ingenuity as an engineer at Vicksburg.<sup>107</sup>

During the Vicksburg siege, he took charge of the trenches along Graveyard Road that led into the city. Kossak discovered that once his work parties had advanced to within twenty feet of the Confederates’ counterscarp, obstructions in front of the sap-roller made “it impossible to move the roller one inch without having the party engaged in the moving killed outright.”<sup>108</sup> He tried moving to the left and right to raise trench cavaliers parallel to the enemy’s counterscarp or sloped wall, when again Kossak had to change plans because he discovered Confederates digging a mine under his sap. The mine was detonated with little effect. Kossak then decided to dig a right oblique tunnel of his own, seventy-sixty feet long, which then cut another seventeen feet rising to the surface landing behind a large, heavy log

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<sup>106</sup> *O. R.*, ser. 1, vol. XXXVIII, part 1, 130.

<sup>107</sup> William Kossak Journals, 1863-1865, James S. Schoff Civil War Collection, Manuscript Division, William L. Clements Library, University of Michigan, Ann Arbor.

<sup>108</sup> *O. R.*, ser. 1, vol. XXIV, part 2, 189-191.



resting across a gully. Then turning ninety degrees, another mine was dug seventy feet toward the Confederate parapet. Working day and night underground until Kossak “received orders from Major General U. S. Grant to stop all work, the place having surrendered.”<sup>109</sup>

Now at Atlanta, Kossak’s pioneers would build seven trestle bridges, each one about 350 feet long on the Chattahoochee River for Sherman’s wagon trains to cross. The bridges were constructed from trees cut from the bank of the river, and five of the bridges were double tracked to accept two-way traffic. The efforts were impressive. Although in his report, Poe only singled out Captain Reese and lieutenants Wharton and Twining, all West Pointers, his engineer and pioneer officers and men, most of whom were volunteers, performed extraordinarily well. Poe’s experience with Congress in 1863 might have explained his reluctance to focus his report on others and not himself. After the campaign he wrote to his wife Nell, “not even a Congress can sever my name from its official connection with them [the history of the Atlanta Campaign]”.<sup>110</sup>

Poe’s subordinates laid out fifty miles of infantry and artillery parapets, six bridges over Peachtree Creek, averaging eighty feet long, five bridges over the Flint River, and numerous small bridges and repaired many miles of roads. As Poe’s biographer, Paul Taylor pointed out, “Some of this work had even been undertaken at night, once the infantry’s main body had gone to sleep. Then the engineer crews would often go to work by moonlight [or torchlight], having new bridges built or old ones rebuilt in time for the next day’s march.”<sup>111</sup> In addition, Poe’s topographers made surveys of all the routes passed by infantry columns, and he drew a map on

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<sup>109</sup> *O. R.*, ser. 1, vol. XXIV, part 2, 189-191. Trench cavaliers were elevations constructed of gabions and earth half-way up the slope or glacis of an enemy’s fortification, designed to provide cover so soldiers could use enfilading fire into the fort or the fort’s covered way.

<sup>110</sup> Taylor, 183.

<sup>111</sup> Taylor, 182.

a scale of four inches to one mile illustrating the siege of Atlanta. In all, 4,000 copies of campaign maps were issued to officers to facilitate military operations.<sup>112</sup>

Confederate engineers at times performed well, but were plagued by a lack of engineer soldiers and in some cases poor planning. For example, most of the defensive positions at places such as Hardee's Salient, the Kennesaw Mountain Line, and the Chattahoochee River Defense Line, were all constructed in advance of the Confederate army's occupation, as was the fortifications surrounding the city of Atlanta. The latter, with redans and lunettes, posed a formidable obstacle to Sherman's three armies. Yet in an article written by archaeologist Robert J. Fryman in 2001, the author pointed out that although the defenses were carefully designed and built in 1863, a critical flaw still existed.

Using archaeological analysis, old maps, and hand-held GPS units, Fryman discovered that the forts themselves were designed to be approximately 1.25 miles from the center of the city, and the woods were cleared a distance of one mile from the forts. In December 1863, Colonel J. F. Gilmer, chief of the Confederate Engineer Bureau visited Atlanta and approved what he saw.<sup>113</sup> The Army of Tennessee's artillery preferred the accuracy and strength of the bronze smoothbore 12-pounder Napoleon field gun, which fired solid shots and shells about 1,680 yards. As Fryman wrote: "The construction of Atlanta's defensive perimeter at an average distance of 1.25 miles would have provided more than adequate protection for the city's buildings and infrastructure had the opposing Federal forces been armed with identical field artillery."<sup>114</sup> They were not. By 1863, Gilmer should have been aware of the capability of the Union army's artillery and planned accordingly. Sherman had weaponry far more powerful than the Confederates had expected.

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<sup>112</sup> *O. R.*, ser. 1, vol. XXXVIII, part 1, 137.

<sup>113</sup> Fryman, 50.

<sup>114</sup> Fryman, 54-55.

Sherman's three armies used 3-inch ordnance rifle, 10-pounder and 20-pounder Parrott rifles, and eight 4.5-inch rifled siege guns, which could fire an average distance of 4,160 yards. This meant that during the siege the Federal artillery could bombard Atlanta from distances beyond the Confederate defensive lines.<sup>115</sup>

The greatest advantage Sherman had, however, during the campaign was the use of the railroads. The USMRR maintenance shops in Nashville repaired one hundred locomotives and one thousand cars each month. McCallum's construction teams built a rolling mill in Chattanooga, and then rerolled rails for one-third the cost of new rails. His men rebuilt eleven bridges and laid seventy-five miles of track during the campaign.<sup>116</sup>

Retreating Confederates had burned the bridge across the Oostenaula at Resaca, but in W. W. Wright's Construction Corps was one of Herman Haupt's master bridge builders E. C. Smeed. Smeed was able to repair the bridge in three days, although both Wright and McCallum got the credit. It was the same with the construction of the railroad bridge over the Etowah River. Smeed and his men arrived at the bridge on June 5<sup>th</sup>, and the following day started work. For three days gangs removed the old structure, and then cut and hauled timber from the woods to the bridge site. The Construction Corps built a 600-foot trestle bridge, made up of five trestles, sixty-seven feet high. It was a magnificent piece of work, yet the most remarkable performance by Smeed and the Construction Corps was still to come.<sup>117</sup>

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<sup>115</sup> Fryman, 55. It should be noted that the Army of Tennessee did have rifled artillery pieces. The Federal Ordnance Corps reported the capture of 3.80-inch James rifles and 12-pounder Parrotts, although most of the artillery captured were smoothbores. See *O. R.*, ser. 1, vol. XXXVIII, part 1, 124-125.

<sup>116</sup> *O. R.*, ser. 3, vol. V, 996-998.

<sup>117</sup> Thienel, *Mr. Lincoln's Bridge Builders*, 189-190. In *Sherman's Memoirs* the general gives credit to Wright for the bridges built over the Oostenaula and Etowah Rivers and never mentions Smeed. McCallum also fails to mention Smeed in any of his reports perhaps because he associated Haupt with him. In McCallum's final report of USMRR operations (*United States Military Railroads. Report of Bvt. Brig. Gen. D. C. McCallum, Director and General Manager, from*

The railroad bridge over the Chattahoochee had to be 780 feet long and 90 feet high, which was almost twice as long as the Potomac Creek bridge Haupt built with Smeed's assistance in 1862. Again using timber cut from the areas' woods, Smeed used the stone piers left standing by the Confederates to form a sturdy foundation. In four and a half days the bridge was finished. Haupt called the building of the Chattahoochee Bridge "the greatest feat of the kind that the world has ever seen."<sup>118</sup> The teacher's effusive praise for his student aside, the word of Northern ingenuity and proficiency in bridge building soon traveled overseas and in 1868 the British Association for the Advancement of Science invited Haupt to attend its meeting to describe how these remarkable feats of engineering were constructed.<sup>119</sup>

McCallum also deserved credit for the management system he put into place during the campaign. With some modifications, the system mirrored the one he designed for the Erie Railroad back in 1857. Supplies such as rails, spikes, crossties, and iron were placed at collection points along the line, and detachments of men from the Construction Corps, with an ample supply of tools, were stationed at certain intervals. McCallum wrote: "Each detachment was under the command of a competent engineer or supervisor, who had orders to move in either direction, within certain limits, as soon as a break occurred, and make the necessary repairs without delay, working day and night when necessary. Under this arrangement small breaks were repaired at once, at any point on the line, even when the telegraph wires were cut and

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1861 to 1866), he never once mentioned Haupt. For his part, Haupt did mention Smeed's work during the Atlanta Campaign in glowing terms because he probably heard reports from various sources, even Smeed himself. Haupt praised Wright as a skilled administrator and he probably understood each man's role in bridge building. Historian Edgar Turner speculates that it may be reasonable to assume that Sherman saw nothing of the operation and gave credit to Wright because he was in command of the Construction Corps. See Turner, fn 29, 400; William T. Sherman, *Memoirs of General William T. Sherman*, vol. 2, (New York: D. Appleton and Company, 1875), 92; Herman Haupt, *Reminiscences*, 51.

<sup>118</sup> Haupt, 51.

<sup>119</sup> Haupt, 317.

special orders could not be communicated to the working parties.”<sup>120</sup> When larger breaks occurred one or more divisions of the Construction Corps were moved as quickly as possible.

Sixty-eight days after Sherman’s army marched into Atlanta, the general ordered Poe “to take charge of the destruction with engineer troops all railroads and property belonging thereto; all storehouses, machine shops, mills, factories, &c, within the lines of the enemy’s defenses of Atlanta.”<sup>121</sup> The following day, November 8, 1864, Abraham Lincoln was re-elected president. As church bells rang with the news of the President’s victory, smokestacks toppled and buildings collapsed under the weight of sledgehammers, wielded by Union engineers and pioneers in Atlanta. The engineers heated torn up rails and then with a cant hook at each end twisted them around their horizontal axis.<sup>122</sup> The objective was to deny the Confederates use of the railroad, so it was considered essential to damage the tracks. Beyond repair.

Now as Sherman’s juggernaut started for Savannah and Lincoln, with four more years, prepared to prosecute the war to a successful conclusion, the Confederate Army of Tennessee and the Army of Northern Virginia would each make one more desperate attempt to escape the grasp of the Union Army and perhaps link up to form a larger army. Northern engineers had clearly proven that there was no place the Confederates could safely hide. No swamp, river, mountain, unmarked roadway or wilderness would block the Yankees from getting at their enemy. The end of the war was near at hand.

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<sup>120</sup> *United States Military Railroads. Report of Bvt. Brig. Gen. D. C. McCallum*, 44.

<sup>121</sup> Thienel, *Mr. Lincoln’s Bridge Builders*, 204.

<sup>122</sup> Thienel, 204.

## CHAPTER 10

### A SIGNIFICANT AMOUNT OF BRIDGING

**If his army goes to hell, it will corduroy the road.**

**General Joseph Johnston, CSA about Sherman's march through the Carolinas.**

When 1865 opened President Lincoln was preparing for his second term, and with congressional Republicans planned to convince several Democratic congressmen to vote to adopt the Thirteenth Amendment to the U. S. Constitution. Lincoln wanted to make emancipation permanent, and he wanted to end the war. His reelection had signaled that the northern public was unwilling to negotiate a settlement with the Confederate government, allowing them to co-exist peacefully with the Union. Fortunately, for the President's reelection prospects, the war had taken a significant turn with Sherman's capture of Atlanta the previous fall, and now the electorate was ready to follow the Lincoln administration to a military victory. Everyone felt victory was near and people were euphoric. Sherman's army was on the move through the Carolinas, and Grant's forces continued to tighten its grip on Lee's army at Petersburg.

The war, however, was not over and Lincoln understood well that northern hopes could turn sour if Union armies in the field were not successful or if Confederate forces under Lee and Joseph Johnston somehow managed to link up and operate against Union supply centers and garrisons in the south. Lincoln needed his generals, especially Sherman, to pursue Johnston tenaciously to prevent the Confederate commander from coming to Lee's rescue. The swamps and tangled forests of central South Carolina and North Carolina, however, were the greatest obstacles to Sherman's movements to trap Johnston.

The operation through South Carolina and North Carolina was a massive road and bridge building project. It was an amazing effort and was performed by pioneers and engineers during what became General William T. Sherman's Carolina Campaign during the winter of 1865. Sherman had three important goals: first, to damage or destroy any manufacturing operations, agricultural surplus not consumed by the Union army, and railroad capacity essential to sustain the Confederate war making effort. Next, to occupy Columbia, South Carolina and Goldsboro, North Carolina and by doing so to render rail traffic and the shipment of supplies blocked from the vital coastal ports of Charleston and Wilmington to Johnston and Lee's armies. Finally, by reaching Goldsboro, Sherman would control the Wilmington & Weldon Railroad, the critical supply link with the Army of Northern Virginia. Sherman's campaign began on January 30, 1865 from Pocotaligo, South Carolina, and his forces arrived in Goldsboro on March 24, 1865.

The engineers carefully had chosen the line of march. During the march from Atlanta to Savannah the army followed a parallel line to the large watercourses. For the Carolina Campaign the same concept was applied. The march was chosen near the junction between the clay of the uplands with the sand of the lower country, which Colonel Orlando Poe, Sherman's chief engineer, wrote, "may be tolerably well defined by tracing [the] line through the lower rapids on each stream we crossed." This way he hoped the best roads would be used and the minimum amount of mud and swamp would need to be crossed.<sup>1</sup>

Poe took great pains to organize the engineers and pioneers before the campaign began, and he readied the pontoon trains and inventory the tool chests and other equipment including a significant number of axes that would be carried by the infantry brigade wagons. The left wing of the army consisted of the XIV and XX Corps and the 58<sup>th</sup> Indiana Volunteer Infantry, under command of Lieutenant Colonel Joseph Moore, served as the engineer troops. They

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<sup>1</sup> *O. R.*, ser. 1, vol. XLVII, part 1, 173.

hailed a pontoon train of eighty-five wagons, which was enough to construct a bridge 1,000 feet long.<sup>2</sup>

The right wing of the army consisted of the XV and XVII Corps and was accompanied by the 1<sup>st</sup> Missouri Volunteer Engineers under the command of Lieutenant Colonel William Tweeddale. The 1<sup>st</sup> Michigan Engineers and Mechanics, led by Colonel J. B. Yates were unassigned and used as Colonel Poe saw fit.<sup>3</sup> The role Poe saw fit to assign the Michigan engineers was the destruction of Southern railroads. Poe instructed generals on how their men were to destroy the rails. The infantry would tear up the railroad and lift the iron laying it across piles of burning ties. Following behind them, the engineers would carefully lift the red-hot rails and twist them until effectively destroyed.<sup>4</sup>

The area Sherman's army needed to move through presented unique problems for his engineers and pioneers. For example, the natives regarded the Big Salkehatchie River and its adjoining swamplands near the tiny communities of Allendale, South Carolina to the south, and Barnwell, South Carolina to the west, as impassable for troops. For the men of Captain George L. Searle's Pioneer Corps attached to Union General O. O. Howard's XVII Corps, the swamps were just places of cold, wet, misery. The pioneers and infantry detachments had bridged the

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<sup>2</sup> *O. R.*, ser. 1, vol. XLVII, part 1, 169. The left wing of the army was originally part of the Army of the Cumberland. In the winter of 1865, Sherman divided the army sending the XXIII and IV Corps with George Thomas to destroy Hood's Confederate army, and the remaining two corps, the XIV and XX accompanied Sherman's march and were redesignated the Army of Georgia under the command of Henry Slocum.

<sup>3</sup> *O. R.*, ser. 1, vol. XLVII, part 1, 169. Colonel Reese was chief engineer for the army's right wing (the Army of the Tennessee), and his assistant was Captain Amos Stickney. Major William Ludlow was chief engineer for the Army of Georgia, Captain William Kossak chief engineer for the XVII Corps, and Captain Klostermann, chief engineer, XV Corps.

<sup>4</sup> Hoffman, 268. See also *O. R.*, ser. 1, vol. XLVII, part 1, 19, 224, 245, 272; Henry Hitchcock, *Marching with Sherman* (New Haven, CT: Yale University Press, 1927), 260-261. Poe wrote, "Three ties in the roadbed as they lie, one tie across these at each end, at right angles; six ties crosswise with these (right angles) with intervals to allow being fired; then the iron laid on top, parallel with the railroad, and kindling wood and surplus ties on top of all." See Taylor, 209.



Savannah River, the Coosawhatchie and Whippy swamps, and now on February 3, 1865, their task was to get the XVII Corps over another river and through a swamp their commanding officer described as “indescribably ugly.”<sup>5</sup>

General Sherman wanted to cut the South Carolina Railroad that linked Charleston to Augusta, and the Big Salkehatchie River was in the way of accomplishing this objective. Joe Johnston’s Confederates understood the importance of blocking the determined Yankees, and consequently, had formed a battle line on the east bank of the river. The lead elements of Major General Joseph Mower’s 1<sup>st</sup> Division had been directed to cross on Rivers’ Bridge, but the enemy, dug in along a narrow causeway on higher ground, were waiting to greet Mower’s men with an array of led and iron projectiles that would, they hoped, send the invaders to their almighty reward.

The environment was as much an enemy to the bluecoats as were the Confederate soldiers trying to kill them. The winter weather was brutal. Orlando Poe noted how “water froze in a tin cup almost instantly,” and that it was “very imprudent to put water on the hair when washing for it froze before one was even aware of it.”<sup>6</sup> In addition, even when the temperature crept above thirty-two degrees, the frequent rains and chronic marshlands kept hands arthritic and feet in wet, unsanitary, cold conditions. Soldiers would notice their feet blister and develop open sores. If they were unlucky gangrene would set in. Warm and dry were the solutions to some of the men’s foot problems, but there was none of that around the Big Salkehatchie.

The swamp itself was eerie, dank, and wild. Shooting up from the mucky soil was a mixture of tall bald cypress, water tupelo, and green ash trees. Cypress knees surrounded the base of the bald cypress. These knees were stumps or woody projections that looked like

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<sup>5</sup> *O. R.*, ser. 1, vol. XLVII, part 1, 386.

<sup>6</sup> Taylor, 208.

stalactites. Vegetation in the swamp included saw grass, cattails, and pickerelweed. Alligators and cottonmouth snakes, normally very active in the warmer weather, were in a state of torpor among the tangle of trees roots, shrubs. The cold weather had slowed their metabolism, but they would strike if disturbed.

The swamp covered approximately a mile in width on the western side of the river and another half mile on the eastern bank. The Confederates had built rifle pits and two redoubts for artillery on elevated ground just beyond the swamp on the eastern side. Since the artillery commanded the bridge and the narrow causeway leading out of the swamp, a Union frontal assault was out of the question. The river leaked a number of tiny streams, and because of the heavy freezing rains and occasional snow, the ground was roofed with one to eight inches of icy cold water. Mower's aide-de-camp, Lieutenant Charles Christensen, had swum the river on the night of February 2<sup>nd</sup> to determine where the best place was to build a road and bridge in order to bypass the Confederate defenses and exit the dreary swamp. He was almost captured by Southern pickets, but dove back into the river and swam the fifty yards back to Union lines.<sup>7</sup>

On the morning of the 3<sup>rd</sup>, under harassment from Confederate artillery, the pioneers began constructing a series of raised roadways through the swamp, both above and below Rivers' Bridge. Men from the 25<sup>th</sup> Wisconsin and 63<sup>rd</sup> Ohio cut trees and gathered planks from nearby houses and barns to use both for corduroying and bridging the Big Salkehatchie River in three places in order to move the entire brigade across the river as quickly as possible. As a diversion, Mower ordered the 43<sup>rd</sup> Ohio over the Rivers' Bridge and up the causeway, while two other brigades moved over roadways and bridges built by the pioneers. By late in the day a lodgment was gained on the eastern bank of the river, and consequently, with the Union threat of flanking the Confederate's entrenched positions, the latter evacuated their line and

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<sup>7</sup> *O. R.*, ser. 1, vol. XLVII, part 1, 389.

disappeared northeast. Mower wrote in his official report, "Captain Searle and his pioneers were for two days and nights in the water constructing roads, and at the conclusion of their labor were well-nigh exhausted."<sup>8</sup>

The following day at Buford's Bridge, just five miles north of Rivers' Bridge, pioneers from the XV Corps built twenty-two bridges scattered over a mile of swampland, and by early evening had also built a corduroyed road through the swamp. Corduroy roads had been built for centuries, and in the United States frontiersmen found them significantly helpful in aiding the movement of wagon trains and settlers over difficult terrain. This knowledge of road building, however, did not make the job any easier. For fourteen hours men felled trees, hauled lumber, hammered log piers into the ground, and in some cases dug drainage ditches under the roads. All of this was done while standing in water sometimes as high as four feet. Furthermore, the pioneers had to remain in the frosty swamp while the corps passed in order to repair shifting logs, which made the roadway hazardous to wagons and dangerous to horses.

Roads were not all level with the ground and none were hard. Pioneers had to build roads that were able to limit sliding logs and withstand heavy traffic, but they required considerable time to construct. The men would lay longitudinal support timbers on either side of the road, and notch the timbers so that the transverse logs could be fitted into the supports. The logs would be tied into place, and a second longitudinal support was laid and tied on either side across the top of the transverse logs. These log mats would need to be anchored when the road was under water.<sup>9</sup> It was an amazing effort, and the example of the work done at both Rivers' and Buford's Bridge was only a part of the extraordinary performance of pioneers and engineers during the campaign.

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<sup>8</sup> *O. R.*, ser. 1, vol. XLVII, part 1, 389.

<sup>9</sup> Benjamin W. Bacon, *Sinews of War: How Technology, Industry, and Transportation Won the Civil War* (Novato, CA: Presidio Press, 1997), 212.

After the action around the Big Salkehatchie River, the army continued north and the engineers and pioneers continued to labor in the swamps and thickets, exceedingly cold, wet, tired, sick, and sore. Poe, in his official report, made the operations appear routine. He described the army's movement between February 9<sup>th</sup> and February 18<sup>th</sup> as follows: "During the night of the 9<sup>th</sup> a pontoon bridge was thrown at Binnaker's, and the enemy driven away from the position he had taken to dispute crossing. Another pontoon bridge was thrown at Holman's, and all our force was across by the evening of the 11<sup>th</sup>.... The enemy opposed the crossing of the North Fork of the Edisto River, but, as usual, he was driven away and three pontoon bridges built.... A pontoon bridge was built at the Saluda River bridge [February 16<sup>th</sup>], near a factory, and a portion of the Fifteenth Corps crossed during the night. The Left Wing pontoon bridge was built over the Saluda at Zion Church, nine and one-half miles above Columbia, and some force crossed. On the 17<sup>th</sup> a pontoon bridge was built just above the ruins of the former bridge over Broad River, three miles above Columbia.... On the 18<sup>th</sup> the Left Wing crossed the Broad River on a pontoon bridge thrown at the mouth of Wateree Creek, near Freshly's Mills...."<sup>10</sup>

Yet, although Poe made the work of the pioneers and engineers appear routine, there was nothing routine about it. Colonel Moore's description of the 58<sup>th</sup> Indiana's crossing of the Catawba River beginning on February 22<sup>nd</sup> was anything but practiced. His men had constructed a 660-foot pontoon bridge across the river during the night. Yet, the following day the skies opened up with a cold torrential rain, and over the next two days as XX Corps and cavalrymen crossed the bridge, three problems made the march over the Catawba increasingly dangerous. First, the steep hill on the opposite bank of the river had turned into an almost impassably muddy egress from the bridge. Second, the river rose, and finally the current became rapid. Moore had to place heavy timbers on the lower ends of the pontoons to prevent them from

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<sup>10</sup> *O. R.*, ser. 1, vol. XLVII, part 1, 171.

sinking or filling with water. At midnight on the 26<sup>th</sup> a 400-foot section of the span broke loose and washed away.<sup>11</sup>

Moore's men quickly used a cable tied to trees on both sides of the river, and using the pontoon as a raft, moved over the rapidly running water holding tightly to the cable. They collected the remaining pontoons, floated them to the western bank of the river, and hauled them out of the water. It was still raining hard. Then with the pontoons from the original bridge, and those that remained on the wagons, the volunteer engineers moved downriver about 500 yards and prepared to assemble another bridge. This operation was suspended until they received further orders.

The following day the weather improved, so moving once again to a spot on the river where the current was less swift, the 58<sup>th</sup> constructed a pontoon bridge 680 feet in length, and by February 28<sup>th</sup> the rest of the right wing crossed. Moore then ordered his exhausted men to take up the bridge, and join the march to Haile's Ferry on the Great Pedee River, reaching there five days later.<sup>12</sup>

It was close to midnight when Moore's men arrived on the banks of the Great Pedee River, and as soon as the soldiers finished unloading the pontoons, balk, and chess, several men rowed to the opposite bank of the river to gather a measurement. The river was 920-feet wide, and the engineers had only 820 feet of pontoons and 460-feet of balk and chess. Furthermore, Colonel Moore was now incapacitated with rheumatism, and the regimental commander, Colonel Buell, was in charge of the operation.<sup>13</sup> Buell ordered the men to begin construction on a trestle bridge for the last 100 feet. The pioneers worked the entire day and night of March 6<sup>th</sup>,

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<sup>11</sup> *O. R.*, ser. 1, vol. XLVII, part 1, 427.

<sup>12</sup> *O. R.*, ser. 1, vol. XLVII, part 1, 427.

<sup>13</sup> Rheumatism in the nineteenth century could describe a number of ailments, but more than likely Moore suffered from a painful bursitis or tendonitis. There is no longer any recognized disorder called "rheumatism."

cutting trees then trimming them to the proper length, framing the trestle section of the bridge, and then placing it in the water. Anchoring the first trestle was not difficult, but driving in the legs of the other trestles became a huge problem because of the river's current. The pioneers had to determine the proper length of the legs by first using a pole to measure the depth of the water, then a pontoon was brought alongside the first trestle placed, two balks were laid from the bridge, and the next trestle was laid on the balks. Pioneers moved the pontoon to the next spot for placing the trestle and the latter was righted into the water.<sup>14</sup> The legs were driven into the river's floor, and the process was repeated.

The current was fastest in the middle of the river where the engineers hoped to use the pontoons. It took all morning on March 7<sup>th</sup>, however, to get the upstream anchors to hold. Finally, at 3 pm the bridge was completed and the men of the XIV and XX Corps started to cross. On March 8<sup>th</sup> a detachment of the 58<sup>th</sup> Indiana took up the bridge, and then marched twenty miles toward Fayetteville. Since February 23<sup>rd</sup> when a 400-foot span of bridge broke loose in the Catawaba River to their arrival in Fayetteville, the 58<sup>th</sup> Indiana had been constantly at work or on the march.

Hundreds of privates from infantry regiments now had joined the pioneers and engineers in corduroying roads and building bridges. A private wrote in his diary, "Our whole division was put to work with engineers.... It was not a pleasant job in our wet clothes with water up to our knees but we had the work done...."<sup>15</sup> Sixteen days, four pontoon bridges, and endless corduroyed roads later, all of Sherman's army walked into Goldsboro, North Carolina.

The army was exhausted and needed all kinds of supplies. In addition to essential items such as clean dry clothes, new shoes, and good food, the engineers required new canvas

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<sup>14</sup> Duane, *Manual for Engineer Troops*, 24, 45-46.

<sup>15</sup> Jack K. Bauer, *Soldiering: The Civil War Diary of Rice C. Bull* (San Rafael, CA: Presidio Press, 1997), 222.

pontoon covers. The Cumberland pontoon had held up well, but the covers, which had been in water almost every day for sixty days, were torn, mildewed, and rotting.<sup>16</sup>

Colonel Poe estimated that during the Carolina Campaign, engineers, pioneers, and infantry had built 400 miles of corduroyed roads, and many with the absence of fence rails, which when found, made road construction less tedious. The First Missouri Engineers had built for the right wing of the army, fifteen pontoon bridges, estimated to have an aggregate length of 3,720 feet. The 58<sup>th</sup> Indiana constructed about 4,000 feet of bridging. The XVII Corps pioneers kept their own records of the immense work they performed, which augmented Poe's report, and pointed to the mechanical ability many Union soldiers possessed. General Mower's First Division built 13,135 yards of corduroyed roads, 133 yards of bridges, and six artillery batteries. Major General Mortimer Dormer Leggett's Third Division constructed 24,753 yards of roadway, and 303 yards of bridges, while Major General Giles Alexander Smith's Fourth Division built 32,975 yards of roads and 439 yards of bridges.<sup>17</sup>

The Carolina Campaign broke the last major supply chain of the Confederacy, and the speed with which Sherman's army moved through the mud and swamps of central South Carolina and eastern North Carolina prevented southern General Joseph Johnston from coming to the assistance of Robert E. Lee. Within one month, on April 26, 1865, Johnston would surrender his army to Sherman near Durham, North Carolina. Johnston would remark, "When I learned that Sherman's army was marching through the Salk swamps, making its own corduroy roads at the rate of a dozen miles a day and more, I made up my mind that there had been no such army in existence since the days of Julius Caesar."<sup>18</sup>

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<sup>16</sup> O. R., ser. 1, vol. XLVII, part 1, 173-174.

<sup>17</sup> O. R., ser. 1, vol. XLVII, part 1, 384.

<sup>18</sup> Taylor, 218; Bacon, 216. See also Jacob D. Cox, *Military Reminiscences of the Civil War*, 2 vols. (New York: Charles Scribner's Sons, 1900) 2: 531-532; Richard Harwell and Philip N. Racine, eds.,

The campaign was a remarkable achievement. Poe's staff, which included Amos Stickney, William Ludlow, and Chauncey Reese were West Point trained engineers, and they deserved credit for the proper execution of orders. The work building corduroy roads in the swamps, however, required improvisation, skill with an axe, saw, and hammer, and the ability to work out problems in brutal conditions. The First Missouri, the First Michigan Engineers and Mechanics, the Fifty-eighth Indiana Infantry, and about six thousand men who served as pioneers in the army did this work. These men were not West Point trained, but rather had learned their skills before the war in the mechanics' shops, mills, railroad and boat yards, and farms in the North. By 1865 Union engineers could take the army anywhere their generals wanted to go over the vast and varied terrain of the Confederacy.

In the eastern theater during the winter and early spring of 1865 the engineers were also hard at work against Robert E. Lee's Army of Northern Virginia, hoping to bring the American Civil War in Virginia to a close.

Grant had every intention of stretching Lee's lines as far as possible, around Richmond and Petersburg. This not only included an extensive flanking movement southwest of Petersburg, but also maintaining pressure on the northeastern defenses near Dutch Gap Canal in the area of the Bermuda Hundred.<sup>19</sup> Union supply distribution in this northeastern sector had used a pontoon bridge, built in September, but by December, freshets, floating ice, and driftwood in the river made passage over the pontoon bridge dangerous.

Therefore, in order to continue to bring quartermaster stores and ordnance into this area planning began for a permanent pile bridge. Grant's strategy was to extend Lee's lines

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*The Fiery Trial: A Union Officer's Account of Sherman's Last Campaign* (Knoxville: University of Tennessee Press, 1986), 213.

<sup>19</sup> The permanent bridge was built across the James River near Varina, and where the Varinal Road ended at the river. The south side of the bridge connected to Curl's Neck.



southwest of Petersburg, but to do so effectively, he needed to prevent Lee from acquiring reinforcements by shifting men from the northeastern sector to the southwestern one. The northeastern sector had to remain active, and consequently, it required a significant amount of supplies. The pile bridge was essential and troops from the 1<sup>st</sup> New York Volunteer Engineers began milling timber cut from the surrounding forests for it. On January 5<sup>th</sup>, Lieutenant William R. King, Corps of Engineers, and pioneers under the command of Captain James W. Lyon, 4<sup>th</sup> Rhode Island Infantry, began work on the bridge.<sup>20</sup>

The weather was erratic, and this caused delays. Private John H. Westervelt recorded in his diary entry for January 10<sup>th</sup>: “This is decidedly the wettest day I ever saw. All that I can see of Virginia is afloat.” The 16<sup>th</sup> he described as beautiful and warm and then the next day it snowed. Five days later he wrote: “This morning it rains and the earth here is covered with a complete glade of ice. The day was one continual deluge but the earth was so completely coated that the water ran off as fast as it fell.”<sup>21</sup>

These were difficult conditions in which to build a 1,350-foot long bridge with piles averaging forty feet long. Furthermore, because the main channel was twenty-five feet deep the piles there had to be 150 feet long. Each pier consisted of three piles driven into the riverbed and connected by a cap piece, and the piers were joined together to form bays fifteen feet wide. To form icebreakers, an inclined brace was attached to the piles at one end, and the other end was chained to a new pile ready to be driven into the riverbed. The new pile was sawed nearly

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<sup>20</sup> Thienel, 229.

<sup>21</sup> Anita Palladino, ed., *Diary of a Yankee Engineer: The Civil War Story of John H. Westervelt, Engineer, 1<sup>st</sup> New York Volunteer Engineer Corps* (New York: Fordham University Press, 1997), 199 and 206.

through just above the chain so once it was driven into the bed the pile could be broken off beneath the surface.<sup>22</sup>

On the left flank of Grant's army the engineers were also called upon to build bridges and roads intended to aid in the extension of the Federal line west, in order to force General Lee to stretch his already thinly held defensive positions even further. Major M. Van Brocklin had taken four companies of the 50<sup>th</sup> New York engineers along the Vaughan Road to Hatcher's Run just ten miles east of Five Forks to build a pontoon bridge and log bridge for the passage of army supply trains. The engineers then began to construct a permanent corduroy road from Hatcher's Run to Fort Siebert with the assistance of 2,000 men from the Second Corps and 2,000 men from the Fifth Corps. By the middle of February the work was completed and Van Brocklin was making a reconnaissance for an extension of the U. S. Military Railroad to Hatcher's Run.<sup>23</sup>

Raw, damp, miserable weather throughout February and March continued to beleaguer the army's flanking movement west and on result of heavy rains was that Van Brocklin's log bridge over Hatcher's Run was washed away. So on March 15<sup>th</sup> the engineers completed a bridge over Hatcher's Run 285 feet long, supported by eleven cribs each sixteen feet long, six feet wide, and from two to six feet high. The new roadway of the bridge consisted of two tracks, each eight feet wide, separated by median strip nailed to the flooring. The rain had also damaged parts of the Vaughan Road, and consequently time was spent making the necessary repairs there.<sup>24</sup>

Ten days later, 100 miles to the north near the point where the Confederate left flank rested on the Appomattox River, Confederate General John Brown Gordon, launched a surprise

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<sup>22</sup> *O. R.*, ser. 3, vol. V, 191-193.

<sup>23</sup> *O. R.*, ser. 1, vol. XLVI, part 1, 160. Fort Siebert was located approximately five miles northeast of the Hatcher's Run crossing and was road connecting the two points was an important supply link.

<sup>24</sup> *O. R.*, ser. 1, vol. XLVI, part 1, 163-164.

attack of the Union line at Fort Stedman, Petersburg. After the initial breakthrough, a Federal counterattack drove the Southerners back to within their own lines, and signaled to an observant General Grant that this was Lee's last effort to take back the initiative before evacuating Petersburg.<sup>25</sup>

In response, Grant wanted to move as quickly as possible to collapse the Confederate right flank and roll up Lee's army before the Virginian's army escaped, and began his race to link up with General Joseph Johnston's men, at this time in North Carolina. Consequently, the engineers work along the Vaughan Road and at Hatcher's Run allowed General Warren's V Corps to advance north, occupying ground on an east/west axis in Confederate General A. P. Hill's front. Major General Edward O. C. Ord's, Army of the James, then filled in between Warren on his left and the entrenched VI Corps of the Army of the Potomac on his right.<sup>26</sup>

Between March 30<sup>th</sup> and April 3<sup>rd</sup>, the engineers of the 1<sup>st</sup> New York, attached to Ord's army, the 50<sup>th</sup> New York, and the Engineer Battalion, skillfully and swiftly repaired roads and built bridges, which enabled Union infantry and cavalry to deliver a coordinated strike against southern forces, and brought on the final chase to Appomattox Court House and Lee's surrender. Colonel Spaulding arrived at Hatcher's Run late in the afternoon on March 30<sup>th</sup> and

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<sup>25</sup> Gordon was another bigger-than-life character produced by the Civil War. A fierce warrior, Gordon became a legendary figure after the war. At Malvern Hill, a Yankee bullet had shattered the handle of his pistol and another tore away the front of his coat before he was finally wounded in the eyes. During the fighting at the Sunken Road at Antietam, he was shot twice in the left leg, then again in the left arm and shoulder, and yet with muscles and tendons ripped and mangled he continued to encourage his men until a minié bullet tore through his face, entering at his left cheek and exiting out his jaw. His wife, Fanny Haralson Gordon, accompanied him in all his campaigns. According to Mark M. Boatner, III, "She was a prime annoyance to Jubal Early, who was once heard to wish to God that the Federals would capture her." See Boatner, III, 349. After the war it was believed that Gordon served as the titular head of the Ku Klux Klan.

<sup>26</sup> Sheridan's Union cavalry had ridden eight to ten miles south of Warren and Ord's lines and approached Dinwiddie Court House on the Boydton Plank Road. At the tip of a V, he was equidistant from Warren's lines to the northeast and Confederate General George Pickett's soldiers to the northwest near Five Forks. Between Warren's left flank and Five Forks there was a four-mile gap unoccupied by either army.

found that persistent rain had raised the water in the stream to where it was overflowing its banks making the approach to the log bridge unserviceable. Working until midnight, and resuming at 4:00am, some companies labored to repair washed out roads, while other companies raised the abutments of the pontoon bridge about four feet, and built a corduroy bridge 100 yards long over the flooded road to the small rise that ran to the south end of the bridge crossing the stream.<sup>27</sup>

With incessant rain turning the soil into sludge the 50<sup>th</sup> New York continued carving out a path for soldiers and the troop trains. Spaulding wrote, "During the 1<sup>st</sup> and 2<sup>nd</sup> of April my whole command was...engaged in building a double corduroy track on the Vaughan road [sic] from the old stage road to Hatcher's Run. During the whole of this time Major Van Brocklin had a pontoon bridge [different from the one next to the log bridge] over Hatcher's Run near W. Perkins house, and also one over Gravelly Run, near the Friends' Meeting House. He was ordered to keep these bridges in use until the whole of the trains on the route of the old stage road had passed."<sup>28</sup>

The Engineer Battalion maintained the roads beyond Hatcher's Run to assure that General Sheridan's sweeping flank movement toward Five Forks was successful. It was. On April 1<sup>st</sup>, Sheridan and Warren combined forces to overwhelm Pickett, and immediately orders were issued along the entire western sector of the Union army to move forward. Spaulding moved his command and pontoon trains along the Boydton Plank Road, the River Road, and Cox's Road, toward Burkeville. They repaired old roads and cut new roads for the movement of the V Corps.<sup>29</sup>

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<sup>27</sup> *O. R.*, ser. 1, vol. XLVI, part 1, 643.

<sup>28</sup> *O. R.*, ser. 1, vol. XLVI, part 1, 643.

<sup>29</sup> *O. R.*, ser. 1, vol. XLVI, part 1, 643.

Meanwhile, the 1<sup>st</sup> New York engineers marched ahead of the Army of the James parallel to the South Side Railroad also repairing roads and bridges. Other engineer troops were kept just as busy. In the city of Petersburg, General Benham ordered the 15<sup>th</sup> New York Volunteer Engineers to repair and reopen three bridges damaged by the Confederates in their evacuation. Under the command of Colonel Brainerd, his men entirely rebuilt one bridge, repaired the railroad bridge, and threw a pontoon bridge across the Appomattox, eliciting high praise from Benham. In the city of Richmond, a detachment of the 1<sup>st</sup> New York constructed a 2,400-foot pontoon bridge across the James River to connect Manchester with Richmond.<sup>30</sup>

During the momentous days of April 4 to April 9, 1865, it was General Ord's 1<sup>st</sup> New York engineers, the vanguard of his Army of the James who first arrived at the Appomattox River at Farmville, Virginia, on April 7<sup>th</sup>. The engineers left from the vicinity of Five Forks on April 3<sup>rd</sup> and had hauled their pontoon train over sixty miles in four days, at one point passing through the village of Blacks & Whites.<sup>31</sup> Just the day before, the Army of the Potomac's Second, Fifth, and Sixth corps pressing toward Sailor's Creek, which meandered just about two miles to the east of High Bridge and four miles east of Farmville, managed to cut off one quarter of Lee's army from their escape route over High Bridge. Sheridan's cavalry had blocked the Confederate's access to the bridge, and Union infantry and artillery working in conjunction with cavalry delivered a devastating defeat to an already depleted Army of Northern Virginia. Almost 8,000 Southerners were captured including nine generals.<sup>32</sup>

Now the 1<sup>st</sup> New York was ordered to throw a bridge over the Appomattox River at Farmville. Colonel Peter S. Michie, chief engineer, Army of the James wrote, "The pontoon train

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<sup>30</sup> *O. R.*, ser. 3, vol. V, 193.

<sup>31</sup> The village of Black & Whites is known today as the city of Blackstone, Virginia.

<sup>32</sup> Most historians identify this battle as Saylor's Creek. This is the modern spelling, although Virginia county maps printed in 1865 designate the site as Sailor's Creek.

of our army having been well kept up to the front, notwithstanding its overloaded condition, was fortunately able to pass over the artillery and train of the Sixth and Second Army Corps and enable them to follow in rapid pursuit of the enemy that night.”<sup>33</sup> General Sheridan telegraphed Grant to say that with the Sixth and Second Corps on Lee’s heels, if Sheridan and the lead elements of the Army of the James could press ahead to the vicinity of Appomattox Court House, Union troops might surround the Army of Northern Virginia forcing Lee to surrender. President Lincoln had seen Sheridan’s correspondence with Grant. Now Lincoln telegraphed Grant on April 7<sup>th</sup> at 11:00am: “General Sheridan says, “”If the thing is pressed I think that Lee will surrender.”” Let the *thing* be pressed.”<sup>34</sup>

The final months of fighting for the Army of Northern Virginia in March and April 1865 were indicative of the difficulties southern armies had in engineering operations. On April 2nd and 3rd, the Army of Northern Virginia evacuated the city of Petersburg and started marching west toward Danville and the railroad there, hoping to find supplies for Lee’s starving men and horses. Colonel Talcott, in advance of Lee’s escape from Petersburg, had ordered Captain G. W. Robertson of the 1<sup>st</sup> Engineer Regiment, to examine the crossings of the following: the Staunton River above the railroad, Moseley’s Ferry to Russell’s Ferry, eight miles above Clarksville, and South Boston on the Dan River.<sup>35</sup> These places would need to be bridged for the army to get to their waiting supplies.

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<sup>33</sup> *O. R.*, ser. 3, vol. V, 194.

<sup>34</sup> *Lincoln: Speeches, Letters, Miscellaneous Writings, Presidential Messages, and Proclamations*, 696.

<sup>35</sup> Harry L. Jackson, *First Regiment Engineer Troops, P. A. C. S.: Robert E. Lee’s Combat Engineers* (Louisa, VA: R. A. E. Design and Publishing, 1998), 132. The Staunton River runs in a westerly direction approximately forty miles south of the Appomattox River. The Dan River runs east to west along the Virginia/North Carolina border connecting with Danville. The Staunton River forks with the Dan thirty miles below Marysville Court House.

Robertson managed to throw a pontoon bridge across the Staunton River near the railroad bridge on March 30<sup>th</sup>. The following day, however, freshets from the recent downpours, exploded down the river and tore away six bateaux, one-third of his chesses, half of the balks, and a quarter of the anchors. Robertson acted quickly. He ordered his men to salvage what they could of the bridge, and the captain sent off a message to Major Grandy, quartermaster in charge of river transportation, asking for additional pontoons and lumber.<sup>36</sup>

The response to Robertson's plea came six days later, when Grandy's assistant informed the captain that the major was not available, and furthermore, he had no orders to allow the engineer troops the use of the pontoons! This response, moreover, was not the only questionable occurrence involving the engineers. Because Lee found his southwestern line of march blocked by Union cavalry and the high water around Bevil's Bridge, he immediately redirected his columns to march north to Goode's Bridge where his entire Petersburg force would cross the Appomattox River. Lee inquired into the whereabouts of a pontoon bridge he had ordered shipped to Genito, fifteen miles north of Goode's Bridge. It turned out that some bureaucrat had appropriated the pontoons so he could float himself and his personal property up the James River. Therefore, with one bridge inaccessible due to high water, and one bridge purloined, Lee ordered the engineers to plank over the railroad bridge at Mattoax. Once across, both the railroad, and for some unexplained reason, the pontoon bridges were destroyed.<sup>37</sup>

Now the Army of Northern Virginia moved west toward Farmville with the hopes of crossing the Appomattox over High Bridge. With a head start and perhaps some luck, Lee hoped to beat the Union army to the South Side Railroad somewhere west of Appomattox Court

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<sup>36</sup> *O. R.*, ser. 1, vol. XLVI, part 3, 1369. See also Jackson, 135.

<sup>37</sup> Jackson, 140. It was possible that Lee did not want his men encumbered by the slow moving pontoon train. They were in a race with Grant's army, although without a pontoon bridge their movement options were limited.

House, gather supplies, and move on to Lynchburg, and then a link-up south with Johnston's army. This was the only possible route left. Taking the roads north, away from Grant's line of march was an option, but eventually by moving north Lee's army would need to cross the James River. He had no pontoons with him to make the crossing.<sup>38</sup>

When the army reached High Bridge on April 6<sup>th</sup> it immediately began to cross the two thousand four hundred foot span. The river at the bridge was only one hundred feet wide, but a wide and steep valley on either side of the river required that the structure be built to such length. The height of the bridge varied from sixty feet, at the abutment, to one hundred twenty-five feet near the river. Twenty-one brick piers on stone bases supported the South Side railroad bridge, and the trestles were made of pine with a tar coating. Just below the superstructure was a wagon bridge, which made it easy for horses and artillery pieces to cross.<sup>39</sup>

On the following morning, April 7<sup>th</sup>, after Lee's army had crossed, Confederate soldiers prepared to burn the bridge. Then from almost nowhere the 19<sup>th</sup> Maine Infantry appeared, and rushed the wagon bridge. As some Mainers used their bayonets to toss the lighted hay bales into the water, others crossed and established a skirmish line with both flanks anchored on the river. The upper bridge caught fire more readily, and Confederate engineers from Company G fought furiously to keep the Yankees off the bridge. Some portion of High Bridge was damaged, but the lower bridge was unharmed. Consequently, the slight distance Lee believed he had placed between his army and that of the pursuing Federals was gone because his men had failed to destroy both bridges. That afternoon Grant wrote a brief note to Lee: "The results of the last week must convince you of the hopelessness of further resistance on the part of the Army of Northern Virginia in this struggle. I feel that it is so, and regard it as my duty to shift from myself

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<sup>38</sup> See *The Official Military Atlas of the Civil War*, plate 137.

<sup>39</sup> Jackson, 147.



the responsibility of any further effusion of blood by asking of you the surrender of that portion of the Confederate State's army known as the Army of Northern Virginia."<sup>40</sup>

The bridge had not been burned sooner due to a lack of flexibility and initiative. Colonel Talcott and his engineer troops were prepared to fire the bridge as soon as they received the order from their infantry commander, General William Mahone. The general, a railroad engineer before the war, more than likely, rode off with his rear guard without giving the order, or assumed the engineers would proceed without his express permission. Either way, it was a costly miscommunication, and it demonstrated little initiative on Talcott's part. When Lee learned what had happened he lost his temper. A staff member observed, "He spoke of the blunder with a warmth and impatience which served to show how great a repression he ordinarily exercised over his feelings."<sup>41</sup>

Lee surrendered his Army of Northern Virginia to General Grant on April 9, 1865. It was only fitting that in one of the final acts of the war an engineer played a central role. After Grant had written out the surrender document in pencil and Lee both read and approved it, Grant turned the paper over to Assistant Adjutant General Theodore Bowers requesting he make a fair copy in ink. Bowers, feeling the solemnity of the proceedings and overcome by the weight of the historical moment, made several flawed attempts to copy Grant's surrender document to Lee. Frustrated and nervous, Bowers turned the responsibility over to another member of Grant's staff, General Ely Samuel Parker.<sup>42</sup>

Parker was a Seneca Indian chief, and after graduating from Rensselaer Polytechnic Institute as a civil engineer, he worked on the Erie Canal and engineering projects in Illinois,

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<sup>40</sup> Robert Hendrickson, *The Road to Appomattox* (New York: John Wiley & Sons, Inc., 1998), 176.

<sup>41</sup> Shelby Foote, *The Civil War, A Narrative: Red River to Appomattox* (New York: Random House, Inc., 1974), 922.

<sup>42</sup> Robert Hendrickson, *The Road to Appomattox* (New York: John Wiley & Sons, Inc., 1998), 198.

where he meet Grant. When the war broke out he asked to join the army as a Union engineer, but Secretary of War Simon Cameron told him he could not because he was Indian.<sup>43</sup> He contacted Grant, who needed engineers, and he assigned Parker to Brigadier General John Eugene Smith. Parker served throughout the Vicksburg Campaign as an engineer before joining Grant's staff.

Now the engineer made a handsome clean copy of the surrender document, which both Grant and Lee signed. The war in the east was over.

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<sup>43</sup> Arthur Parker, *The Life of General Ely S. Parker* (1919; repr., Buffalo: Buffalo Historical Society, 2005), 102-103.

## CHAPTER 11

### **“THE BRIDGE SHOULD HAVE BEEN FINISHED LONG AGO.”**

**Honor and shame from no Condition rise;  
Act well your part, there all the honor lies.**

**Alexander Pope, *An Essay on Man***

The day after Confederate General Robert E. Lee surrendered to Union General Ulysses S. Grant Lee wrote his Farewell Address: “After four years of arduous service, marked by unsurpassed courage and fortitude, the Army of Northern Virginia has been compelled to yield to overwhelming numbers and resources.”<sup>1</sup> Beginning in the winter of 1862-1863, when Lee’s army went hungry and it became increasingly difficult to replace soldiers lost to capture, wounds, or death, the southern army fought a losing battle against declining resources, which gnawed away at their ability to sustain the fight. The lack of food, clothing, footwear, medical supplies, and manpower made conditions brutal. In the final days of the war, Lee believed and wanted everyone else to believe that overwhelming resources had crushed the Confederate army.

On paper the North did have overwhelming resources. At the start of the war twenty-two million Americans lived in the North, and only nine million lived in the South including 3.5 to 4 million African American slaves who would never support the Confederacy. The North was the manufacturing center of the country, and as such, had a monopoly on industry, iron, textiles, machine shops, railroad and shipyards. The Northern railroad system was three times the size of

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<sup>1</sup> Hendrickson, 202. See Elizabeth R. Varon, *Appomattox: Victory, Defeat, and Freedom at the End of the Civil War* (Oxford: Oxford University Press, 2014). Varon skillfully argues that Lee’s comments regarding “overwhelming resources” were not entirely true and were not just commentary on why the South lost the war. Instead, Lee consciously established the post war theme of “might beat right” highlighting the Confederacy as noble but overawed experiment. This set the southern political agenda in the post war period, which worked to frame, celebrate, and maintain the principle values of the old Confederacy.

the South's, which directly contributed to the flow of supplies from farmers in Minnesota and Wisconsin, and factories in Pennsylvania and Connecticut, to army depots in Philadelphia, Boston, New York, Louisville, and Cincinnati. These resource advantages were especially prevalent when it came to manpower on the battlefield. In reviewing the ten costliest battles of the Civil War, in all but one—Chickamauga—the North outmanned the South.<sup>2</sup> Furthermore, during the Peninsula, Vicksburg, Atlanta, and Carolina campaigns the South was outnumbered. As historian Richard N. Current posited in the 1960s, and what has become the most common explanation of why the South lost the Civil War, it was overwhelming resources.

Yet, the overwhelming resources argument alone did not account for northern victory. First, delivering these abundant supplies to the forward areas of advancing Union armies presented a unique challenge. It was one made particularly problematic by the great advantage the South had in fighting on home soil, in the number of civilians the South had acting as scouts and spies, and in the operation of guerilla bands wreaking havoc on Union supply lines. Furthermore, two other Confederate advantages neutralized the North's considerable resources: tactical warfare in the mid-nineteenth century and terrain.

Soldiers carried muzzle-loading rifles into combat with an effective range of 150 to 200 yards. Generally, a soldier could fire three shots in a minute, discounting the panic and terror that would come from being shot at by an enemy intent on killing you. Therefore, as regiments attacked and attempted to close upon the opponent, the attackers firepower was diminished as they ran forward toward the enemy's lines. Consequently, for those on the defensive their advantage was significant. Standing or kneeling behind barricades provided the soldier with a

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<sup>2</sup> The ten costliest battles of the Civil War, in descending order, are the following: Gettysburg (51,112), Chancellorsville (34,624), Spotsylvania (30,399), Chickamauga (30,099), the Wilderness (25,416), Second Manassas (25,251), Stone's River (24,645), Shiloh (23,741), Antietam (23,134), and Fort Donalson (19,455).

greater chance of firing and reloading quickly, getting off several shots before the enemy was close enough to use their bayonets. Artillery canister and grapeshot also played havoc with the attackers. As a result, to attack successfully required overwhelming numbers of men at the point of attack, which meant you needed at least three times the number of men to drive the enemy from a well-defended position. In addition, defenders had the advantage of hastily moving men from one place in the defensive line to the point under attack. Operating on internal lines of communication this gave the defender another distinct advantage over the attacker. Southern forces had fewer soldiers than their northern enemy, but they had the tactical and strategic benefit of defending ground of their own choosing to defend and of moving men and material on more direct and shorter internal lines.

In addition to the strategic and tactical advantage the South had, the terrain, which had to be overcome and tamed by Northern troops as they extended into Southern territory, was vast. The eleven seceding states formed an area of approximately 750,000 square miles. There was no central road system and Southern railroads, built hastily and engineered as cheaply as possible offered no help to the invading armies.<sup>3</sup> The Appalachian Mountains, the lowlands and swamps in North Carolina and South Carolina, the Mississippi flood plain, the Cumberland, Tennessee, and Mississippi Rivers, and the myriad of lakes, streams, and small rivers, and dense forests provide fierce natural obstacles to the North's strategic planning.

With strategic, tactical, and terrain advantages in mind, many southerners after the war rejected the overwhelming resources theory (yet accepted the noble experiment theory) in an attempt to explain why the South lost. General P. G. T. Beauregard claimed that, "no people ever warred for independence with more relative advantages than the Confederates; and if, as a military question they must have failed, then no country must aim at freedom by means of war."

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<sup>3</sup> John Keegan, *The American Civil War: A Military History* (New York: Alfred A. Knopf, 2009), 70.

He continued, "The South would be open to discredit as a people if its failure could not be explained otherwise than by mere material conquest." Beauregard, no admirer of Jefferson Davis, blamed flawed strategy and the president's lack of leadership for Confederate defeat.<sup>4</sup>

Flawed strategy arguments were difficult to prove. Beauregard, Joseph Johnston, and Braxton Bragg represented a western bloc of generals who had, throughout the war, insisted on focusing manpower resources in the western theater, much to the disapproval of Lee in the eastern theater. Davis was in the middle. He did not want to alienate either side, and for the most part, supported General Lee's suggestions. Davis's favoritism toward the eastern theater certainly had an impact on military operations in the west, but did not result in the Confederacy's military failure.

Some southerners blamed President Jefferson for defeat. The argument went that the Confederacy collapsed because Davis was unable to see beyond the South's states' rights dogma, and he failed to manage Congress and state governors in a more courageous fashion. For example, as historian David M. Potter pointed out, the Confederate Congress adopted an economic policy, which Davis supported, that lacked the central controls necessary to sustain the war effort financially. The embargo on cotton, the failure to pass a national tax to curb inflation, and the impressment of goods and services placed the South on financial quicksand. These policies drained Southern bank accounts, and brought suffering and starvation to millions of Confederate civilians. Defeats on the battlefields and hardships at home eventually weakened the South's will to fight.

Davis's adherence to states' rights policies by not insisting on a national tax, his decentralized command structure, his failure to nationalize the railroads, and his inability to

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<sup>4</sup> Richard E. Beringer, Herman Hattaway, Archer Jones, and William N. Still, Jr., *The Elements of Confederate Defeat: Nationalism, War Aims, and Religion* (Athens, GA: The University of Georgia Press, 1988), 187.

persuade state governors such as Zebulon Vance of North Carolina, to adopt a more unified view of sharing resources and services throughout the entire Confederacy, might just have led to the South's breakdown.

Yet, although Davis lacked diplomatic or political skills, and bickering generals, flawed economic policies, and declining morale have been the focus of historians' inquiries as to why the South lost the Civil War, these explanations appear inadequate. Even though Davis's leadership skills compared unfavorably to Lincoln's, even though a poor fiscal and monetary policy, limited resources, poor economic policies, suffering on the home front, and the lack of a military grand strategy hindered the Confederacy, the South still had an opportunity to win its independence.

Certainly in 1863 after Gettysburg and Vicksburg it seemed unlikely that the Confederates would enjoy their own Cannae, Agincourt, or Rorke's Drift, but there still remained the possibility that the South could force the Union to the bargaining table, and with a war weary northern citizenry, and pressure from the Democratic Party, gain their independence. Therefore, the question to ask is up to what point in the war did southern independence remain possible? Why after this point was southern independence impossible? How should historians assess the years of fighting leading up to this critical breaking point?

In November 1864, when Abraham Lincoln was elected president for a second term, defeating the Democratic candidate George McClellan, who ran on a platform that left open the possibility of a negotiated peace, the hopes of the Confederacy vanished. Lincoln had promised to prosecute the war until the Confederacy collapsed and the Union was restored. Now Confederate morale fell precipitously, desertions in the army soared, and the economy with three hundred percent inflation was on the verge of collapse.

The Confederacy's hopes had rested on the outcome of the North's November election, and for sometime it had looked as if McClellan and the Peace Democrats would win. The war had dragged on for four long, brutal, and heartbreaking years, and although Union armies had achieved some success, the northern public and press perceived the Wilderness, Cold Harbor, and Spotsylvania as accomplishing nothing but more dying and suffering. Was it all worth the cost? In early August, Grant was stalled outside Petersburg, and Sherman was struggling around Atlanta. Wilmington, North Carolina and Mobile, Alabama remained in Confederate hands. If Southern armies could prolong the war by maintaining control of Atlanta, Petersburg, and Richmond until at least the election, disillusioned northern voters might put another man in the White House.

Of course, they did not. Southern forces ran out of real estate between Chattanooga and Atlanta, and they had to evacuate the city on September 1, to escape being completely surrounded. They were unable to delay Sherman's advance any further. Confederate partisans, cavalry, and guerrillas had tried to block Union soldiers, with little success, from advancing farther south through Georgia in the summer of 1864. Union engineers were also more skillful at circumventing those roadblocks when they did occur.

It was like this during the four years of war. On numerous occasions, southern forces had tried to cut off or delay Union supply trains from reaching combat areas as Confederates damaged railroads, blocked roads with felled trees, and destroyed bridges. Furthermore, the natural geographic barriers, including cypress swamps, flooded rivers, and deep ravines piled on to the obstacles the Union army had to overcome. If delays of just weeks or a month, had stopped Union armies from controlling the Cumberland and Tennessee Rivers or prevented them from getting to Vicksburg when they did, perhaps Sherman would not have arrived in Atlanta, if at all, until November too late to help swing the election in Lincoln's favor. So in



looking back at the crucial campaigns and battles in 1862 at Forts Henry and Donelson and Island No. 10, or in 1863 at Vicksburg and Chattanooga, if these events had turned out differently, or more importantly, if they had delayed the advance of the Union army longer than they did, would the Confederacy's chances for independence been conceivably greater? It is difficult to speculate, but the evidence strongly suggests that the real difference maker in the war was the North's ability to sustain military operations deep inside the Confederacy, and the South's problem in fighting a war of logistics.

The North was able to sustain military operations in the South over vulnerable and lengthy supply lines subject to frequent sabotage and disruptions because they had a large pool of trained civil engineers, mechanics, toolmakers, and managers to draw upon. Conversely, the South's pool of men with mechanical ability and managerial skills was too small primarily because the South was blinded by its own cultural assumptions, and because before the war the constraining factor of slavery contributed to a culture that denied ordinary southern white men the benefits of common school education, prevented the dissemination of ideas out of fear, blocked attempts to expand industrial development, and promoted a top-down "planters know best" mentality.

What made the difference between winning and losing the war was in the Union's ability to sustain the operations of armies deep inside the Confederacy, and the South's inability to manage a war of logistics, which would have allowed for greater flexibility in both strategic and tactical planning. If Lee's army was better fed and supplied in the winter of 1862-1863 would a Gettysburg campaign have been necessary? If better railroad management and engineering had been present in the winter of 1862, would Sidney Johnston would have been able to hold onto upper Tennessee and the Cumberland and Tennessee Rivers longer than several months preventing Yankees from taking over Nashville so early in the war?

Channing M. Bolton, a young man who had studied engineering at the University of Virginia for one year before joining the State of Virginia's Engineers in 1861 and then served with the Army of Northern Virginia, remembered a time he had travelled with General Lee. The engineers had been ordered to build a bridge over the Rappahannock River, but the work had been delayed far too long to suit the general. After learning who was in charge, Lee spoke to the lieutenant sternly. "What is the trouble here? My people have been waiting for hours to cross this stream. The bridge should have been finished long ago." The lieutenant responded that he did not have the necessary guy ropes to complete the construction. Dismounting, Lee walked toward the bridge and noticed the end of a rope under the seat in one of the boats. Bolton continued, "He [Lee] called to a soldier to pull it out, and this proved to be a coil of just such a rope as the lieutenant needed. The general told the soldier to drop it in front of the lieutenant, and without saying a word more, he mounted his horse and rode off."<sup>5</sup> The limited amount of competent Southern engineering and poor logistical management damaged the Confederate war effort.

The reason for the small pool of skilled men who, before the war, were trained as professional engineers and managers was the result of the constraining factor of slavery on many levels. Besides the horrific toll slavery took on the men, women, and children enslaved, it also was responsible for choking off intellectual growth among its citizens. The upper class South carefully protected their status in society, and opportunities for financial and intellectual growth were consciously limited. Information and ideas were contained. When talk of bringing manufacturing to western Virginia reached the halls of the state's legislature, the controlling planter elite blocked efforts to pass laws that might assist in supporting industry because

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<sup>5</sup> Channing M. Bolton, "With General Lee's Engineers," *The Confederate Veterans Magazine* vol. XXX, no. 8 (August 1922): 300.

manufacturing was perceived as a threat to the establishment's power. When the few manufacturing businesses in the South did required training to adjust to changing technological developments, owners were careful to select white men who would not spread ideas about liberty and freedom to the predominately black labor force. Furthermore, ideas in the South only flowed one way: top down. Labor, white or black, did not dare suggest ideas to management.

This relationship between management and labor mirrored the relationship between owner and slave. The parochial worldview established in the years before the war was directly linked to how the Confederacy managed, not the fighting—for commanding men came naturally to Southerners—but the most critical business of war. The South's vulnerability in conducting the massive logistical operations required during the Civil War was exemplified in the educational, and transportation systems established during the antebellum period.

Before the war the South paid considerable attention to higher education and the development and growth of private academies to instruct the sons of plantation owners and the small middle class. Following in the tradition of Thomas Jefferson whose concept of the university maintained by the state and free to young men who intellectually qualified, the South pioneered the state university and before 1830 had established five of six institutions of this class in the United States.<sup>6</sup>

The academies were represented by a variety of institutions, some private, some aided by the state, and many under denominational control. Yet, they all had one thing in common: these schools were designed to prepare the sons of the wealthy for college, and consequently, provided a classical education, which included the study of Greek and Latin. Discipline was

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<sup>6</sup> Herbert T. Coleman, "The Status of Education in the South Prior to the War Between the States," *Confederate Veteran Magazine* 25, no. 10 (October 1907), 441.

Spartan like, so it was not uncommon for the famous headmasters of these schools, such as Moses Waddell and Robert L. Armstrong to “ruin many a heavy pair of winter pantaloons at a single whipping.”<sup>7</sup>

For the majority of Southern citizens, however, there was little opportunity to master the basics of learning. The common school movement in the South, with the exception of North Carolina, was virtually non-existent before the war. The teachers in the few schools that did exist were often incompetent. State legislatures did not supervise nor care about these schools, there were no district libraries, and the schoolhouses themselves were in many cases without furniture and books. Furthermore, many farmers wanted their sons to handle an axe and plow, and believed formal learning was only required of the upper classes.

This lack of attention to the development of common schools was a choice. Comfortable in maintaining the social hierarchy, the men who held the power to change the system had no interest in doing so. This did not mean, of course, that illiterate Southerners did not possess remarkable good sense and intelligence. It did mean, however, that during the Civil War when men were needed to repair railroads or build bridges, those with more than good sense were hard to find. Bridge building and repairing locomotives also required some mechanical knowledge and some basic mathematics and science. Therefore, it should not be surprising that when the Confederate First Regiment Engineers were formed in 1863, only half the companies could be designated as pontoon bridge builders.

The Confederacy’s management, or mismanagement, also had its roots in the antebellum period. Southern railroads, with the exception of a half dozen lines, were built in places that allowed the owners to transport the wealth of crops grown on the plantations to the market. Frequently, these lines did not connect with others creating serious gaps in the system.

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<sup>7</sup> Coleman, 444.

For example, the West Feliciana Railroad, Clinton & Port Hudson, and Baton Rouge, Grosse Tete & Opelousas all ran from the countryside to the Mississippi River. Moreover, the management of these short lines closely guarded their turf, running them as cheaply as possible because the low volume of passenger traffic generated little revenue. Since they were small lines, management could be highly centralized supervising every aspect of the business. The reliance on others who might have to manage a station on a longer line 150 miles away, was not something Southern railroad management, for the most part, had to consider.

Repair work on the tracks, bridges, water stations, and locomotives was done locally, which impaired the manufacturing of railroad supplies and locomotives. There were a small number of locomotive manufacturers and rolling mills in the South and this kept demand limited. There were also not enough skilled mechanics to support a booming manufacturing sector of the economy. Limited demand, few skilled workers, a transportation system with significant gaps, and a dominant planter class worked in conjunction to create a business culture that was not prepared for the logistical challenges of the Civil War. In the final days of the Army of Northern Virginia's existence, the Richmond & Danville Railroad had managed to rescue all of its engines and cars from the burning city, and the president of the company, Lewis E. Harvie, wanted Jefferson Davis to order the small labor force working to build fortifications at Danville instead, to work to change the width of the Piedmont Railroad so it matched the gauge of Harvie's trains. The disagreement between Davis and Harvie was moot. It does reveal, however, that right until the end, the Confederacy's management issues haunted them.<sup>8</sup>

During the first two years of war there was enough Confederate firepower to block Union advances into Tennessee, Mississippi, and Alabama. Poor planning and a limited number of skilled engineers and mechanics resulted in careless engineering efforts at Forts Henry and

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<sup>8</sup> *O. R.*, ser. 1, vol. XLVI, part 3, 1391-1392.

Donelson, confusion and conflict between private railroad companies and the Railroad Bureau, the loss of Pemberton's army at Vicksburg, Bragg's failure to capture Grant's army at Chattanooga, and the Confederate army's unwillingness to form engineering regiments until the spring of 1863. Confederate difficulties during the first half of the war did not exist because of limited manpower, but because of the skills or lack of particular skills men in both armies possessed. Engineering constituted the "tipping point," as author Malcolm Gladwell coined the phrase, of the war. Both sides had skilled warriors and generals; only one side had an overwhelming number of skilled mechanics, craftsmen, and engineers.

A major number of skilled craftsmen in the South were African-American slaves. These men were forced to construct forts and earthworks throughout the Confederacy during the war, but many slave owners were obstinate in their refusal to lend their slaves to the military. In December 1864 the War Department's Bureau of Conscription, announced a plan, approved by General Lee, to impress African-American slaves into Confederate labor gangs based on a state quota system. Governor A. G. Magrath of South Carolina asked his state agent, R. B. Johnson to investigate how his citizens would respond to the new War Department directive. On January 10, 1865, Johnson reported to the governor: "...I am fully assured, from my knowledge of the difficulties and embarrassments which attend the levying of slave labor, that the conscript authorities cannot successfully proceed with such impressment." He continued, "The aid and the authority of the master is indispensable, and as the Confederate authorities possess no control over him, can impose upon him no pain or penalties, they must in the present condition of affairs be powerless to act effectually. I am satisfied that slaves can be impressed only through the agency of the State authorities in conformity with State law."<sup>9</sup>

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<sup>9</sup> *O. R.*, ser. 4, vol. III, 1022-1023.

With no money and a limited labor force, Southern engineer officers and their men would perform as well as possible considering the circumstances. An example of this was the Third Regiment Engineers, which accompanied the Army of Tennessee from the late spring of 1863 to the end of the war. Under the command of Lieutenant Colonel Stephen W. Presstman and Major John W. Green, the regiment spent the Atlanta Campaign building field fortifications and throwing pontoon bridges. On some occasions, as in the lines at "East Point" (Atlanta), Presstman's men served as infantry.<sup>10</sup>

The regiment officially listed nine companies, but only eight were raised, and of those only five were effective bridge builders.<sup>11</sup> In December 1864, when General Hardee sought to leave Savannah one step ahead of Sherman's approaching army, engineers from companies B and F used three pontoon bridges to aid in the southern army's escape. The first connected the wharves of Savannah with Hutchinson's Island and was 1,000 feet long. Next a bridge was thrown over the Middle River, and a third spanned Back River to the rice dams of South Carolina. The bridges were made up of barges because of the shortage of pontoons. Once the army crossed the bridges were destroyed.<sup>12</sup>

Unfortunately, the successful extraction of Hardee's army from Savannah was not enough to prevent the eventual surrender of Joseph Johnston's army. In mid-January 1865, Company E, Hart's Engineers, and Company A, under the command of Captain Robert C. McCalla, were ordered to report to General Jubal Early to form the Engineer Battalion of the Department of Western Virginia and East Tennessee. They were assigned the impossible task of

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<sup>10</sup> *O. R.*, ser. 1, vol. XXXVIII, part 5, 961.

<sup>11</sup> Confederate Engineer regiments identified men with some mechanical or carpentry skills as artificers. Of the eight companies in the Third Regiment only companies A (36), B (65), C (50), F (54), and G (60), had a sufficient number of artificers. The others, D (1), E (5), and H (11) did not have enough skilled men to be responsible for pontoon bridge building. Company K was never formed.

<sup>12</sup> Nichols, 100.

repairing thirty-three destroyed railroad bridges on the Virginia & Tennessee Railroad. It was a forlorn hope.<sup>13</sup>

It took days to get a pontoon bridge in place, and once men crossed, engineers often failed to take up the bridge or destroy it. On February 17, 1865 a pontoon bridge was ordered across the Savannah River on the road between Abbeville, South Carolina and Washington, Georgia. A Major McCrady was charged with the duty. Two days later the bridge was still not in place and Captain A. H. Buchanan, Army of Tennessee engineers, reported that he would assume responsibility for its construction.<sup>14</sup>

The three other Confederate engineer regiments also experienced difficulties in the final months of the war. The 4<sup>th</sup> Regiment Engineers had formed in the summer of 1864 at Shreveport, and most of the men who signed on with the unit were from Louisiana, Arkansas, and Texas. They worked on the Mobile, Alabama defenses, but no more than three companies were formed, and the regiment was broken up in early 1865.

In the eastern theater, General Lee's pioneers and the First and Second Engineers did all in their power to maintain the defenses around Petersburg. According to engineer Lieutenant Henry Herbert Harris, the engineers spent their time countermining, working on fascines, and repairing bridges. He noted in his diary, "September 24, Saturday...Again...worked on the bridge...a showery day and I got quite wet.... In the afternoon prepared a sermon for tomorrow's exercises."<sup>15</sup> Four days later he wrote, "Got our bridge passable for footmen." Then finally on

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<sup>13</sup> "Company E 3<sup>rd</sup> Regiment Confederate Engineers," at hartsengineers.com (accessed September 21, 2013). See also *O. R.*, ser. 1, vol. XLIX, 1022; *O. R.*, ser. 1, vol. XLIII, part 2, 945.

<sup>14</sup> *O. R.*, ser. 1, vol. XLVII, part 2, 1210-1230.

<sup>15</sup> Henry Herbert Harris, "H. H. Harris' Civil War Diary (1863-1865) Part II," ed. W. Harrison Daniel, *The Virginia Baptist Register* 36 (1997): 1855.



September 30, "We finished our bridge."<sup>16</sup> Harris never mentioned the type of bridge nor its length, yet six days was a long time to finish the structure.

In addition to suffering from a lack of skilled mechanics and engineers, the Confederate military had a thorny time trying to solve its persistent and vexing railroad problems. The Railroad Bureau in Richmond had tried valiantly to repair damaged lines, collect and operate engines, cars, and repair facilities, manage a train schedule, negotiate with owners of private companies regarding issues of military traffic and freight rates. The bureau could not, however, overcome poorly laid track, few repairmen, egotistical generals, a command structure that was dysfunctional, and a government committed to ideological purity rather than military necessity.

For example, after the fall of Atlanta, the Army of Tennessee, led by General Hood, requested that the Mobile & Ohio and Memphis & Charleston be repaired as far as Decatur, Alabama. The request was sent to General Bragg, military adviser to Jefferson Davis. Bragg passed the message on to General Beauregard who was recently appointed commander of the Military Division of the West. Beauregard finally approved the request, but no one communicated the decision to Major George Whitefield, the railroad engineer in charge of repairs. When Whitefield was notified of the need for his services, he quickly organized a work force of impressed slaves, and they managed to mend the tracks so supplies could be forwarded to Hood's army.<sup>17</sup>

In Virginia, General Lee had hoped to use the Piedmont, the South Side, and the Richmond & Danville railroads as his supply line as the army moved west after evacuating Petersburg. Depots were filled with food and ammunition at Greensboro, Danville, and Lynchburg, but the railroads themselves were in considerable disrepair. Since June 1862,

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<sup>16</sup> Harris, 1855.

<sup>17</sup> Black, III, 264-265. See also *O. R.*, ser. 1, vol. XXXIX, part 2, 844-845.

Captain Edmund T. D. Myers of the Confederate Corps of Engineers had supervised the construction of the forty-eight mile Piedmont Railroad between Danville, Virginia and Greensboro, North Carolina. It was completed in May 1864, and yet in the winter of 1865 the railroad still had no water stations, supplies of wood, or sufficient sidings.<sup>18</sup> Furthermore, throughout the month of January 1865, Colonel Sims, chief of the Railroad Bureau, had to negotiate with the management of both the South Side and Danville & Richmond, because neither was willing to interchange their rolling stock. The two railroads finally compromised. They agreed to share their cars for one month until “neutral” cars could be brought in from the Virginia & Tennessee Railroad, which had been destroyed by Union General George Stoneman’s cavalry.<sup>19</sup>

Government control of the railroads was needed, it had been always needed, and with the collapse of the Confederacy looming, it was finally addressed. On February 19, 1865 the Confederate Congress overwhelmingly passed “an act to provide for the more efficient transportation of troops, supplies and munitions of war upon the railroads, steamboats and canals in the Confederate States, and to control telegraph lines employed by the Government.”<sup>20</sup> It was, of course, too late to change the outcome of the war.

For popular historians like Bruce Catton and Shelby Foote, the problems with the Confederacy’s railroad system during the war only highlighted the accomplishments of Southern railroads and made manifest how remarkable it was that the South achieved any success at all—like the transfer of Longstreet’s men to Chickamauga—working with so little.<sup>21</sup> The limited

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<sup>18</sup> Jackson, 121.

<sup>19</sup> Black, III, 282. See also the Richmond *Daily Examiner*, January 3 and January 31, 1865.

<sup>20</sup> *Journal*, Confederate States Congress, VII, 584-586.

<sup>21</sup> Clark, Jr., 231.

accomplishments were impressive, but these historians failed to address why the South was working with so little.

Historian James Huston remarked that the Confederacy did not have a Lincoln or Stanton, a Tom Scott, Herman Haupt, David McCallum, and the skillful mechanics working in support of these great minds.<sup>22</sup> The flaw in Huston's argument, however, was the implication that these men just happened to live in the North before the Civil War, when in reality during the antebellum period, the South chose to invest in plantation farming in general, and cotton in particular, and not in manufacturing. Historian John E. Clark, Jr. wrote:

"Southerners...demonstrated entrepreneurial initiative in those enterprises that they valued. Unfortunately for the Confederacy, they spurned those endeavors that would have taught them the variety of talents most needed to a fight a war of logistics. Excellence in managing cotton plantations does not seem to have given them adequate transferable skills for war management."<sup>23</sup>

Conversely, the efforts of the railroad men of the North should not be taken for granted. Shelby Foote's "the North could have fought the war with one hand tied behind its back," interpretation was a far cry from the innovation, labor, and effort expended to supply the armies in the fields. For example, in Daniel McCallum's final report in 1866 for the United States Military Railroad Department, he wrote about the experimental nature of managing military railroads and said, "The fact should be understood that the management of railroads is just as much a distinct profession as is that of the art of war..." and that "it was extremely difficult to induce those who were really valuable to leave the secure positions and enter upon a new and

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<sup>22</sup> James A. Huston, *The Sinews of War: Army Logistics 1775-1953* (Washington, DC: Office of the Chief of Military History, United States Army, 1966), 210-211.

<sup>23</sup> Clark, Jr., 223.

untried field of action.”<sup>24</sup> Moreover, “the attempt to supply the army of General Sherman in the field [1864], construct and reconstruct the railroad in the rear, and keep pace with its march...” was regarded by many railroad men as a dangerous experiment that could result in disaster and defeat.<sup>25</sup>

Yet, the damage done by guerillas and cavalry was so quickly repaired by the Construction Corps that Sherman never worried about delay, and Sherman continued to press forward confident that the railroad would catch up to him. Similarly, around Petersburg, Virginia, General Grant’s campaign to capture the Army of Northern Virginia, or drive Lee’s army into the open, was supported by logistical arrangements made possible by United States Military Railroads. From City Point, Virginia, at the confluence of the James and Appomattox Rivers, where supplies were unloaded, to beyond the left flank of the Union army, the Construction Corps restored nine miles of the Petersburg & City Point Railroad, and over ten months built an additional twenty-one miles of track.

A detachment of the Virginia Construction Corps ordered to North Carolina in January 1865 to assist with logistical operations during Sherman’s Carolina Campaign, worked until Construction Corps members could be sent from the military division of the Mississippi. Before Sherman reached Goldsboro, North Carolina in late March, both the Atlantic & North Carolina Railroad ninety-five miles from Morehead City to Goldsboro, and the eighty-five mile section of the Wilmington & Weldon, from Wilmington to Goldsboro were repaired. Of these roads, in addition to two others, twenty-five miles of main track were rebuilt, and five miles of side- track were laid. On the same roads 3,263 lineal feet of bridges were built, and at Morehead City the

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<sup>24</sup> Daniel C. McCallum, *United States Military Railroads. Report of Bvt. Brig. Gen. D. C. McCallum, Director and General Manager, from 1861 to 1866*, 42.

<sup>25</sup> McCallum, 43.

Construction Corps built a wharf covering an area of 53,682 square feet, using 700,000 board feet of timber.<sup>26</sup>

When the war ended, McCallum reported to the War Department a series of staggering numbers quantifying the work of the railroad organization during the war. The USMRR department obtained 419 locomotives during the conflict, and of that number 312 were built in Northern shops. In addition, the department operated 2,105 miles of track, used or built 6,330 cars, constructed or rebuilt 137,418 feet (twenty-six miles and one hundred thirty-eight feet) of bridges, laid or re-laid 641 miles of track, and a total of 24,964 men were employed with an average monthly rate of 2,378 men working in the Virginia, Pennsylvania, and Maryland sector in 1864, and 11,580 men working monthly in the Division of the Mississippi, which covered Tennessee, Georgia, Kentucky, Alabama, Mississippi, and Arkansas.<sup>27</sup>

The success of the North's military railroad organization was due to several factors not the least of which was the practical training men received working on the railroads in the years before the war. With many lines over 150 miles long new management systems had to be invented to operate a decentralized business, and men such as Daniel McCallum and Herman Haupt designed new organizational charts that were essential for large railroad companies. First Haupt, then McCallum, took their organizational models and transferred them to the military railroads. It was easy to look at the USMRR in 1865 and marvel at its efficiency and sophistication. It was easy to forget that in April 1861 the USMRR did not exist, and there was no previous military model.

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<sup>26</sup> McCallum, 34.

<sup>27</sup> McCallum, 10, 31, and 45. In the Virginia, Pennsylvania, and Maryland sector the average number of persons employed monthly rose over the four years of war. In 1862 the average was 750 men, in 1863, 1,974 men, in 1864 2,378 men, and in 1865 3,060 men. In the Division of the Mississippi the monthly average went from 11,580 men in 1864 to 10,061 men in 1865. For North Carolina only the greatest number of persons employed monthly in 1865 was recorded. That number was 3,387.

Next, the military railroads were only as good as the men who worked on them.

Whether it was machinists in repair shops, carpenters building trestle bridges, mason's working on foundations, laborers laying track or cutting timber, and mechanics and blacksmiths working on locomotives and cars, these men educated in common schools, mechanics' institutes, or on the job in shipyards, clock factories, or textile mills, had learned how to work with their hands, repair their own broken tools, and innovate when necessary, which was often. For example, in October 1864 Private James Woodward of the 24<sup>th</sup> Wisconsin, Private William E. Ott of the 46<sup>th</sup> Pennsylvania, and Private James Nichols from the 13<sup>th</sup> New Jersey were ordered to report to the USMRR, Division of the Mississippi, for special assignment.<sup>28</sup> Ott and Nichols had been part of the Army of the Potomac until the 11<sup>th</sup> and 12<sup>th</sup> Corps were transferred by rail to Sherman's army, and now these infantry soldiers were assigned railroad work. No doubt when asked, the regimental colonels selected these men because of their mechanical skills.

Finally, the USMRR succeeded because President Lincoln and his Secretary of War, Edwin Stanton, had the foresight to nationalize the railroads and the temerity and toughness to trust and support USMRR operations. Stanton's Special Order No. 337 summed up the secretary's conviction. In part it said, "No officer, whatever be his rank, will interfere with the running of the cars as directed by the superintendent of the road. Any one who so interferes will be dismissed from the service for disobedience of orders."<sup>29</sup>

Of course, the railroads were only one means of moving the Union army's men and supplies inside enemy territory over harsh terrain. Getting at the enemies' forces, or in one case,

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<sup>28</sup> Record of the Office of the Quartermaster General: Transportation, 1834-1917. Printed and Manuscript Orders, Circulars, and Letters of Instruction Relating to the U. S. Military Railroad, 1861-1864, Box number 1, National Archives, Washington, DC.

<sup>29</sup> McCallum, 41.

escaping from their clutches, required the critical skills of the men who served as combat engineers and pioneers.

The North's better engineering efforts and management superiority made the difference. Despite its vast amount of resources, the Union army still had to execute strategic, tactical, and logistical operations in order to destroy Southern forces. Delivering the Federal army to those key points of contact and providing the essential support to keep the army in ammunition and food was the job of the army engineers and the United States Military Railroad. The manpower resource to draw from could not come from a small cadre of railroad managers or West Point trained engineers; the war was much too grand in scale for that. Instead, the manpower came from the ranks of the citizen soldiers, many of whom had developed mechanical skills before the war. Even when volunteer engineers were unavailable, men from infantry regiments, such as privates Woodward, Ott, and Nichols assigned to the USMRR, could be called upon to execute repairs to roads or build bridges often with a pontoon train. It was remarkable.

For example, Sherman's Atlanta campaign could have turned out differently if Union engineers and the railroad Construction Corps did not keep transportation lines repaired and open. The Construction Corps, engineers, and pioneers built roads and bridges that allowed Union generals to move their armies over difficult and problematic terrain. Grant's ability to move his army through the floodplain along the western side of the Mississippi River in eastern Louisiana in 1863 was the result of inventive engineering, not overwhelming resources. The rescue of Banks's army along the Red River, Grant's army in Chattanooga, and even McClellan's army on the Peninsula, was the result of inventive thinking, the exchange of ideas, sometimes from the bottom up, and the mechanical skill of the men required to execute the plan. The Union Army engineered the victory in the American Civil War.

The statistics alone are striking. For example, Colonel Ira Spaulding of the 50<sup>th</sup> New York wrote in June 1865 that his regiment had built eighty-six bridges from September 1862 to May 1865 totaling 21,248 feet or just over four miles. This data did not include the large number of trestle, timber, and corduroy bridges built by the 50th New York, nor the bridgework done by the 1<sup>st</sup> and 15<sup>th</sup> New York or the regular engineer battalion. In addition, over the course of the war, the Union adopted better management techniques. By 1864 each engineer company was furnished with a company wagon, a commissary wagon, forage wagon, tool wagon, and a carpenters' tool chest. Spaulding wrote, "By this means the whole or any portion of the regiment was prepared to move at any time of the day or night, with fifteen days' supplies and a complete outfit for the performance of all kind of engineer duty."<sup>30</sup>

The greatest feat of military engineering during the war, and perhaps the greatest feat in American military history, came at Vicksburg. Grant began the campaign with only the company of First Kentucky Engineers and Mechanics and three regular army engineers attached to his headquarters' staff. Recognizing and utilizing the skills he had within his ranks, Grant tapped officers, who in civilian life had engineering experience, and infantry units with men of mechanical ability. The results were incredible: two attempted canal projects, a series of floating and trestle bridges, corduroy roads through wetlands, wooden towers built for sharpshooters, fabricated sap rollers, fascine from pork barrels, and gum tree mortars.

What made this work possible was the attention paid to industrial development, railroad management, and common school reform in the North in the years before the Civil War. No doubt the density of the northern population helped ideas to bubble up during the antebellum period, yet there was a fundamental belief that ideas were important. Information was exchanged all the time, whether at agricultural fairs, lyceum meetings, mechanics institutes,

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<sup>30</sup> *O. R.*, ser. 1, vol. XLVI, part 1, 649-650.



or universities. State governments recognized the need to reform common schools because an educated citizenry was good for individuals including those in the working class, and it was good for business.

Lincoln spoke often of providing opportunities for the laboring classes to improve their station in life. He believed that there was an important positive relationship between labor and capital, and the evidence suggested that many people in the North felt the same way. On March 6, 1860 in New Haven, Connecticut, Lincoln said: "So while we do not propose any war upon capital, we do wish to allow the humblest man an equal chance to get rich with everybody else. When one starts poor, as most do in the race of life, free society is such that he knows he can better his condition; he knows that there is no fixed condition of labor, for his whole life."<sup>31</sup>

Northern laborers recognized opportunities to improve their station in life. Risk and reward was a part of the culture in the industrialized North. Risk and reward, business acumen, and entrepreneurship applied to the South as well, but generally only for those who ran plantations and sold their crops for enormous profits. Labor, and especially slave labor, was viewed as the necessary "mud-sill" of society. Education and ideas were reserved for the elite. Slavery represented the economic backbone of the Confederacy, and slavery contributed to the Confederacy's doom. Not just because the war came as a result of the peculiar institution, but because the institution of slavery permeated Southern culture, and consequently, limited creativity, innovation, openness, and adaptation to change. These were all essential elements in a war that required enormous logistical considerations, and consequently demanded creativity, innovation, and adaptation to change. Island No. 10, Vicksburg, Chattanooga, and Atlanta required ideas and innovations that had never been attempted before on such a scale. Generating new ideas was often the difference between victory and defeat. Chances of success

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<sup>31</sup> Fehrenbacher, ed., "Speech at New Haven, Connecticut," 144.

increased, therefore, when those ideas came from as many people as possible. It was not just the generals who were relied upon to offer a new approach to a new problem. In the North, a volunteer engineer captain from New York who worked as a civil engineer before the war, an infantry sergeant from Pennsylvania who had been a miner, or a private from Illinois who had worked as a machinist, generated ideas. This was the advantage the Federal army had over the Confederacy. It was the reason why the North won the Civil War.

The free flow of information and ideas has always been the United States' greatest strength. The freedom to create, to challenge, and to disagree, has been the sure foundation of our people and nation. In the twenty-first century this exchange of ideas between manager and laborer, teacher and student, politician and citizen is more important than ever. Yet, in the United States over the past twenty years alarming voices have been raised signifying that the nation would be better off celebrating sameness rather than diversity. Tolerance, respect, and compromise have come under attack. Freedom to think and act differently has become instead, for some, freedom from those who think and act differently.

Today it is critical we maintain a prosperous, accessible, accountable press. It is important we address the challenges of public education and access to higher education. It remains essential that we provide opportunities for all citizens, not just the wealthiest. The stakes are high.

Between 1861 and 1865 the United States fought a Civil War to both maintain "the last best hope on earth," and to deliver "a new birth of freedom." The reason for the North's victory was because at significant times during the four-year struggle Union engineers, the majority of them volunteers, were able to apply ingenuity and innovation to the complex problem facing them. In the spring of 1861 both sides prepared for the one great, decisive battle that would determine the outcome. It never happened. Battles continued to unfold and men continued to

die. These historic battles have captured the imagination and attention of Americans ever since. What ended the war, however, was not the battles per se but the Union army's ability to overcome the geography of the South and the chronic damage done to the railroads, bridges, and roads as Confederates relentlessly tried to cut supply lines and stop the Yankees from pressing any advantage. The adroitness, proficiency, and versatility of the Union's citizen soldiers were the *sine qua non* of their army's success. Indeed, the North engineered victory in the Civil War.

## TABLES

**Table 1: West Point Graduates who served as Engineers, 1802-1860, Union States**

| Engineers from Union States |                                |   |  |  |
|-----------------------------|--------------------------------|---|--|--|
|                             | Served in Corp of<br>Engineers | Upon Graduation<br>Entered<br>Engineers | Served in Civil<br>War as an<br>Engineer | Served in Civil War<br>as a general<br>officer |
| Connecticut:                | 6                              | 5                                       | 4  |  |
| Delaware:                   | 2                              | 2                                       |  |  |
| District of Columbia:       | 3/1*                           | 2                                       | 1*                                       | 1  |
| Illinois:                   | 1                              |   |  |  |
| Kentucky:                   | 2                              | 1                                       |  | 1  |
| Maine:                      | 2                              | 1                                       |  |  |
| Maryland:                   | 3/1*                           | 2                                       |  |  |
| Massachusetts:              | 19                             | 16                                      | 6  | 2  |
| Michigan:                   | 2                              | 2                                       |  |  |
| Missouri:                   | 1                              | 1                                       |  |  |
| New Hampshire:              | 5/1*                           | 3                                       | 2/1*                                     | 1  |
| New Jersey:                 | 4/1*                           | 3                                       | 2/1*                                     |  |
| New York:                   | 27/1*                          | 26                                      | 13/1*/1**                                | 2  |
| Ohio:                       | 9                              | 6                                       | 5  | 4  |
| Pennsylvania:               | 13                             | 8                                       | 6  | 2  |
| Rhode Island:               | 1                              |   |  |  |
| Wisconsin:                  | 1/1*                           | 1                                       | 1*                                       |  |
| Vermont:                    | 7                              | 6                                       | 1  |  |
| Totals:                     | 108                            | 85                                      | 41                                       | 13   |

\*Some cadets received at large appointments. In these cases Cullum's *Biographical Register* indicated the state of birth, not the state where cadets lived at the time of their appointment.

\*\* One graduate from New York served during the war as a Confederate engineer, and one graduate from North Carolina served as a Union engineer.

On August 3, 1861 Congress authorized the Corps of Engineers to expand to six more officers, three from the West Point class of 1861 that graduated May 6<sup>th</sup>, and three more from the West Point class of 1861 that graduated on June 24<sup>th</sup>. Three cadets, from Delaware, the District of Columbia, and Rhode Island received at large appointments. The cadet from the District of

Columbia resigned his commission and served during the war as a Confederate engineer. The other five cadets were from the following states: Massachusetts, Vermont, Pennsylvania, Wisconsin, and Connecticut.

During the war twenty additional members of the Corps of Engineers came from the West Point classes of 1862, 1863, and 1864. Two graduates, one from the District of Columbia and the other from New York received at large appointments. The others represented the following states: Indiana (2), Illinois (2), Maine (1), Massachusetts (2), Nebraska (1), New York (4), Oregon (3), Pennsylvania (2), and Tennessee (1).

Note: The first column represents the total number of West Point graduates from each state who served in the regular army Corps of Engineers. For Example, in New York, twenty-seven men served in the engineers, one of them received an at large appointment. In addition, of the twelve who served in the Civil War, one was the graduate who received the at large appointment and the other served in the Confederate engineers.

These numbers include the years 1802 to 1818 when no class rank was assigned to cadets. During these years twenty-two men entered the Corps of Engineers, and they received their appointments from the following states: Connecticut 1; District of Columbia 1; Maryland 1; Massachusetts 5; New York 3; Pennsylvania 2; Vermont 4; Georgia 1; North Carolina 1; South Carolina 2; Virginia 1.

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Source: George W. Cullum, *Biographical Register of the Officers and Graduates of the United States Military Academy at West Point New York* since its establishment in 1802, vol. I and II, 3<sup>rd</sup> ed. (Cambridge, MA: The Riverside Press, 1891).

**Table 2: West Point Graduates who Served as Engineers, 1802-1860, Confederate States**

| Confederate States |                                |                                      |                                       |   |
|--------------------|--------------------------------|--------------------------------------|---------------------------------------|---|
|                    | Served in<br>Corp of Engineers | Upon Graduation<br>Entered Engineers | Served in Civil War<br>as an Engineer | Served in Civil War<br>as a general officer |
| Alabama:           | 2                              | 2                                    | 1                                     |   |
| Florida:           | 1                              | 1                                    |                                       |   |
| Georgia:           | 2                              | 2                                    | 1                                     |   |
| Louisiana:         | 3                              | 3                                    | 2                                     |   |
| North Carolina:    | 4                              | 3                                    | 1/1**                                 |   |
| South Carolina:    | 2                              | 2                                    |                                       |   |
| Mississippi:       | 2/1*                           | 1                                    |                                       | 1*  |
| Tennessee:         | 4                              | 4                                    |                                       |   |
| Virginia:          | 8/1*                           | 6                                    | 1                                     | 4/1*  |
| Totals:            | 28                             | 24                                   | 7                                     | 5   |

\*Some cadets received at large appointments. In these cases Cullum's *Biographical Register* indicated the state of birth, not the state where cadets lived at the time of their appointment.

\*\* One graduate from New York served during the war as a Confederate engineer, and one graduate from North Carolina served as a Union engineer.

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**Table 3: Statistics from the 6<sup>th</sup> Census of the United States Regarding Manufacturing Totals 1840**

| Manufacturing totals 1840 |    |            |
|---------------------------|----|------------|
| New York:                 | \$ | 88,200,209 |
| Pennsylvania:             | \$ | 51,950,935 |
| Massachusetts:            | \$ | 41,774,446 |
| Virginia:                 | \$ | 18,803,885 |
| Ohio:                     | \$ | 16,905,257 |
| Connecticut:              | \$ | 13,669,139 |
| Rhode Island:             | \$ | 10,696,136 |
| New Hampshire:            | \$ | 9,252,448  |
| Tennessee:                | \$ | 6,847,431  |
| Vermont:                  | \$ | 4,326,440  |
| North Carolina:           | \$ | 3,838,900  |
| South Carolina:           | \$ | 3,216,970  |
| Michigan:                 | \$ | 3,112,240  |
| Georgia:                  | \$ | 2,899,565  |

Source: *Statistics of the United States of America as collected and Returned by the Marshals of the Several Judicial Districts under the 13th section of the act for taking the 6th Census corrected at the Department of State June 1, 1840* (Washington, DC: Blair and Rives, 1841).



**Table 4: Statistics from the 8<sup>th</sup> Census of the United States Regarding Employment Statistics 1860**

Employment Statistics 1860

|    | Civil and<br>Mechanical<br>Engineers | Iron<br>Workers | Iron Railing<br>Manufacturers | Machinists | Carpenters | Wheelwrights |
|----|--------------------------------------|-----------------|-------------------------------|------------|------------|--------------|
| CA | 717                                  | 6               | 0                             | 448        | 3,923      | 619          |
| CT | 507                                  | 170             | 0                             | 2,677      | 3,333      | 523          |
| DE | 92                                   | 27              | 0                             | 229        | 954        | 208          |
| IL | 1,555                                | 61              | 0                             | 1,356      | 12,668     | 3,098        |
| IN | 1,226                                | 18              | 0                             | 947        | 10,584     | 1,881        |
| IA | 675                                  | 21              | 0                             | 292        | 6,526      | 1,013        |
| KS | 194                                  | 0               | 0                             | 35         | 1,295      | 156          |
| KY | 693                                  | 214             | 0                             | 406        | 5,858      | 964          |
| ME | 344                                  | 90              | 0                             | 954        | 4,952      | 273          |
| MD | 389                                  | 107             | 0                             | 1,046      | 5,572      | 849          |
| MA | 1,503                                | 656             | 0                             | 6,897      | 14,541     | 1,182        |
| MI | 949                                  | 66              | 0                             | 603        | 8,045      | 1,046        |
| MN | 241                                  | 0               | 0                             | 95         | 1,757      | 154          |
| MO | 1,134                                | 107             | 0                             | 608        | 9,333      | 1,478        |
| NH | 161                                  | 0               | 24                            | 1,260      | 3,075      | 381          |
| NJ | 960                                  | 288             | 85                            | 1,923      | 7,444      | 1,197        |
| NY | 4,103                                | 105             | 1,296                         | 8,774      | 38,897     | 2,579        |
| OH | 2,107                                | 10              | 642                           | 2,487      | 21,571     | 2,684        |
| OR | 65                                   | 0               | 0                             | 31         | 761        | 135          |
| PA | 4,284                                | 43              | 3,942                         | 6,541      | 29,855     | 4,240        |
| RI | 210                                  | 0               | 70                            | 1,630      | 2,137      | 150          |
| VT | 73                                   | 0               | 12                            | 478        | 2,739      | 409          |
| WI | 587                                  | 0               | 14                            | 538        | 6,709      | 1,878        |

Source: Joseph C. G. Kennedy, *Population of the United States in 1860 Compiled From the Original Returns of the Eighth Census* (Washington, DC: Government Printing Office, 1864).

Employment Statistics 1860 (continued from previous page)

|    | Civil and<br>Mechanical<br>Engineers | Iron Workers | Iron Railing<br>Manufacturers | Machinists | Carpenters | Wheelwrights |
|----|--------------------------------------|--------------|-------------------------------|------------|------------|--------------|
| AL | 375                                  | 26           | 0                             | 295        | 2,386      | 431          |
| AR | 137                                  | 0            | 0                             | 72         | 1,613      | 363          |
| FL | 117                                  | 0            | 0                             | 70         | 693        | 76           |
| GA | 445                                  | 37           | 2                             | 615        | 3,219      | 592          |
| LA | 917                                  | 24           | 0                             | 256        | 4,865      | 204          |
| MS | 255                                  | 20           | 0                             | 225        | 2,100      | 336          |
| NC | 286                                  | 2            | 26                            | 194        | 3,217      | 588          |
| SC | 298                                  | 0            | 12                            | 175        | 1,844      | 355          |
| TN | 406                                  | 0            | 55                            | 368        | 5,391      | 970          |
| TX | 237                                  | 0            | 10                            | 73         | 2,773      | 526          |
| VA | 760                                  | 0            | 226                           | 936        | 9,482      | 1,657        |

Total number from Delaware, Kentucky, Maryland, and Missouri:

| Civil and<br>Mechanical<br>Engineers | Iron<br>Workers | Iron Railing<br>Manufacturers | Machinists | Carpenters | Wheelwrights |
|--------------------------------------|-----------------|-------------------------------|------------|------------|--------------|
| 2,308                                | 455             | 0                             | 2,289      | 21,717     | 3,499        |

Total number from all other Union States:

|        |       |       |        |         |        |
|--------|-------|-------|--------|---------|--------|
| 20,461 | 1,534 | 6,085 | 37,966 | 180,812 | 23,598 |
|--------|-------|-------|--------|---------|--------|

Total number from the Confederate States:

|       |     |     |       |        |       |
|-------|-----|-----|-------|--------|-------|
| 4,233 | 109 | 331 | 3,279 | 37,583 | 6,098 |
|-------|-----|-----|-------|--------|-------|

Source: Joseph C. G. Kennedy, *Population of the United States in 1860 Compiled From the Original Returns of the Eighth Census* (Washington, DC: Government Printing Office, 1864).

**Table 5: Colleges in the United States in 1860**

Union States(continued  
onto the next page)

|    | Literary | Theological | Law or<br>Dept<br>of Law | Military | Medical or<br>Dept<br>of Medicine | Scientific or<br>Dept<br>of Science | Normal | Agriculture or<br>Dept<br>of Agriculture |
|----|----------|-------------|--------------------------|----------|-----------------------------------|-------------------------------------|--------|--|
| CA | 4        | 1           | 0                        | 0        | 0                                 | 0                                   | 1      | 1  |
| CT | 3        | 3           | 1                        | 0        | 1                                 | 1                                   | 1      | 1  |
| DE | 0        | 0           | 0                        | 0        | 0                                 | 0                                   | 0      | 0  |
| DC | 0        | 0           | 0                        | 0        | 3                                 | 1                                   | 0      | 0  |
| IL | 12       | 9           | 1                        | 0        | 2                                 | 0                                   | 1      | 1  |
| IN | 12       | 2           | 2                        | 0        | 0                                 | 0                                   | 0      | 1  |
| IA | 7        | 2           | 0                        | 0        | 1                                 | 0                                   | 1      | 1  |
| KS | 3        | 0           | 0                        | 0        | 0                                 | 0                                   | 1      | 1  |
| ME | 2        | 1           | 0                        | 0        | 1                                 | 0                                   | 1      | 1  |
| MA | 6        | 4           | 1                        | 0        | 3                                 | 2                                   | 5      | 1  |
| MI | 4        | 1           | 1                        | 0        | 1                                 | 1                                   | 1      | 1  |
| MN | 3        | 0           | 0                        | 0        | 0                                 | 0                                   | 1      | 1  |
| NH | 1        | 2           | 0                        | 0        | 0                                 | 1                                   | 1      | 0  |
| NJ | 3        | 2           | 0                        | 0        | 0                                 | 0                                   | 0      | 1  |
| NY | 10       | 13          | 5                        | 0        | 8                                 | 5                                   | 2      | 1  |
| OH | 20       | 10          | 1                        | 1        | 3                                 | 0                                   | 3      | 1  |
| OR | 3        | 0           | 0                        | 0        | 0                                 | 0                                   | 0      | 0  |
| PA | 19       | 13          | 1                        | 0        | 5                                 | 1                                   | 4      | 1  |
| RI | 1        | 0           | 0                        | 0        | 0                                 | 1                                   | 1      | 1  |
| VT | 2        | 1           | 0                        | 1        | 3                                 | 1                                   | 0      | 1  |
| WI | 8        | 2           | 0                        | 0        | 0                                 | 0                                   | 1      | 1  |

Confederate States (continued from previous page)

|    |          |             | Law or<br>Dept<br>of Law | Military | Medical or<br>Dept of<br>Medicine | Scientific or<br>Dept of<br>Science | Normal | Agriculture or<br>Dept of<br>Agriculture |
|----|----------|-------------|--------------------------|----------|-----------------------------------|-------------------------------------|--------|--|
|    | Literary | Theological |                          |          |                                   |                                     |        |  |
| AL | 5        | 4           | 1                        | 1        | 0                                 | 0                                   | 0      | 0  |
| AR | 0        | 0           | 0                        | 0        | 0                                 | 0                                   | 0      | 0  |
| FL | 0        | 0           | 0                        | 0        | 0                                 | 0                                   | 0      | 0  |
| LA | 8        | 2           | 1                        | 1        | 0                                 | 1                                   | 0      | 0  |
| MS | 4        | 0           | 0                        | 1        | 0                                 | 0                                   | 0      | 0  |
| NC | 4        | 0           | 1                        | 0        | 0                                 | 0                                   | 0      | 0  |
| SC | 4        | 5           | 0                        | 2        | 1                                 | 0                                   | 1      | 0  |
| TN | 7        | 3           | 1                        | 1        | 2                                 | 0                                   | 0      | 0  |
| TX | 4        | 0           | 0                        | 0        | 0                                 | 0                                   | 0      | 0  |
| VA | 10       | 2           | 1                        | 2        | 0                                 | 0                                   | 0      | 0  |

**Table 6: School Attendance in the United States in 1860, Confederate States**

| Confederate States |  |                   |  |   |   |  |
|--------------------|--|-------------------|--|---|---|--|
|                    | Number of<br>White Children<br>Between<br>5-14 years old | Common<br>Schools | Number of<br>Students in<br>Attendance | Percent of<br>Children 5-14<br>years old in<br>Attendance | Number of<br>Grammar<br>Schools<br>Or Academies | Number of<br>Students in<br>Attendance |
| AL                 | 152,808  | 1,903             | 61,751                                 | 40%   | 206   | 10,778                                 |
| AR                 | 97,672   | 727               | 19,242                                 | 19%   | 109   | 4,415                                  |
| FL                 | 22,007   | 97                | 2,032                                  | 9%  | 138   | 4,486                                  |
| GA                 | 168,269  | 1,752             | 56,087                                 | 33%   | 242   | 11,075                                 |
| LA                 | 87,570   | 713               | 31,813                                 | 36%   | 152   | 11,274                                 |
| MS                 | 101,414  | 1,116             | 30,970                                 | 30%   | 169   | 7,974                                  |
| NC                 | 169,907  | 2,994             | 105,025                                | 61%   | 434   | 13,169                                 |
| SC                 | 78,219   | 757               | 20,716                                 | 26%   | 226   | 8,277                                  |
| TN                 | 230,346  | 2,965             | 138,809                                | 60%   | 264   | 15,793                                 |
| TX                 | 115,580  | 1,218             | 34,611                                 | 29%   | 97  | 5,916                                  |
| VA                 | 278,738  | 3,778             | 85,443                                 | 30%   | 398   | 13,204                                 |
| Totals:            | 1,502,530  | 18,020            | 586,499                                | 34%   | 2,435   | 106,361                                |

**Table 7: School Attendance in the United States in 1860, Border States**

| Border States |  |                   |  |   |   |  |
|---------------|--|-------------------|--|---|---|--|
|               | Number of<br>White Children<br>Between<br>5-14 years old | Common<br>Schools | Number of<br>Students in<br>Attendance | Percent of<br>Children 5-14<br>years old in<br>Attendance | Number of<br>Grammar<br>Schools<br>Or Academies | Number of<br>Students in<br>Attendance |
| DE            | 22,431   | 256               | 11,736                                 | 52%   | 40  | 1957                                   |
| KY            | 251,229  | 4,507             | 156,158                                | 52%   | 223   | 17597                                  |
| MD            | 125,511  | 935               | 36,216                                 | 28%   | 140   | 4745                                   |
| MO            | 281,666  | 4,120             | 175,855                                | 62%   | 240   | 20143                                  |
| Totals:       | 680,837  | 9,818             | 379,965                                | 55%   | 643   | 44,442                                 |

**Table 8: School Attendance in the United States in 1860, Union States**

| Union States |   |                   |  |   |   |   |  |
|--------------|---|-------------------|--|---|---|---|--|
|              | Number of White<br>Children Between<br>5-14 years old | Common<br>Schools | Number of<br>Students in<br>Attendance |   | Percent of<br>Children 5-14<br>years old in<br>Attendance | Number of<br>Grammar<br>Schools<br>Or Academies | Number of<br>Students in<br>Attendance |
| CA           | 41,169  | 496               | 24,977                                 |   | 60%   | 92  | 3,153                                  |
| CT           | 89,277  | 1,805             | 82,530                                 |   | 92%   | 197   | 8,749                                  |
| IL           | 429,701   | 8,489             | 433,018                                | * | 100%  | 211   | 13,205                                 |
| IN           | 362,234   | 6,563             | 293,089                                |   | 81%   | 261   | 22,971                                 |
| IA           | 177,155   | 3,836             | 165,588                                |   | 93%   | 67  | 4,949                                  |
| KS           | 26,323  | 123               | 4,758                                  |   | 18%   | 29  | 1,059                                  |
| ME           | 144,159   | 4,376             | 186,717                                | * | 130%  | 110   | 8,273                                  |
| MA           | 240,871   | 4,134             | 206,974                                |   | 86%   | 319   | 14,001                                 |
| MI           | 177,370   | 4,007             | 201,391                                | * | 113%  | 84  | 9,683                                  |
| MN           | 38,475  | 879               | 31,038                                 |   | 81%   | 29  | 1,605                                  |
| NH           | 64,613  | 2,301             | 70,539                                 | * | 110%  | 208   | 11,444                                 |
| NJ           | 148,026   | 1,496             | 110,000                                |   | 74%   | 251   | 12,892                                 |
| NY           | 850,650   | 10,650            | 697,283                                |   | 82%   | 910   | 86,565                                 |
| OH           | 589,568   | 11,783            | 590,549                                | * | 100%  | 131   | 54,035                                 |
| OR           | 12,511  | 239               | 8,158                                  |   | 65%   | 15  | 1,654                                  |
| PA           | 710,189   | 11,597            | 565,303                                |   | 80%   | 487   | 33,638                                 |
| RI           | 34,684  | 426               | 25,570                                 |   | 74%   | 58  | 3,127                                  |
| VT           | 68,976  | 2,696             | 80,904                                 | * | 117%  | 96  | 7,851                                  |
| WI           | 197,602   | 3,795             | 198,676                                | * | 100%  | 120   | 10,031                                 |
| Total:       | 4,403,553   | 79,691            | 3,977,106                              |   | 90%   | 3,675   | 308,885                                |

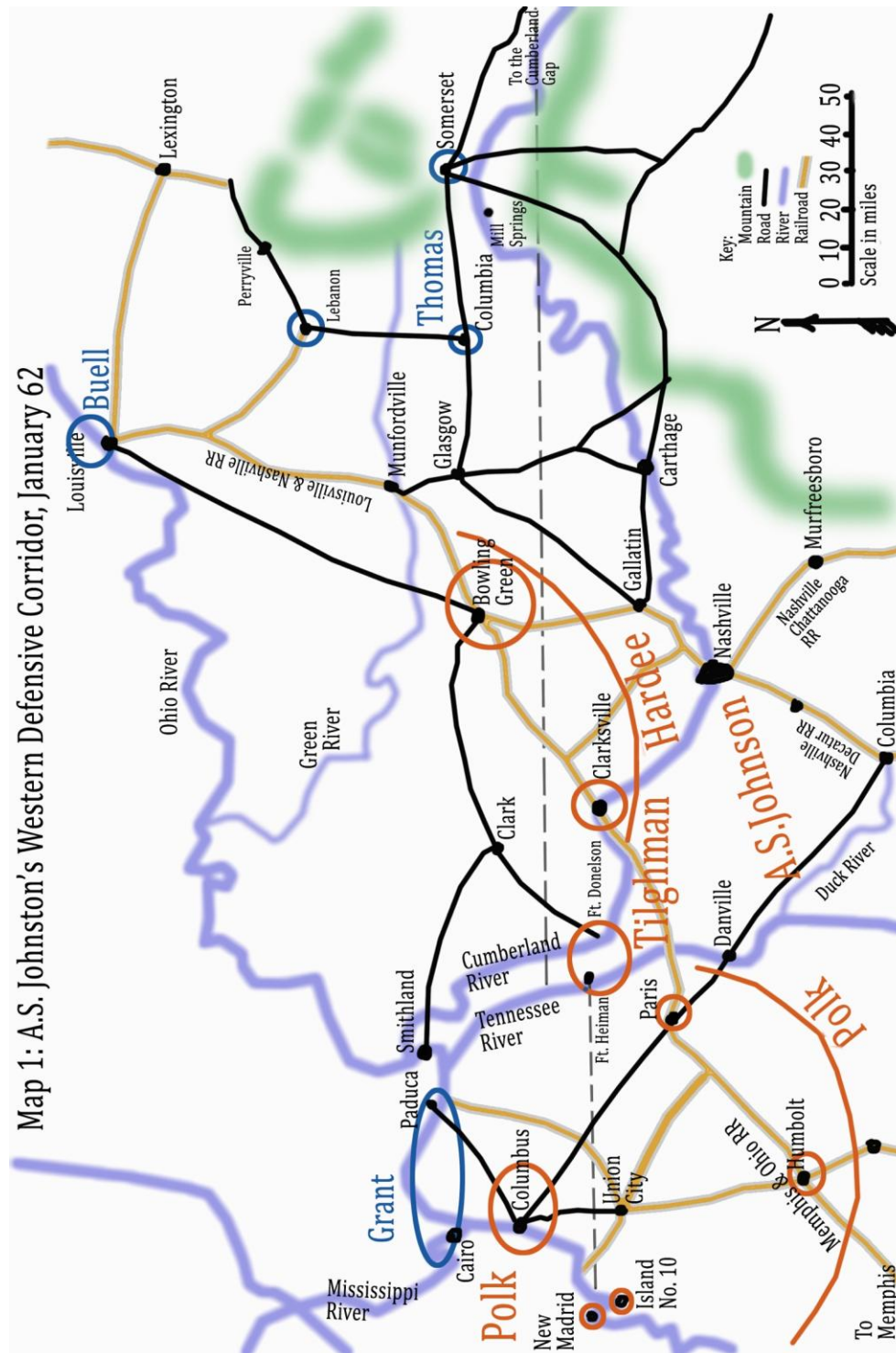
\*The Eighth Census compiled population numbers for white males and females by age ranges such as Under 1, 1-4, 5-9, 10-14, and 15-19. In addition, counting school attendance was an Inexact science because some children attended school for only several months throughout a year and others attended for as long as ten months. These numbers were compiled from population statistics between the ages of five and fourteen. These were the most common ages of school attendance. Yet district school records indicated that a small percent of students were fifteen and sixteen years old. For example, for the October 1860 to January 1861 term, the Fairfield, Connecticut North School District recorded that of the twenty children in attendance, nineteen were between five and fourteen years old and one was sixteen years old.

Sources: Fairfield North School District Journal, 1851-1861. The Connecticut Historical Society, Hartford, Connecticut. *Statistics of the United States Including Mortality, Property, etc. in 1860 Compiled from the Original Returns and Being the Final Exhibit of the Eighth Census* (Washington, DC: Government Printing Office, 1866), 506-509 and 592.

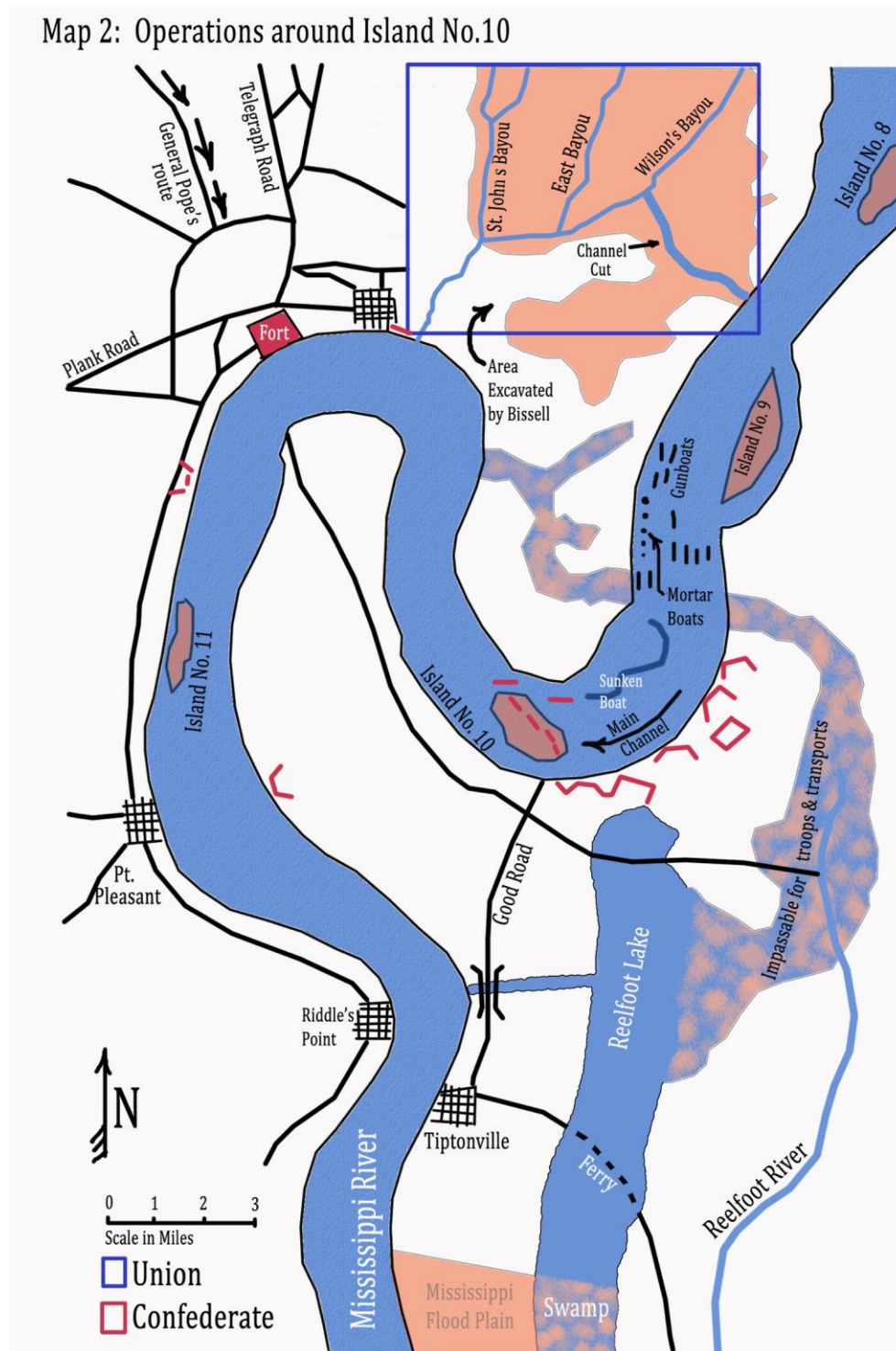


## MAPS

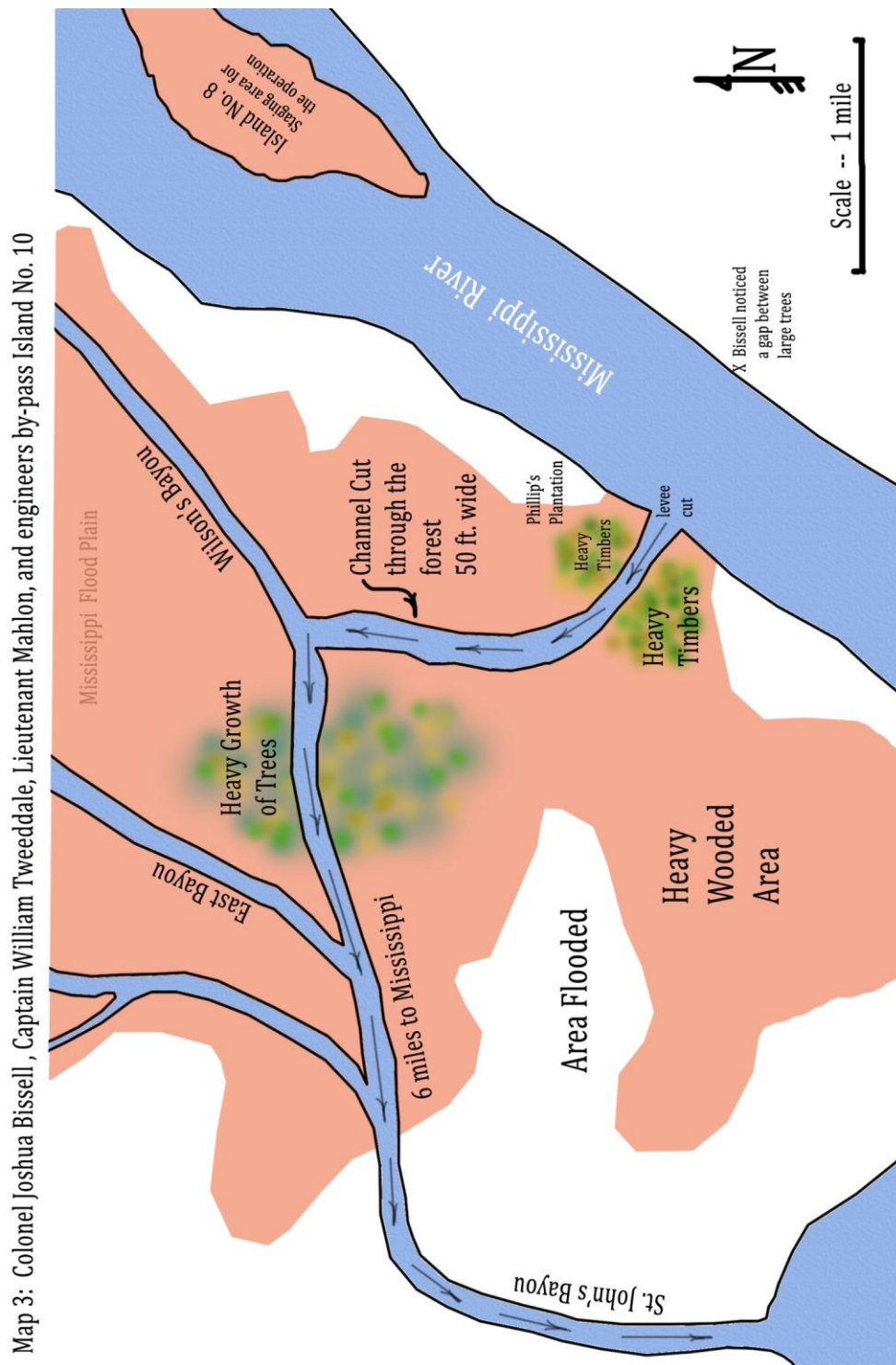
Map 1: A.S. Johnston's Western Defensive Corridor, January 1862



Map 2: Operations around Island No. 10

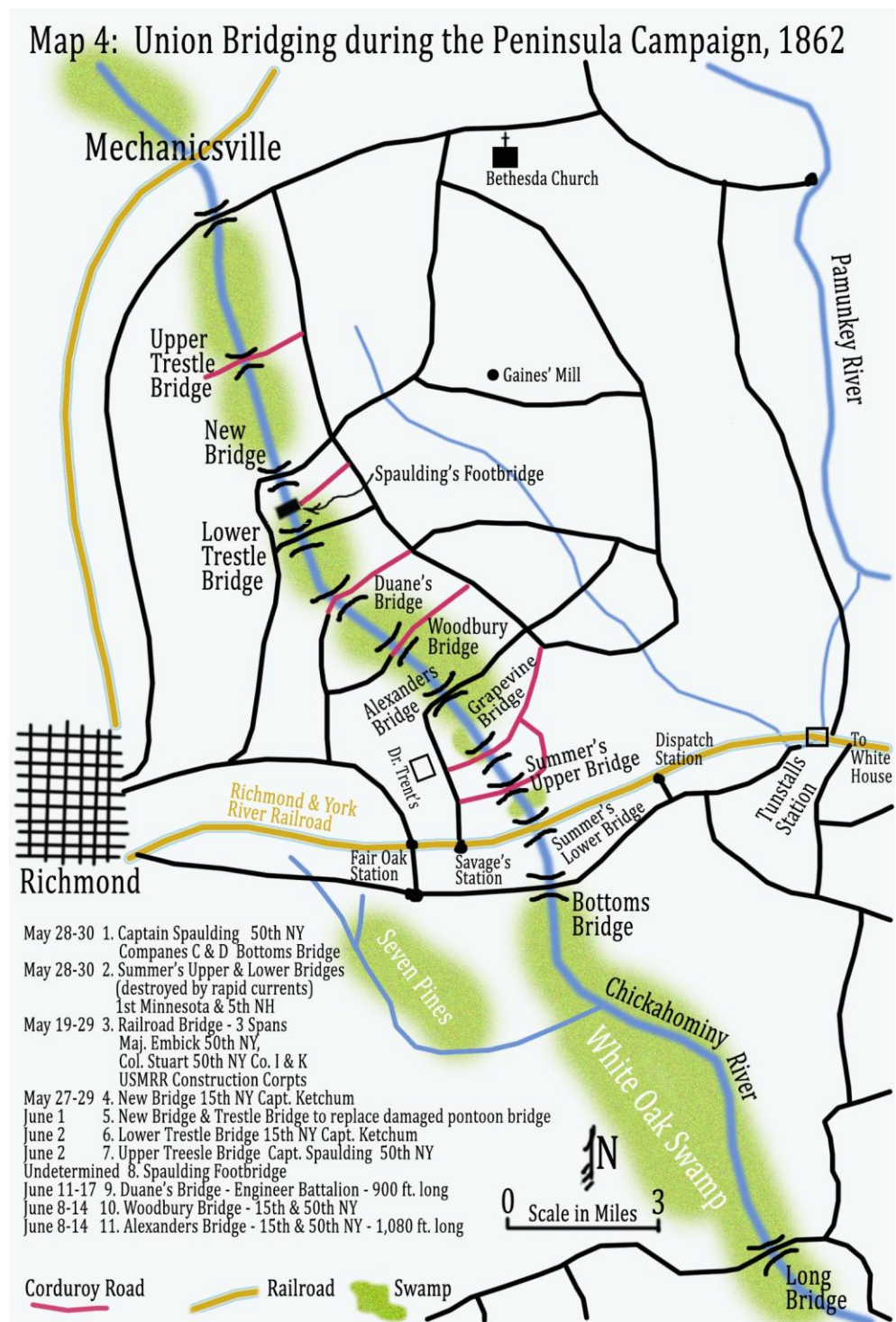


**Map 3: Bissell, Tweeddale, Mahon, and Engineers By-Pass Island No. 10**

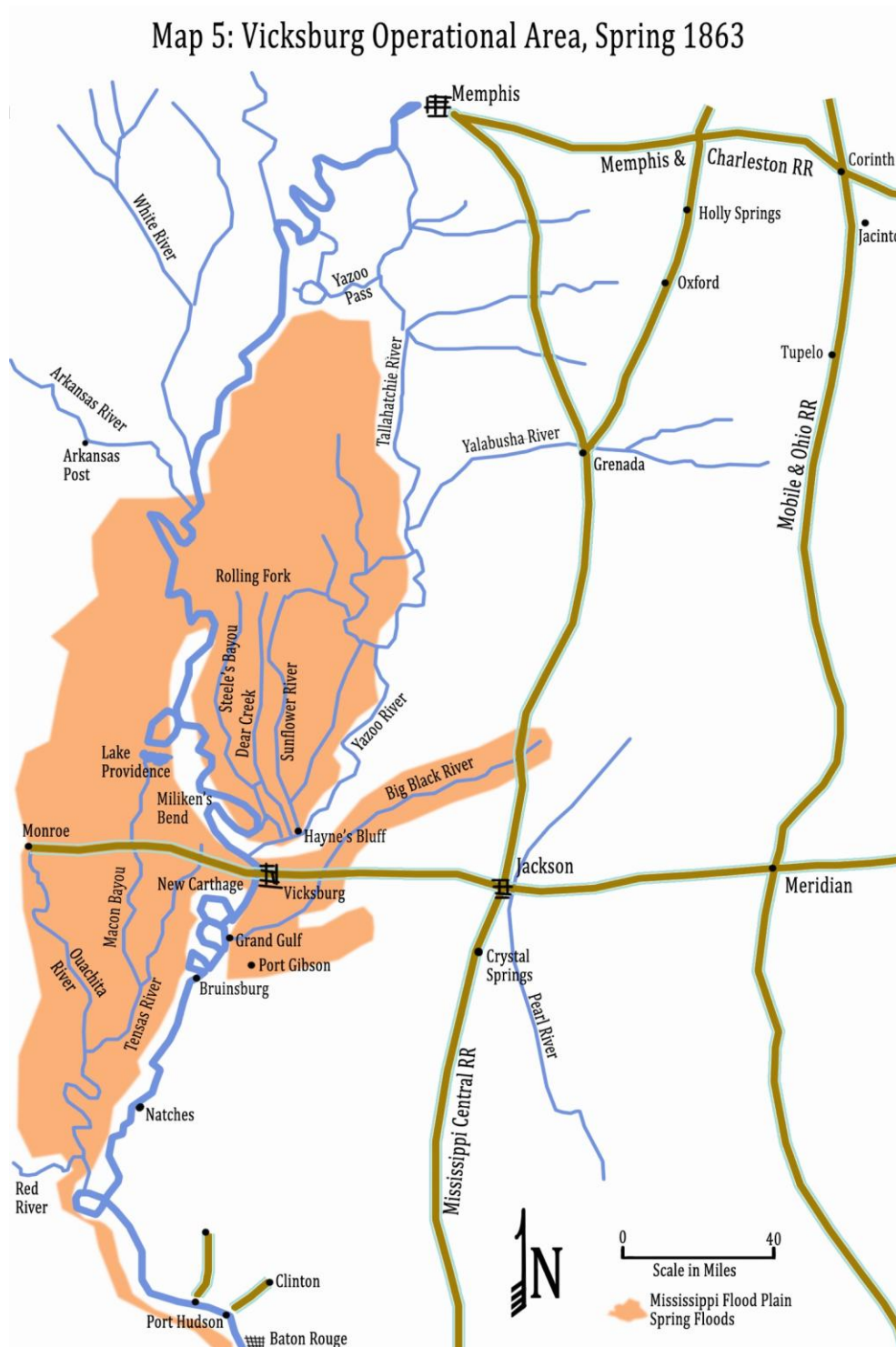




**Map 4: Union Bridging During the Peninsula Campaign, 1862**

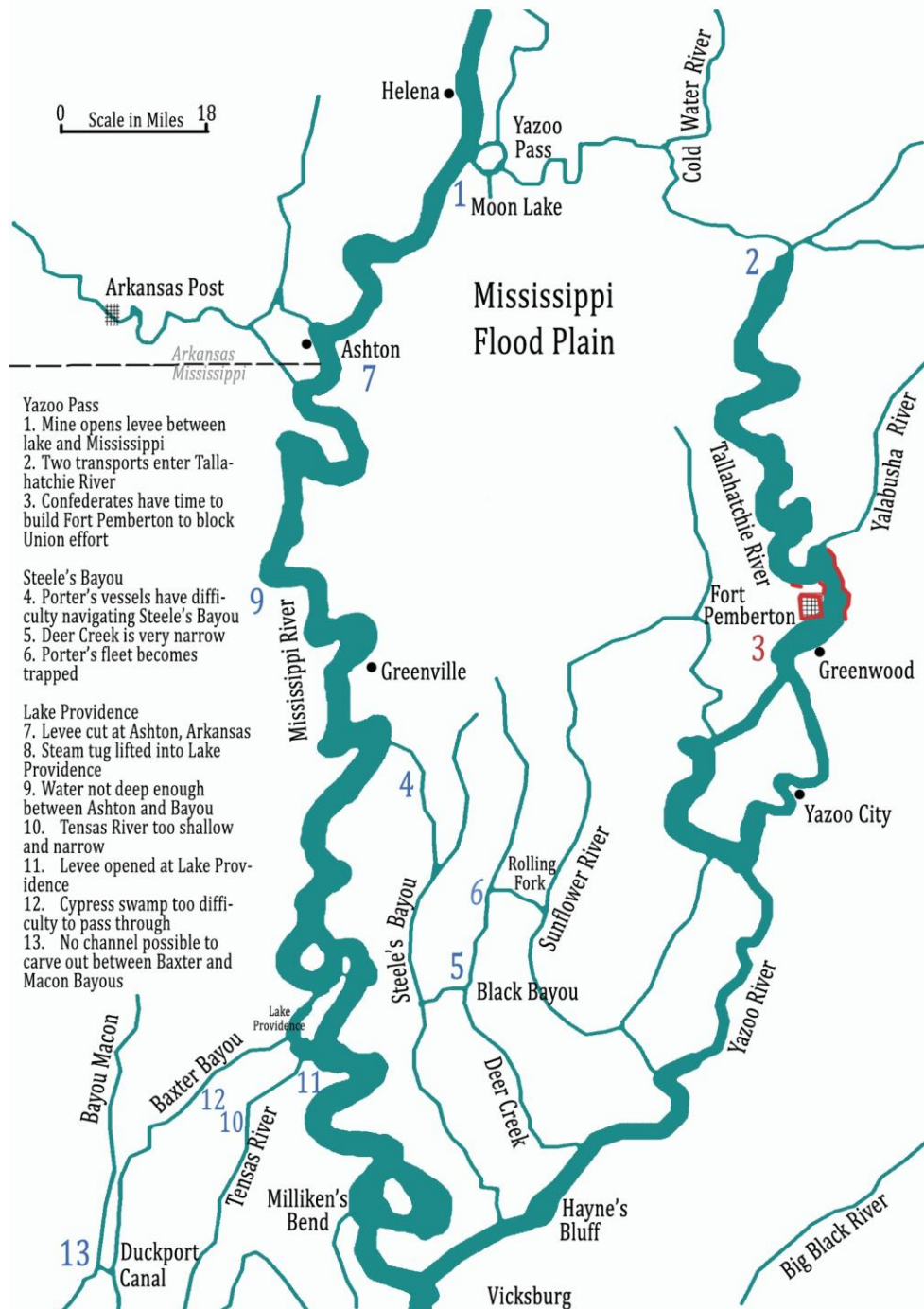


Map 5: Vicksburg Operational Area, Spring 1863



**Map 6: Yazoo Pass, Steele's Bayou, and Lake Providence Operations**

Map 6: Yazoo Pass, Steele's Bayou, and Lake Providence Operations





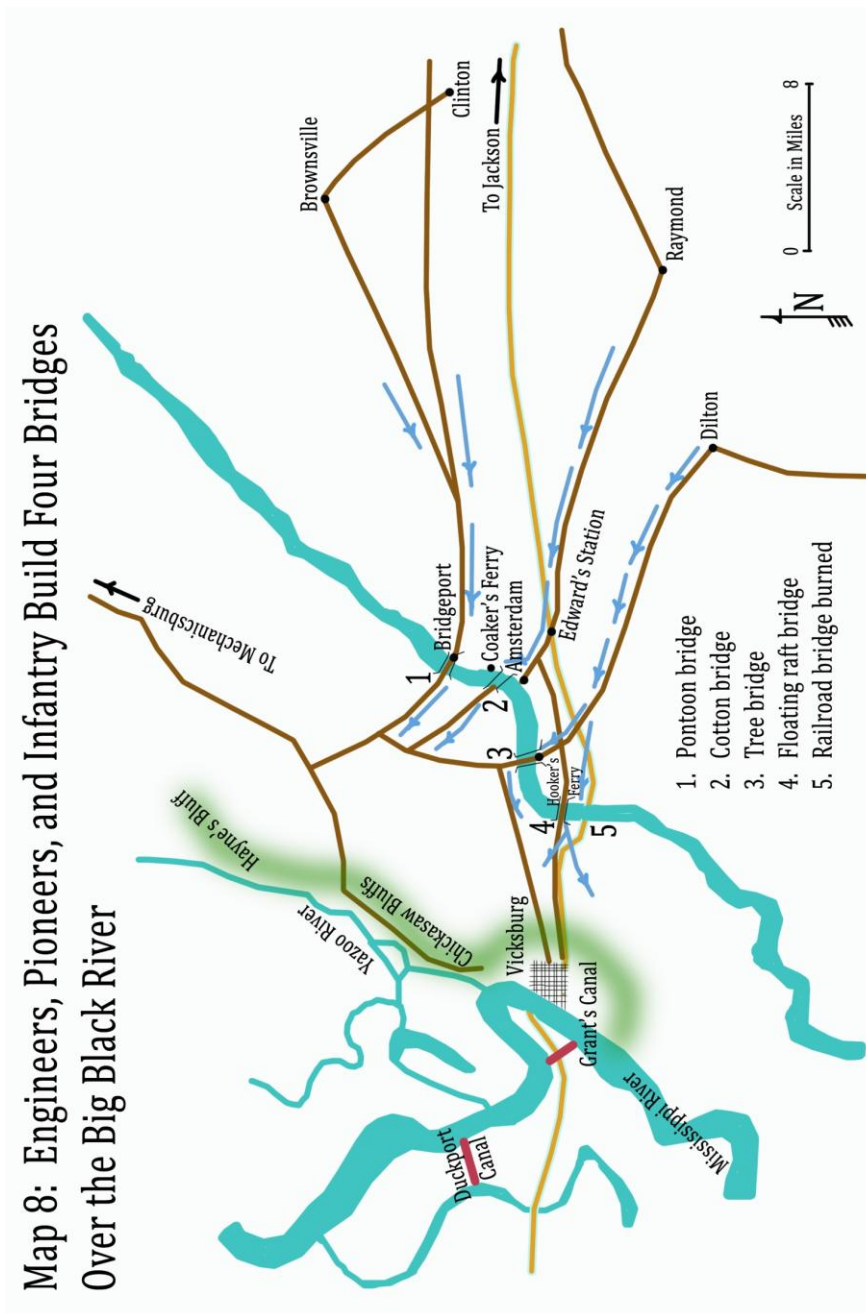
## Map 7: Grant Crosses the Mississippi and Engineers Open a Supply Line

### Map 7: Grant Crosses the Mississippi and the Engineers Open a Supply Line

1. Scow found to transport advance elements of army to New Carthage and Lone
2. Sawmill at Lone used to build pontoons to ferry men from Pointe Clear, Lone, and New Carthage
3. Transports run Vicksburg batteries April 16th and 18th
4. Grant decided it was too difficult to ferry equipment and men from New Carthage. Engineers ordered to build roadway along Bayou Vidal. (Richard, the number was cut off on my copy) bridges built
5. Four bridges built from Mrs. Perkins's Plantation to Hard Times
6. From Hart Times to Bruinsburg. Army crosses the river

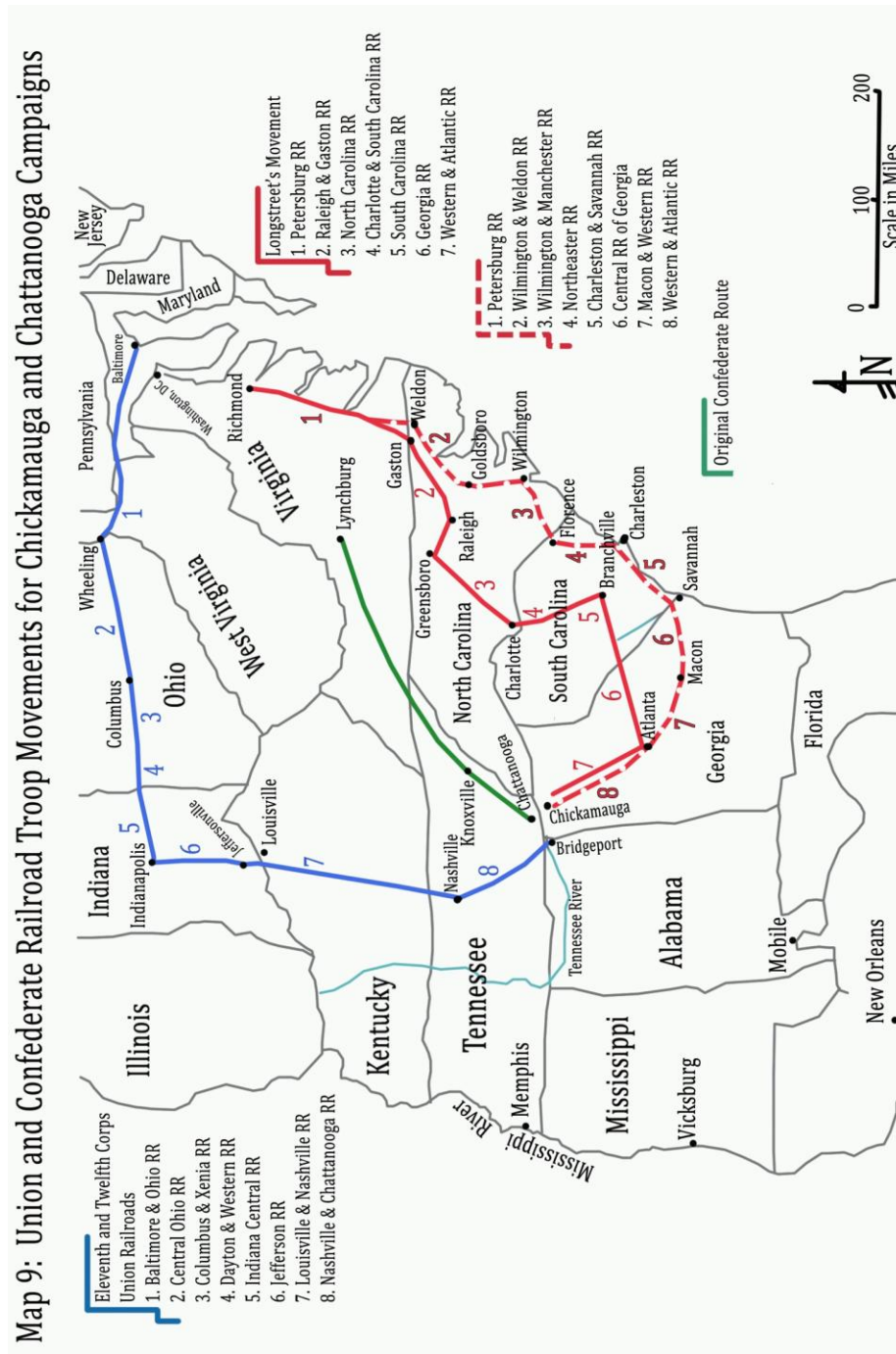


Map 8: Engineers, Pioneers, and Infantry Build Four Bridges over the Big Black River



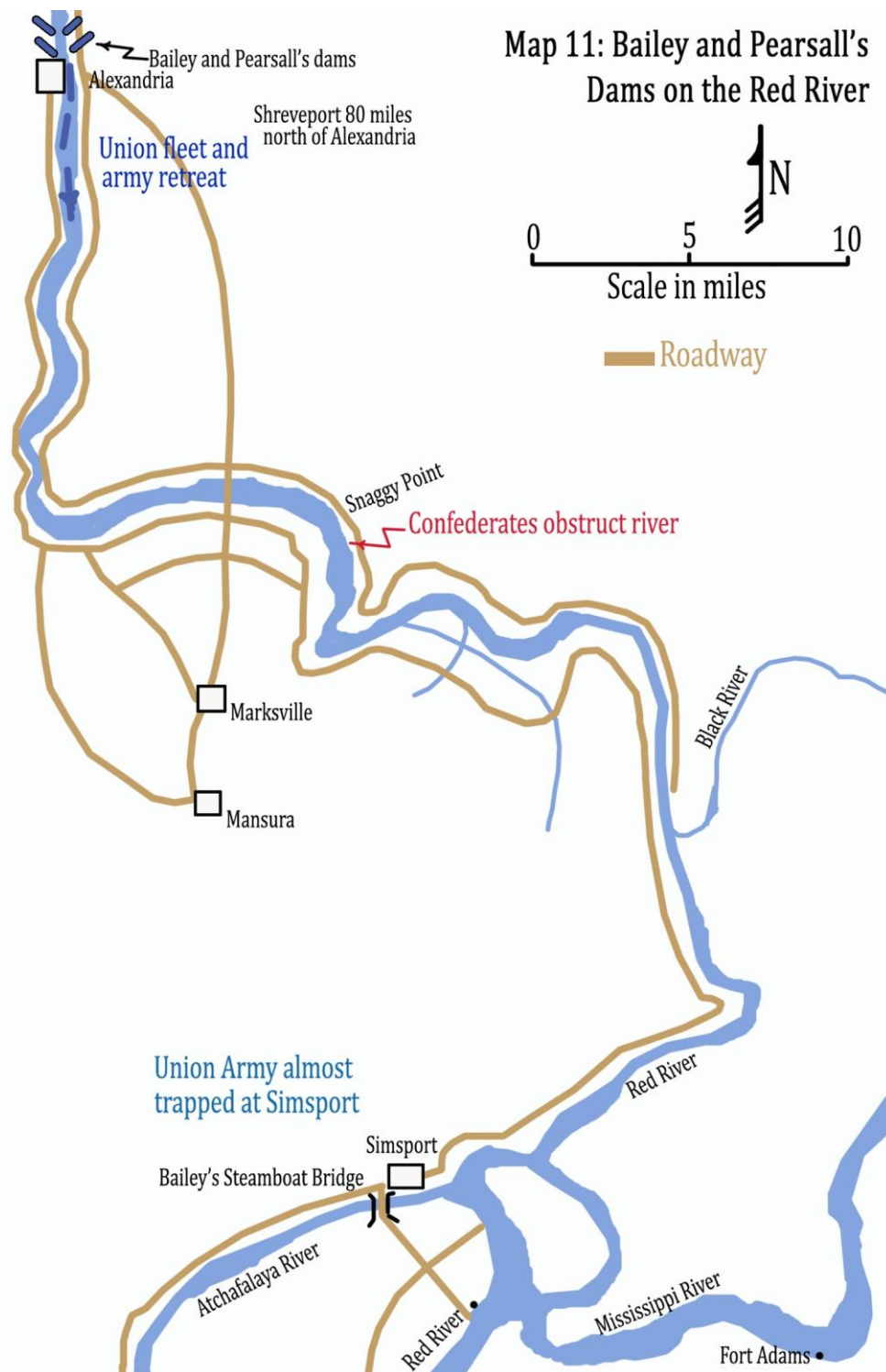


Map 9: Union, Confederate Troop Movement for Chickamauga, Chattanooga Campaigns



[illegible]

Map 11: Bailey and Pearsall's Dams on the Red River

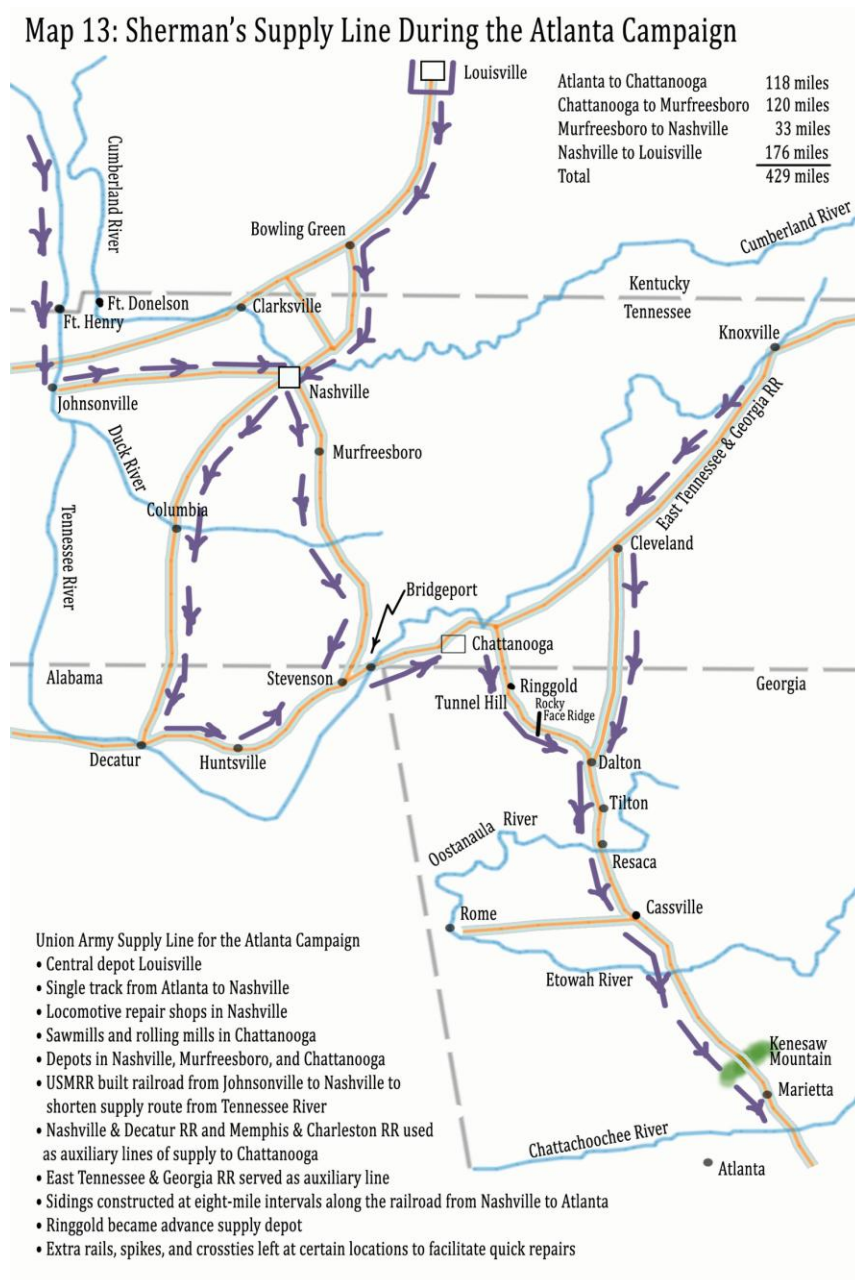


Map 12: Crossing the James River, June 1864

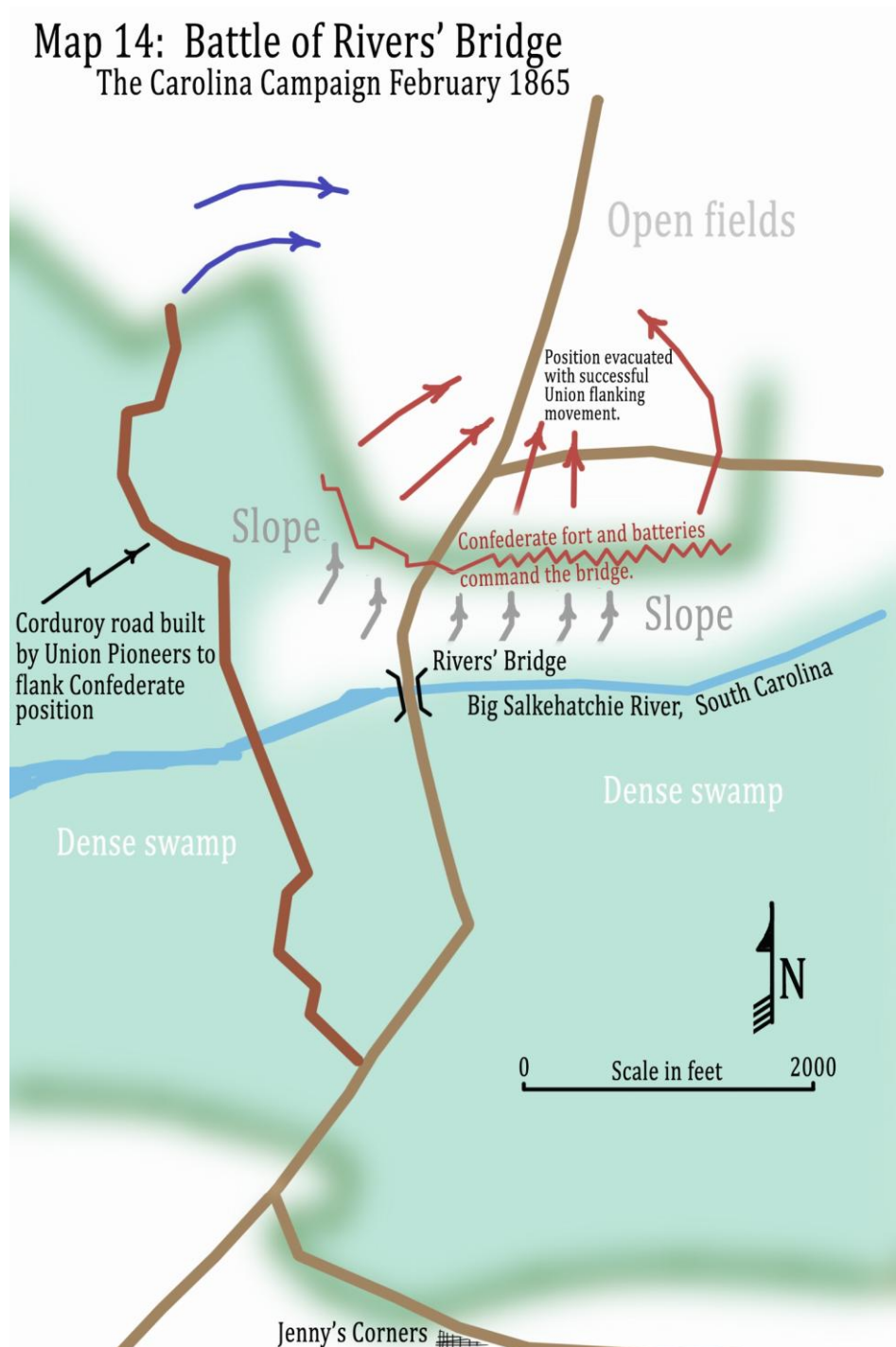




## Map 13: Sherman's Supply Line During the Atlanta Campaign



Map 14: Battle of River's Bridge



## **APPENDIX A**

### **UNION ARMY ENGINEERING ASSETS DURING THE CIVIL WAR**

#### **1861:**

- Engineer Department  
Chief of Engineers, Brigadier General Joseph Gilbert Totten
- Topographical Engineers Department  
Chief of Topographical Engineers, Colonel John James Abert, retired September 1861.  
Chief of Topographical Engineers, Colonel Stephen H. Long, September 1861 to March 1863
- Corps of Engineers: (40) engineers  
On August 3, 1861 six engineers added to the corps.  
  
First Engineer Battalion, Captain James C. Duane, Commanding  
Company A organized in 1846. Three companies more companies recruited beginning August 1861.
- Corps of Topographical Engineers: (37) topographical engineers  
On August 3, 1861 six topographical engineers added to corps.
- Volunteer Engineers:  
  
First Regiment, New York Volunteer Engineers or “Serrell’s Engineers”  
Lieutenant Colonel Edward Wellman Serrell, Commanding  
Organized October 1861. Ten companies  
  
Fifteenth Regiment, New York Volunteer Engineers  
Colonel John McLeod Murphy, Commanding  
Mustered-in as Infantry regiment, June, 1861 and converted to an Engineer regiment, October 1861. Twelve companies  
  
Fiftieth Regiment, New York Volunteer Engineers  
Colonel Charles H. Stuart, Commanding  
Mustered-in as Infantry regiment, July 1861 and converted to an Engineer regiment, October 1861. Twelve companies  
  
First Michigan Engineers and Mechanics  
Colonel William Power Innes, Commanding  
Organized October 1861. Twelve companies

Patterson's Independent Company of Volunteer Kentucky Engineers  
Captain William F. Patterson, Commanding  
Organized September 1861.

Engineer Regiment of the West or "Bissell's Engineers"  
Colonel Josiah Wolcott Bissell, Commanding  
Organized July 1861. Twelve companies

- Volunteer Engineers that served three to thirteen months:

Wolster's (Voerster's) Independent Company Sappers and Miners  
Organized May 1861 and disbanded September 1861

Howland's Battle Creek Engineers  
Organized September 1861 and disbanded December 1861

Balz's Company Sappers and Miners  
Organized October 1861 and disbanded February 1862

Gerster's Independent Company Pioneers  
Organized August 1861 and disbanded September 1862

- Corps of Topographical Engineers assisted by United States Coast Survey

#### **1862:**

- Fifteenth New York Engineers} Engineer Brigade formed March 1862/  
combined with Recognized by Congress July 1862  
Fiftieth New York Engineers} Brig. Gen. Daniel P. Woodbury, Commanding

- United States Military Railroads (USMRR)  
Military Director and Superintendent: David C. McCallum

Eastern Theater:

Chief of Construction and Transportation: Colonel Herman Haupt

Construction Corps:

Squad (Ten men) Supervised by civilian foremen

Gangs (Groups of squads) Supervised by army

Engineers

Western Theater:

Manager of Railroads: John B. Anderson

Construction and Repair:

Detachments from Bissell's Engineers and First

Michigan Engineers and Thirteenth Ohio Infantry

- Wrigley's Independent Company of Pennsylvania Engineers  
Organized August 1862



Captain Henry E. Wrigley, Commanding

- Pioneer Brigade attached to Army of the Cumberland  
Organized December 1862  
Captain James St.Clair Morton, Commanding

**1863:**

- Topographical Engineers consolidated with Corps of Engineers  
March 3, 1863

- Corps de Afrique: Department of the Gulf

First Regiment Engineers  
Organized April 1863  
Captain Andre Cailloux, Commanding

Second Regiment Engineers  
Organized August 1863  
Colonel Spencer H. Stafford, Commanding

Third Regiment Engineers  
Organized August 1863  
Colonel George D. Robinson, Commanding

Fourth Regiment Engineers  
Organized September 1863  
Colonel Charles W. Drew, Commanding

Fifth Regiment Engineers  
Organized February 1864  
Colonel Uri B. Pearsall, Commanding

- Infantry used as Engineers or Pioneers at Vicksburg:

15<sup>th</sup> Iowa; 48<sup>th</sup>, 49<sup>th</sup>, and 59<sup>th</sup> Indiana; 4<sup>th</sup> Minnesota;  
18<sup>th</sup> Wisconsin; 35<sup>th</sup> Missouri; 114<sup>th</sup> Ohio; 127<sup>th</sup> Illinois  
45<sup>th</sup> Illinois, 20<sup>th</sup> Illinois, 9<sup>th</sup> Connecticut

- Temporary Engineer Brigade at Chattanooga:

Detachment First Michigan Engineers; 13<sup>th</sup>, 21<sup>st</sup>, and 22<sup>nd</sup>  
Michigan; 18<sup>th</sup> Ohio

**1864:**

- Engineer Department  
Chief of Engineers, Brigadier General Richard Delafield
  
- First Veteran Volunteer Engineers: Army of the Cumberland  
Organized April 1864  
Colonel William E. Merrill, Commanding
  
- Corps de Afrique redesignated April 1864  
First Regiment Engineers now  
95<sup>th</sup> United States Colored Troops (U. S. C. T.)  
Second through Fifth Regiments Engineers now  
96<sup>th</sup> U. S. C. T.  
97<sup>th</sup> U. S. C. T.  
98<sup>th</sup> U. S. C. T.  
99<sup>th</sup> U. S. C. T.
  
- Engineer Regiment of the West (Bissell) consolidated with 25<sup>th</sup> Missouri Infantry  
now First Missouri Engineers
  
- First Pontoniers: Department of the Gulf  
Organized March 1864  
Captain Peter C. Hains, Commanding
  
- Pioneer Brigade disbanded September 1864
  
- 58<sup>th</sup> Indiana Infantry organized as Pioneer regiment April 1864  
Colonel George Pearson Buell, Commanding
  
- Western Theater USMRR reorganized April 1864  
Adna Anderson  
General Superintendent of Transportation  
And Maintenance  
W. W. Wright  
Chief Engineer of Construction

Construction Corps:

Division (Supervised by army engineer)

Five Subdivisions (Supervised by assistant army engineer)

Bridges and Carpentry (Supervised by foreman and sub-foreman)

Squads (ten men); Gangs (groups of squads)

Track

Water Stations

Masonry

Ox Brigade

Train crew, conductors, brakemen, locomotive engineers

Firemen, cooks

**1865:**

- A large number of infantry regiments served as pioneers during General Sherman's Carolina Campaign

Sources: Thomas H. S. Hamersly, *Complete Regular Army Register of the United States: For One Hundred Years, 1779 to 1879* (Washington, DC: T. H. S. Hemersly, 1881). Phillip M. Thienel, "Engineers in the Union Army. 1861-1865," *The Military Engineer* 315 (January-February 1955).

## **APPENDIX B**

### **CONFEDERATE ENGINEERING ASSETS DURING THE CIVIL WAR**

#### **1861:**

- Corps of Engineers organized in spring. (50) Engineer officers appointed all with the rank of either captain or lieutenant.
- Engineer Bureau established in April:
  - “Acting Chief” Major Josiah Gorgas (April to August 1861)  
Gorgas also served as Chief of Ordnance for the entire war
  - “Acting Chief” Major Danville Leadbetter (August to November 1861)
  - “Acting Chief” Lt. Col. Alfred L. Rives (November to September 1862)
- Quartermaster Department established in April  
Quartermaster General Colonel Abraham C. Myers
- Director of Railroad Transportation to the Confederate armies in Virginia  
Major and Assistant Quartermaster William Sheppard Ashe

#### **1862:**

- Corps of Engineers expanded to 100 officers
- Engineer Bureau:
  - Chief of Bureau Lt. Col. Jeremy F. Gilmer (September to August 1863)
- Military Department of Richmond:
  - Chief Engineer Lt. Col. Walter Husted Stevens
  - Establishment of Map Office July 1862
- Map Office established within Engineer Bureau November 1862
  - Chief officer Captain Albert H. Campbell
  - Civilian mapmakers hired, i.e. Jedidiah Hotchkiss and others
- Quartermaster General’s Office:
  - Director of Railroad Transportation in Virginia:  
Captain Mason Morfit
- Director of Military Traffic, North Carolina:
  - President of the Atlantic & North Carolina Railroad, John D. Whitford

- Superintendent of Government Railroad Traffic (November):  
Colonel William W. Wadley

### **1863:**

- Engineer Bureau:  
"Acting Chief" Lt. Col. Alfred L. Rives (August 1863 to March 1864)
- First Regiment Engineers organized in August. Eight companies.  
Colonel Thomas M. R. Talcott, Commanding
- Quartermaster General Alexander R. Lawton (August to May 1865)  
Quartermaster officers at all principal railroad station points  
Throughout the Confederacy
- Commissary General Lucius B. Northrop (1861-1865)  
Commissary officers at all principal railroad station points  
Throughout the Confederacy
- Presidents of southern railroads maintained control of their own lines throughout the war.
- Railroad Bureau functioned by name beginning in fall 1863. Bureau, however, never officially recognized by the Confederate Congress.  
Lt. Col. Frederick William Sims, Bureau Head

### **1864:**

- Engineer Bureau:  
Chief of Bureau Major General Luther Martin Smith (March to April)  
"Acting Chief" Colonel Alfred L. Rives (April to June)  
Chief of Bureau Major General Jeremy F. Gilmer (June to end of war)  
Engineer Bureau asks Conscription Bureau for a force of  
20,000 slaves  
War Department ordered the rebuilding and repair of railroads the  
Purview of the Engineer Bureau
- Second Regiment Engineers organized in summer. Two companies.  
Second Regiment did not exist as a separate command  
Eventually six undersized companies served in the southeast  
Under local commanders  
Four companies were folded into the First Regiment Engineers
- Third Regiment Engineers organized in the summer. Eight companies  
Lt. Col. Stephen Wilson Presstman, Commanding

- Fourth Regiment Engineers organized in the summer. Four companies.

Colonel Hugh T. Douglas, Commanding

Records indicate that the nucleus of the Fourth Regiment Engineers came from the First Engineer Battalion organized by Douglas sometime between December 1863 and April 1864.

- Railroad Bureau announced the service of two new administrators:

Captain John M. Robinson, Supervisor of Railroad Transportation

Between Wilmington, North Carolina and Richmond, Virginia

Major George Whitfield, Supervisor of Railroad Transportation

Beyond the Alabama River

### **1865:**

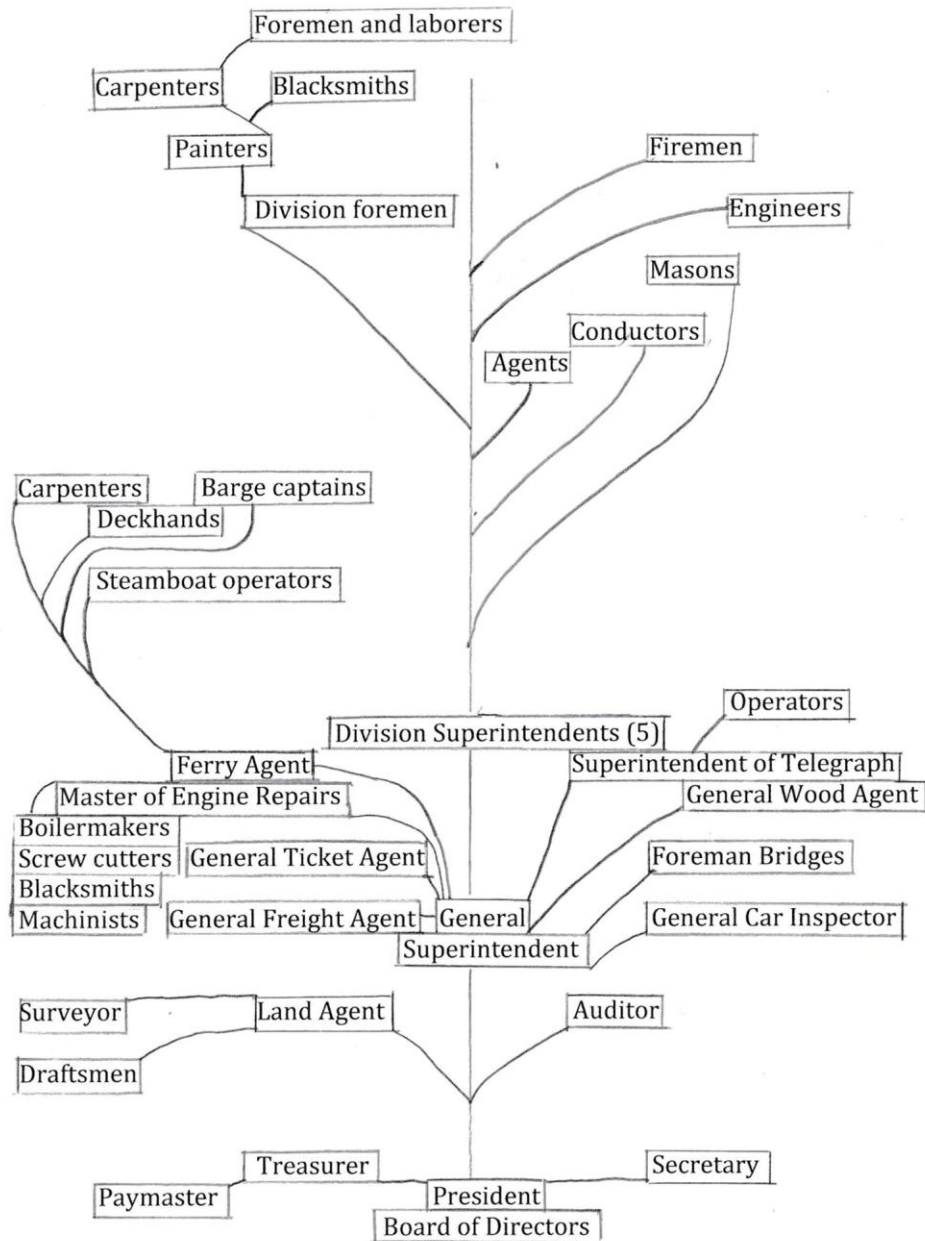
- Confederate President Jefferson Davis signs bill March 1, 1865 to nationalize southern railroads.

Sources: Robert C. Black, III, *The Railroads of the Confederacy* (Chapel Hill: The University of North Carolina Press, 1998). Robert E. L. Krick, *Staff Officers in Gray: A Biographical Register of the Staff Officers in the Army of Northern Virginia* (Chapel Hill: The University of North Carolina Press, 2003). George T. Ness, Jr., "Engineers of the Civil War," *The Military Engineer* 299 (May-June 1952).

## APPENDIX C

### GENERAL OUTLINE OF DANIEL C. McCALLUM'S ORGANIZATIONAL CHART

#### FOR THE NEW YORK & ERIE RAILROAD, 1854



## **APPENDIX D**

### **A SHORT HISTORY OF THE UNITED STATES ARMY'S CORPS OF ENGINEERS AND CORPS OF TOPOGRAPHICAL ENGINEERS**

The formation and history of the Corps of Engineers and Corps of Topographical Engineers can be broken into five periods: (1) The Foundational Period, 1775 to 1783, (2) The Post-Revolutionary War Period, 1784 to 1800, (3) The Jeffersonian Period, 1800 to 1819, (4) The Jacksonian Period, 1820 to 1845, and (5) The Mexican War and Peacetime Period, 1846 to 1861.

After British soldiers from His Majesty's 43<sup>rd</sup> Regiment of Foot, "fired the shots heard round the world" on the morning of April 19, 1775 at the North Bridge in Concord the thirteen American colonies found themselves moving rapidly towards a war of revolution with the greatest military power in the western world, Great Britain. It also soon became apparent to the colonies' new commander-in-chief, General George Washington, that militia critical in defending states from British encroachment, could not be relied upon to operate and contest the British Army over considerable time and space. Yet, in addition to efforts required to recruit foot soldiers for the new Continental Army, Washington needed military engineers. Eighteenth century warfare demanded that armies build both reliable field fortifications and conduct effective siege operations, and to do so required the expertise of skilled military engineers. At the start of the Revolution, however, few colonists had any knowledge of military engineering.

For the Foundation Period (1775-1783) of the Corps of Engineers, Washington and the Second Continental Congress would first have to rely on the few New Englanders who had gained some engineering experience during the French and Indian War and some who were self taught mechanics and builders.



Colonel Richard Gridley was one of those Yankees who had studied mathematics as a boy in Boston, as a young man applied his knowledge to mechanical problems in the city, and during the French and Indian War joined the British forces as a military engineer. He observed the professional engineers in the British Army, and participated at the siege of Louisburg in 1745. He had gained valuable experience throughout the war.

Gridley had laid out an excellent defensive plan on Bunker Hill with the help of two others, Captain Jeduthan Baldwin and Lieutenant Colonel Rufus Putnam. Baldwin was from Woburn, Massachusetts and as a civilian had demonstrated an aptitude for building and carpentry. Baldwin, no doubt, also obtained his interest in the mechanical arts from his most likely relative Loammi Baldwin, a civil engineer also from Woburn. Loammi was a cabinetmaker in town but would frequently walk to Cambridge to attend lectures on mathematics and science by Professor John Winthrop of Harvard. Rufus Putnam, also from Massachusetts, gained a rudimentary understanding of engineering before the war. As a boy he was apprenticed to a millwright and in the mid-1770s worked as a builder and surveyor.

When Washington arrived in Cambridge in the summer of 1775 he immediately recognized Gridley's skills and as a result, made him the Continental Army's first chief engineer. The Congress had authorized the establishment of the Continental Army on June 16, 1775 and they provided for a Chief Engineer and two assistants with the army, and a Chief Engineer and two assistants in an Engineering Department if one was established. Gridley, a capable engineer and brave soldier, remained chief engineer until September 1776, when because of his age (66) he was replaced by Rufus Putnam as chief engineer.

It was Colonel Putnam who orchestrated one of the war's most remarkable engineering operations. Following Lexington and Concord in April 1775 the British army had come under siege in Boston by the Americans who occupied Cambridge and the surrounding communities.

The British attack on Bunker Hill was an attempt to break the siege, but very high English casualties prevented British General William Howe from following up his brief albeit costly victory.

In 1775 Boston was a peninsula. The only way out of the city on foot was over a tiny neck of land leading to the town of Dorchester. As the siege dragged on into the bitterly cold months of January and February 1776 Washington became increasingly impatient. The general was anxious to strike at his enemy by crossing the ice on the Charles River and attacking the British in the city. The other generals believed an attack over the frozen Charles would only invite disaster, and instead, suggested that a better strategy was to draw the redcoats out of Boston by taking possession of Dorchester Heights.

Washington told Putnam of the suggestion to take Dorchester Heights, and the engineer informed the general that the ground frozen twenty-two inches deep and hard as a rock made it impossible to establish a lodgment in the usual way on the heights. Putnam needed time to study the problem, which Washington happily granted. Washington would now pursue his original plan of crossing the Charles reminding his generals that the army needed to take the initiative and attack. Putnam, in the meantime, would visit the quarters of General William Heath just to pay his respects. Putnam's social call would change the course of the siege of Boston.

On Heath's table was a copy of M. le Chevalier de Clairac's book *Ingenieur de Campagne ou Traite de la Fortification Passagere*, which Putnam asked to borrow.<sup>1</sup> Heath agreed to loan the book. Putnam, returning to his tent, began to review the treatise. Almost immediately Putnam stumbled over the word *chandilears*. He was unfamiliar with the word but discovered an illustration of one and realized he had a solution to the lodgment problem on Dorchester

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<sup>1</sup> *The Field Engineer or a Brief Treatise on Fortifications.*

Heights. The *chandilear* was a type of crib used to build a section of fortification during siege operations. A ten-foot long board was laid on the ground, and at about three feet from each end other boards were placed, which looked like narrow pyramids and ran perpendicular to the floorboards. These were braced to the boards themselves for support. Two of these structures would be placed four or five feet apart and then large pieces of timber and dirt were placed between them creating a wall approximately ten feet high.

These *chandeliers* were built in camp and then moved stealthy into position on the night of March 4<sup>th</sup> and early morning of March 5<sup>th</sup>. Work parties moved tools, stones, barrels filled with stone and sands, and hay to the heights to build a makeshift fortification approximately four hundred feet long and ten feet high. Perhaps it was apocryphal, but it was reported that when British General William Howe saw the fort at sunrise on March 5<sup>th</sup> he said, “the Americans did more work in one night than his whole army would have done in six months.” Archibald Robertson, one of Howe’s engineers, did call the effort “a most astonishing night’s work.”<sup>2</sup>

Despite Putnam’s successful *chandelier* fortification and the British Army’s evacuation of Boston on Saint Patrick’s Day 1776, Washington continued to request more engineers from Congress, and Congress in response to the general’s plea, turned to France for assistance. The story of the arrival of French engineer officers was a complex one, yet by the end of 1777 Congress appointed Louis Lebègue Duportail brigadier general and chief engineer. Duportail, who held his position throughout the rest of the war, contributed considerable energy to training American officers as engineers. With his political connections in Congress, and his easily recognized professionalism, Duportail managed to persuade Congress to both authorize three

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<sup>2</sup> Paul K. Walker, *Engineers of Independence: A Documentary History of the Army Engineers in the American Revolution, 1775-1783* (Alexandria, VA: U. S. Army Corps of Engineers, 1981), 65-70. See also Mark M. Boatner, III, *Encyclopedia of the American Revolution* (Mechanicsburg, PA: Stackpole Books, 1994).

companies of Sappers and Miners in 1778, and on March 11, 1779, to pass a resolution, which formed the Continental Army's first Corps of Engineers. Two years before the Corps of Engineers formed Congress had appointed Robert Erskine as Geographer of the Army, and upon Erskine's death in 1780, appointed Simeon De Witt Geographer for the Northern Army and Thomas Hutchins Geographer for the Southern Army.

After the American victory at Yorktown in 1781, in which French and American engineers and the companies of Sappers and Miners played an important part, the Congress turned its attention to governing the new nation. Among the myriad of questions to address, and the one that would stir debates during the second or Post-Revolutionary Period (1784-1800) of the Corps of Engineers development was whether the new nation should maintain a peacetime army.

General Washington believed a peacetime army essential for American security. He had spent eight years fighting a revolutionary struggle to win independence from Great Britain, and he believed that in order to sustain and defend the new nation that military preparedness was essential. His experience, moreover, taught him that a well trained corps of engineers and expert artillerists could not be raised in a day or a month, or even a year because a firm grasp of mathematics and geometry were required of these officers, as well as considerable technical training and practice. He proposed to Congress a four-part plan for the future of the army. First, the nation should maintain a small regular army with professional officers. Second, the states would continue to train their militia companies. Third, the government would establish military supply depots throughout the country, and finally, schools would be created to train artillerists and engineers in military science.

Congress had a different view. They remembered the quartering of English officers in private homes, the arrogance those officers displayed, and the deference paid to them. The war

had broken the yoke of tyranny and absolutism, including the tyranny of the British Army. So despite Washington's rational and recommendations for a peacetime army, Congress was not interested. Between 1783 and 1793 the army was reduced to several regiments and no engineers served in it.

In March 1794 as tensions began to boil between the United States and Great Britain over the impressment of American sailors by British naval commanders, Congress authorized President Washington to appoint temporary engineers to direct fortifications of key harbors along the east coast. In May 1795 Congress decided to organize a Corps of Engineers and Artillerists under the command of Lieutenant Stephen Rochfontaine at West Point, New York, and Congress also created a national coastal defense policy known as the First Defense System. Three years later when the XYZ Affair precipitated a Quasi War with France, Congress authorized a second regiment of the Corps of Artillerists and Engineers.<sup>3</sup>

In 1801, two years after hostilities between the U. S. and France came to a close, Thomas Jefferson was elected (by the House of Representatives) President of the United States. He would usher in the Jeffersonian Period (1800-1816) in the development and history of the Corps of Engineers with the establishment in 1802 of the United States Military Academy at West Point, New York.

Jefferson realized that the country needed trained engineers to design and build the harbors and roadways of the new nation, and thus he supported Congress' decision to separate the engineers from the artillerists and establish the military academy on March 16, 1802. The president believed that if the government created a military school then it could also influence both the mission and curriculum. A military school, which trained young men to serve as

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<sup>3</sup> *The History of the U. S. Army Corps of Engineers* (Alexandria, VA: The U. S. Army Corps of Engineers, 1988), 17-22.

scientists, naturalists, and civil engineers made perfect sense to Jefferson. Finally, the recent conflict with France impressed upon everyone the need stop relying on foreigners for engineers and to divorce their direct influence from the army. Jefferson selected Colonel Jonathan Williams to be the academy's first superintendent. Williams had joined the American Philosophical Society in 1788, and he had published articles on scientific subjects. Williams was in Jefferson's mind a scientist and engineer first and a soldier second.

Once again as war with Great Britain threatened the United States in 1807, Congress renewed its fortification program and the Second Defense System was born. The fort that would become the prototype for the nation's coastal protection was designed and supervised by Colonel Williams. One half mile from the southern tip of Manhattan, Castle Williams still sits on Governors Island in New York harbor, a testament to early American military engineering.

When the War of 1812 broke out, the seventeen engineer officers and nineteen enlisted men in the corps of engineers performed admirably. They had constructed permanent defenses along the Atlantic coast, and at times, the officers had assumed command responsibility for troops in the field. This necessary transfer of engineer officers from staff to line positions, however, caused confusion. To whom did the engineers report? Did the commanding officers in the field have responsibility for the engineers serving in their forces? Were engineer officers responsible to the chief engineer? Were engineers responsible to the Secretary of War? These questions made for a faulty command structure, which remained unanswered up to the beginning of the Civil War.

Yet, changes were made to the Corps of Engineers that enabled the organization to provide great service to the growing nation. The Corps of Engineers entered the Jacksonian Period (1817-1846) of its development, and John C. Calhoun of South Carolina became one of the corps advocates and leaders.

As secretary of war (1817-1825), Calhoun made several critical changes to the engineers' organization. First, he determined that West Point would be assigned to the corps of engineers and that the superintendent of the academy would be appointed from the corps. Next, he ordered that the inspector of West Point was always to be the chief of the corps of engineers. Next, Calhoun decided to move the chief of engineers from West Point to Washington, DC to head the Engineer Bureau within the War Department. It was also under Calhoun's leadership that the army formed the topographical engineers and a topographical office to serve within the Engineer Bureau of the War Department.

Finally, with memory of the War of 1812 firmly implanted in its mind, Congress authorized, and Calhoun led, an ambitious program to build fifty new forts along the coast, thus inaugurating the nation's Third Defense System.<sup>4</sup> The government formed a Board of Engineers for Fortifications to oversee the construction projects and to maintain tight control over all expenditures. The building of the fort to guard the entrance to Savannah harbor (Georgia), Fort Pulaski, was for a short time supervised by a young second lieutenant named Robert E. Lee. By 1861, forty-three of the fifty planned fortifications had been constructed.

When West Point was assigned to the corps of engineers the curriculum developed principally under three men: Sylvanias Thayer class of 1808, Dennis Hart Mahan class of 1824, and Henry Wager Halleck class of 1839. Thayer, called the "Father of West Point," spent two years studying at the *École d'Arts et Métiers* at Metz, France where he acquired valuable experience and knowledge, which he incorporated into West Point's mathematics, science, and engineering curriculum. Mahan, who became a professor of civil and military engineering at the

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<sup>4</sup> For an outstanding discussion of the Third Defense System see Mark A. Smith, *Engineering Security: The Corps of Engineers and Third System Defense Policy, 1815-1861* (Tuscaloosa: University of Alabama Press, 2009). Some of the forts built during this period included Fort Sumter (South Carolina), Fort Monroe (Virginia), Fort Pulaski (Georgia), Fort Pickens (Florida), Fort Adams (Rhode Island), and Fort Trumbull (Connecticut).

academy, introduced the study of field fortifications into the curriculum. His book, *A Treatise on Field Fortifications* influenced the strategy and tactics of many a Civil War general.

Mahan's favorite student was Henry Halleck. Unlike his teacher, however, Halleck was as interested in military theory as he was in applied military science. His ideas were influenced by the Austrian Henri Jomini, and in Halleck's book *The Elements of Military Art and Science* (1846), he wrote at length about Jomini's theory of using internal lines of communication to take advantage of the enemy's weakest position. Halleck also argued that the body of knowledge necessary to be a good officer could only be mastered through professional education.

During the Jacksonian Period army engineers made significant contributions to the development of the country's emerging transportation system. West Point trained engineers surveyed the country, and built roads, canals, bridges, and railroads. They improved waterways and harbors, designed and built lighthouses. Captain Richard Delafield designed and supervised the building of the first cast iron bridge in the United States. The Dunlap's Creek Bridge at Brownsville, Pennsylvania is still in use today.<sup>5</sup>

Like the engineers, the corps of topographical engineers worked on harbor and lighthouse projects. The tallest lighthouse in the Florida Keys and built on a reef was designed by Lieutenant George G. Meade just seven years before he faced Robert E. Lee's Army of Northern Virginia at Gettysburg. Meade was a member of the corps of topographical engineers. In July 1838 Congress had authorized a separation of the corps of topographical engineers with the corps of engineers, and it established a Topographical Engineer Bureau within the War

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<sup>5</sup> Richard Delafield would become Chief Engineer of the U. S. Army in 1864.



Department. Furthermore, the government turned over all civil engineering projects to the corps of topographical engineers.<sup>6</sup>

At the same time that West Point was becoming more professional and army engineers and topographical engineers were working on improving the country's infrastructure, some Jacksonians led by Tennessee Congressman Davey Crockett, and former West Point superintendent Alden Partridge raised the question as to whether a federally funded military academy was even needed. They argued that a well-educated and trained officer corps was dangerous to free government. Public funding of the academy, moreover, was a misuse of the country's resources because the nation could rely on its citizen-soldiers to defend our homeland in time of crisis as our forefathers had done. Sylvania Thayer had replaced him as superintendent of the academy but Partridge refused to step down, and consequently was court-martialed.

Two states' legislatures, Ohio and Tennessee, also passed resolutions asking their federal congressmen and senators to work to close West Point. Eventually, a board of visitors defended the academy, as did the U. S. House Committee on Military Affairs. In 1834, the latter produced a report entitled a "Statement to the History and Importance of the Military Academy at West Point, New York and Reasons Why it Should Not be Abolished."<sup>7</sup> The political attacks among the Jacksonians finally subsided and the nation focused on its Manifest Destiny and especially expansion in the southwest.

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<sup>6</sup> Henry P. Beers, "A History of the U. S. Topographical Engineers, 1818-1863," U. S. Corps of Topographical Engineers, [www.topogs.org/History.htm](http://www.topogs.org/History.htm) (accessed February 2, 2014).

<sup>7</sup> For an excellent discussion on West Point's struggle to survive in the 1830s see Captain Mark Rice, "Defending the Ramparts: The United States Military Academy's Struggle for Survival In the Age of Jackson," United States Military Academy, digital-library.usma.edu/libmedia/archives/toep/usma\_struggle\_survival\_age\_jackson.pdf (accessed March 1, 2014).

When war broke out along the Texas border between the United States and Mexico in 1846 the corps of engineers and topographical engineers entered a new era. This period covered both the war and the peace which followed until hostilities erupted in 1861.

Just prior to the outbreak of the Mexican-American War, the Corps of Engineers had forty-three officers and the corps of topographical engineers had thirty-six officers. The corps' work, with the exception of the Seminole Wars (1817-1818, 1835-1842, and 1855-1858) served a peacetime function, and its labor force came from the civilian population. When hostilities between Mexico and the United States erupted on the Texas border in April 1846, Major General Winfield Scott asked Congress to increase the army's strength, including the Corps of Engineers. Scott and Chief Engineer Joseph Gilbert Totten, for a number of years, had argued for trained engineer soldiers. Congress finally responded favorably to their request one day before it declared war on Mexico. Congress increased the army from 7,000 to 18,000 regulars and established a 100-man company of sappers, miners, and pontoniers who became Company "A," Corps of Engineers.<sup>8</sup>

The company was to consist of ten sergeants, ten corporals, thirty-nine artificers or privates first-class, thirty-nine laborers or privates second-class, and two musicians. Three officers were placed in command of the company: Captain Alexander Swift, who had spent two years at the *École d'Application d'Artillerie et de Génie* at Metz; Lieutenant Gustaf W. Smith, a faculty member at West Point; and Brevet Second Lieutenant George B. McClellan.<sup>9</sup>

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<sup>8</sup> Congress approved the creation of a company of engineer troops on May 15, 1846 and declared war on Mexico May 16, 1846.

<sup>9</sup> Paul K. Walker, "War with Mexico: The Northern Campaign, 1846-1847," *Engineer* (December 1996). For a detailed discussion on the role topographical engineers played during the Mexican-American War see Adrian Traas, *From the Golden Gate to Mexico City: The U. S. Army Topographical Engineers in the Mexican War, 1846-1848* (Washington, DC: U. S. Government Printing Office, 1993). McClellan was one of Smith's students at West Point, and Smith

Recruitment for the company was slow and it never reached one hundred men. The company, however, distinguished itself on numerous occasions during the war including at Vera Cruz, Cerro Gordo Pass, Contreras, and Chapultepec. By the end of the war, both the officers and men of the company took considerable pride in their accomplishments and they believed that their unique skills and versatility made them an elite unit within the army. This attitude was on display when Artificer (Private First-Class) Frederick W. Gerber told the story of an argument he had with a sergeant of infantry just after the war ended. The two men had been drinking, and eventually started to quarrel over the question of who won the war, the infantry or the engineers. At some point the sergeant threatened to arrest Gerber for disturbing the peace. Gerber replied, "No damned infantry sergeant has rank enough to arrest an artificer of engineers." This prompted the two men to draw swords, and to the amusement of onlookers, they began swing at one another until the sergeant had his sword knocked out of his hand by the deft artificer. Gerber, pride intact, was immediately arrested and only released after his company commander came to claim him. For his part, the company commander did not punish Gerber but instead promised him a promotion. Gerber was promoted and remained in the army after the war. By the Civil War he had become sergeant major of the Engineer Battalion.<sup>10</sup>

Company "A" returned to West Point where it was stationed until war began in 1861.

In the final decade before the Civil War the corps of engineers focused its attention, as it did before the Mexican-American War, on the nation's infrastructure and fortifications. Second Lieutenant Nathaniel Michler worked on a survey of the interoceanic ship canal from the Gulf of Darien to the Pacific Ocean, and Second Lieutenant William Rosecrans supervised repairs to Fort

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recommended Cadet McClellan as the junior lieutenant in Company "A." Consequently, McClellan was appointed to the company several days before he graduated from the academy.

<sup>10</sup> William M. Robinson, Jr., "The Engineer Soldiers in the Mexican War," *The Military Engineer* 133 (January-February 1932).

Adams in Newport, Rhode Island. Second Lieutenant Gouverneur Warren surveyed and mapped the Dakota and Nebraska Territories, and Second Lieutenant Frederick Prime supervised the building of a fort on Alcatraz Island, San Francisco harbor.<sup>11</sup>

When shots were fired at Fort Sumter in the early morning hours of April 12, 1861 army engineers and topographical engineers were scattered throughout the continent working on projects that for the most part, were designed to bring peacetime prosperity to the United States. Now some engineer and topographical engineer officers would resign from the army and join the Confederate cause. Whether serving as Union or Confederate engineers, map makers, or general officers, their work now would turn from peacetime pursuits to wartime operations. Harbor improvements, navigational problems, and lighthouse building would give way to pontoon bridge construction, corduroy roads, mines, and trenches.

#### Chief Engineer of the Continental Army:

|                               | Date of Service | Birthplace    |
|-------------------------------|-----------------|---------------|
| Colonel Richard Gridley       | 1775-1776       | Massachusetts |
| Colonel Rufus Putnam          | 1776            | Massachusetts |
| Major General Louis Duportail | 1777-1783       | France        |

#### Chief Engineer, United States Army

|  |           |               |
|--|-----------|---------------|
| Lieutenant Colonel Stephen Rochefontaine | 1783-1798 | France        |
| Lieutenant Colonel Henry Burbeck         | 1798-1802 | Massachusetts |

#### Chief Engineer, U. S. Army Corps of Engineers

|                           |                     |               |
|---------------------------|---------------------|---------------|
| Colonel Jonathan Williams | 1802-1803/1805-1812 | Massachusetts |
|---------------------------|---------------------|---------------|

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<sup>11</sup> George W. Cullum, "Biographical Register of the Officers and Graduates of the United States Military Academy at West Point, New York, Since its Establishment in 1802," Cullum's Register [Penelope.uchicago.edu/Thayer/E/Gazetteer/Places/America/United\\_States/Army/USMA/Cullums\\_Register/home.html](http://Penelope.uchicago.edu/Thayer/E/Gazetteer/Places/America/United_States/Army/USMA/Cullums_Register/home.html) (accessed February 4, 2014). The Gulf of Darien is in the southern most area of the Caribbean Sea, north and east of the border between Panama and Columbia.

|                                     |           |               |
|-------------------------------------|-----------|---------------|
| Colonel Joseph Gardner Swift        | 1812-1818 | Massachusetts |
| Colonel Walker Keith Armistead      | 1818-1821 | Virginia      |
| Colonel Alexander Macomb            | 1821-1828 | Michigan      |
| Colonel Charles Gratiot             | 1828-1838 | Missouri      |
| Brigadier General Joseph Totten     | 1838-1864 | Connecticut   |
| Brigadier General Richard Delafield | 1864-1866 | New York      |

Chief Topographical Engineer, U. S. Army Corps of Engineers

|                       |           |              |
|-----------------------|-----------|--------------|
| Major Isaac Roberdeau | 1818-1829 | Pennsylvania |
|-----------------------|-----------|--------------|

Chief Topographical Engineer, U. S. Army Corps of Topographical Engineers

|                      |           |               |
|----------------------|-----------|---------------|
| Colonel James Abert  | 1829-1861 | Maryland      |
| Colonel Stephen Long | 1861-1863 | New Hampshire |

APPENDIX E

ILLUSTRATIONS

ILLUSTRATION 1

SAW USED BY MISSOURI ENGINEERS ISLAND NO. 10

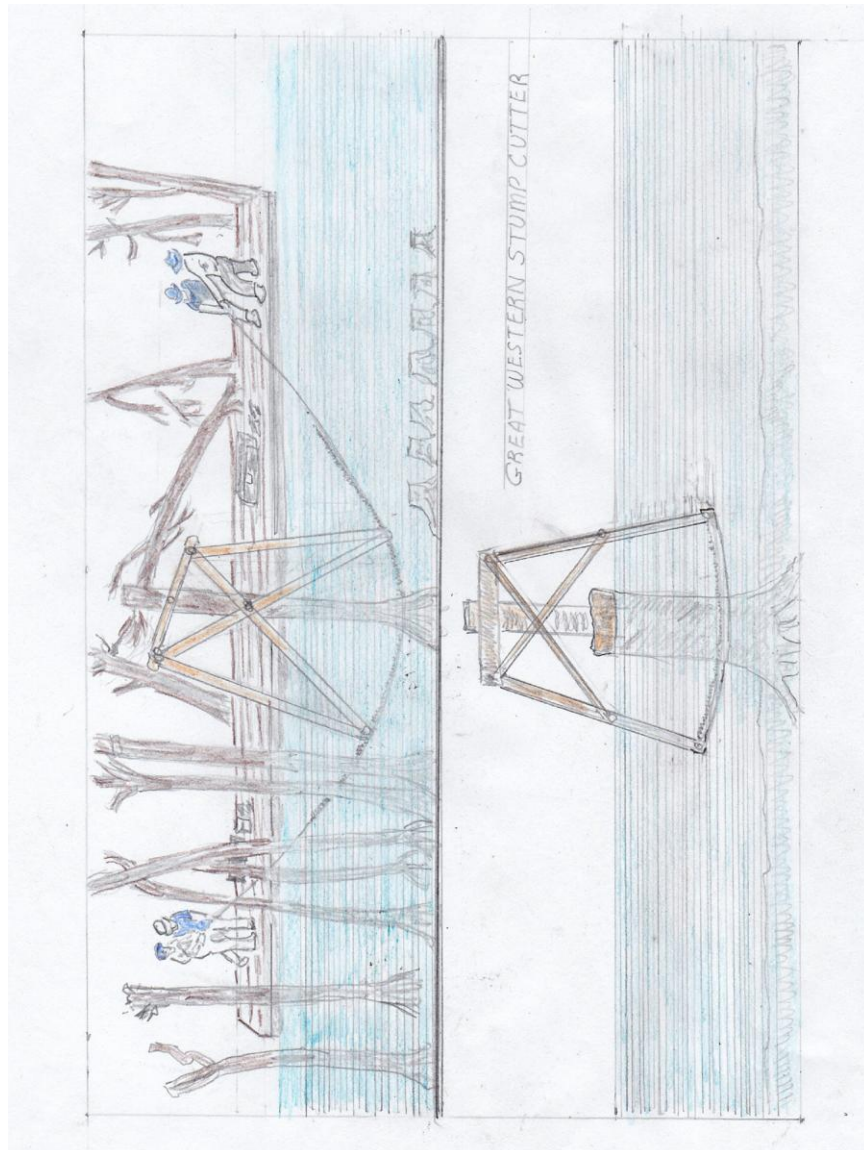


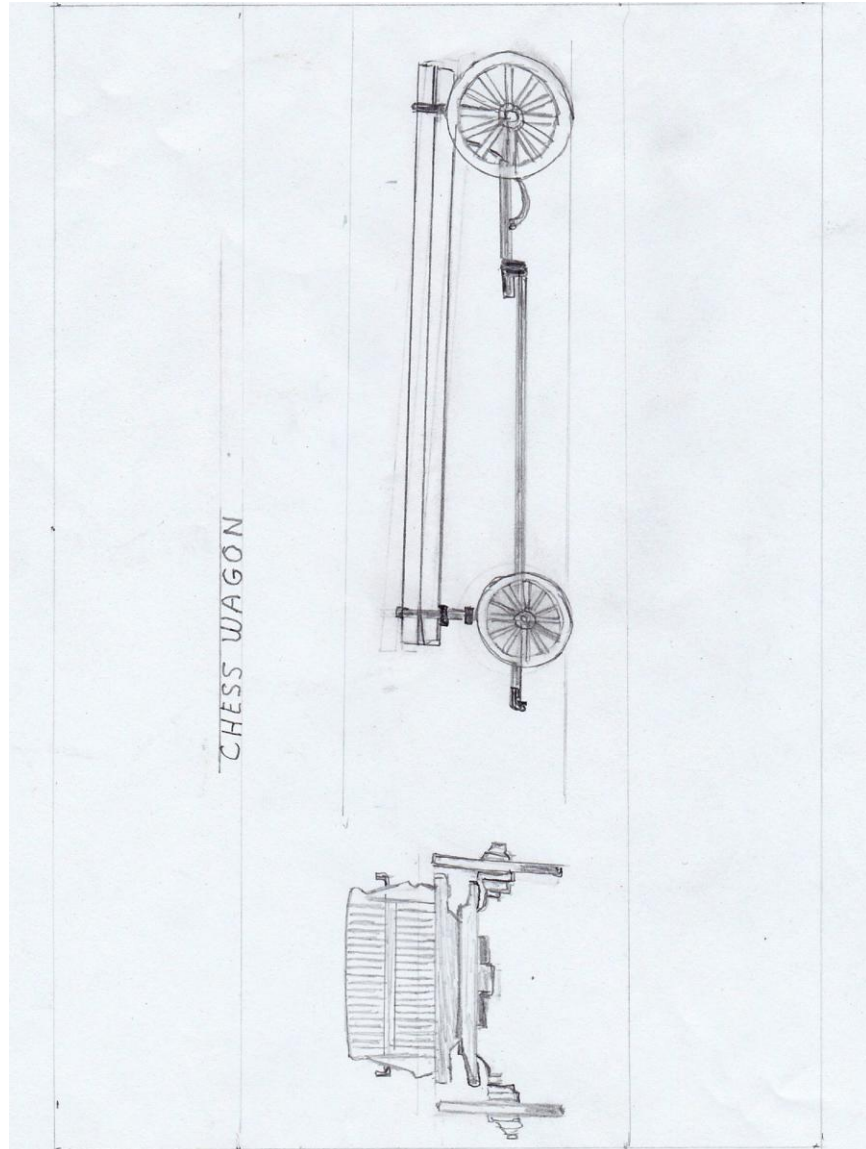
ILLUSTRATION 2

POTOMAC CREEK BRIDGE



### ILLUSTRATION 3

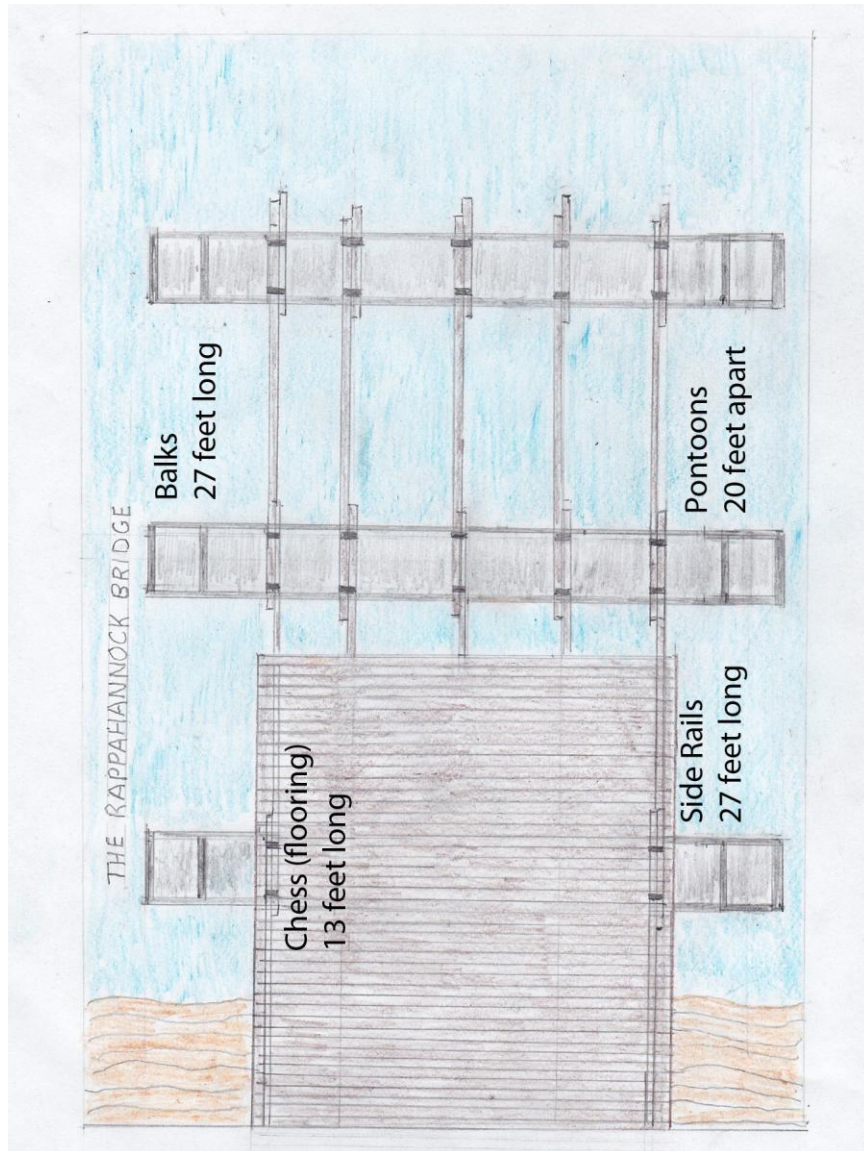
#### CHESS WAGON





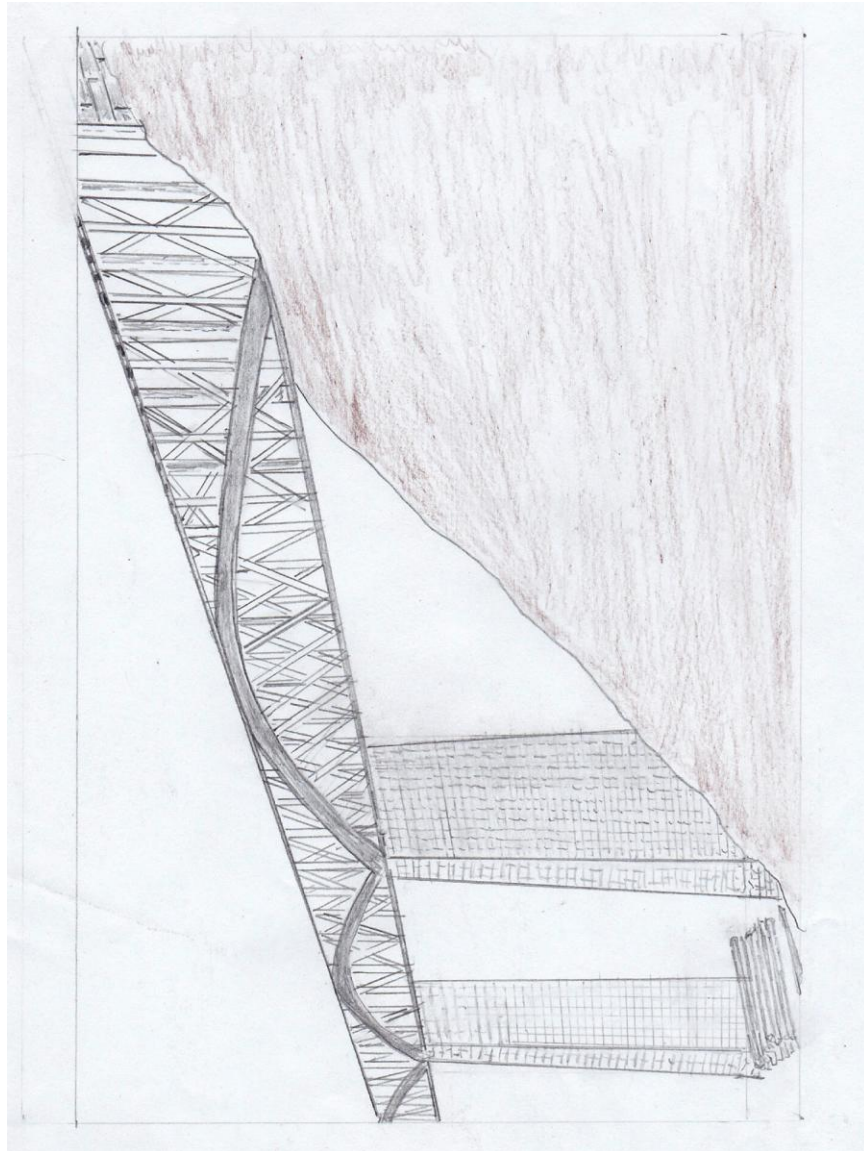
## ILLUSTRATION 4

### WOODEN PONTOON BRIDGE CONSTRUCTION



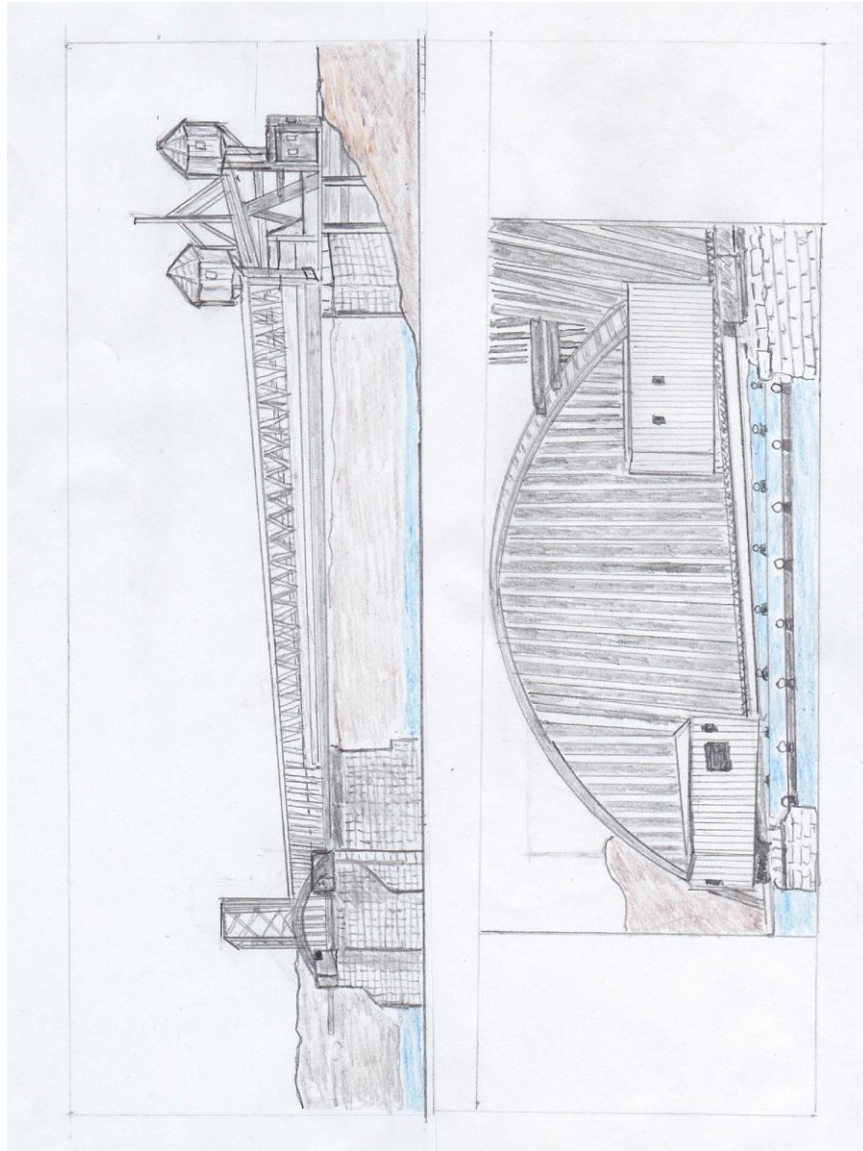
## ILLUSTRATION 5

### RAILROAD BRIDGE WITH TRUSSES



## ILLUSTRATION 6

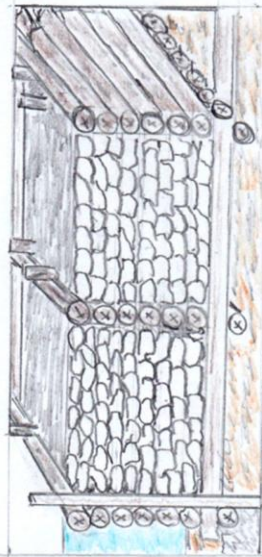
### BRIDGE WITH GUARD TURRETS AND BLOCKHOUSES BUILT BY MICHIGAN ENGINEERS



## ILLUSTRATION 7

### BAILEY'S AND PEARSALL'S DAM: RED RIVER CAMPAIGN

BAILEY'S AND PEARSALL'S DAM: RED RIVER CAMPAIGN



Crib and Stone Dam



Tree Dam



## BIBLIOGRAPHY

### Primary Sources:

Alexander, Edward Porter. *Fighting for the Confederacy: The Personal Recollections of General Edward Porter Alexander*. Edited by Gary W. Gallagher. Chapel Hill: University of North Carolina Press, 1998.

*American Industry and Manufactures in the Nineteenth Century: A Basic Source Collection Compiled from U. S. Government Documents*. 3 vols. Elmsford, NY: Maxwell Reprint Company, 1970.

*Annual Report of the Adjutant General of the State of New York for the Year 1898: Registers of the First, Fifteenth, and Fiftieth Engineers and the First Battalion of Sharpshooters*. Serial No. 16. New York: Wynkoop Hallenbeck Crawford Company, 1899.

*Atlas to Accompany the Official Records of the Union and Confederate Armies*. 1891-1895. Reprint, New York: Barnes & Noble Publishing, Inc., 2003.

Barnard, Henry. *Second Annual Report of the Board of Commissioners of Common Schools in Connecticut Together with the Second Annual Report of the Secretary of the Board, May 1840*. Hartford: Case, Tiffany, and Burnham, 1840.

Barnard, J. G. and W. F. Barry. *Report of the Engineer and Artillery Operations of the Army of the Potomac*. New York: D. Van Nostrand, 1863.

Basler, Roy P. ed. *The Collected Works of Abraham Lincoln*. New Brunswick, NJ: Rutgers University Press, 1953.

Bates, David Homer. *Lincoln in the Telegraph Office: Recollections of the United States Military Telegraph Corps During the Civil War*. New York: D. Appleton-Century Company, Inc., 1907.

Bauer, Jack K., ed. *Soldering: The Civil War Diary of Rice C. Bull*. San Rafael, CA: Presidio Press, 1997.

Bearss, Edwin C. "Pvt. Charles E. Affeld Describes the Mechanicsburg Expeditions." *Journal of the Illinois State Historical Society* 56, no. 2 (Summer 1963): 233-256.

Beecher, Catherine E. *The Evils Suffered by American Women and American Children: The Causes and the Remedy. Presented in an Address by Miss C. E. (Catherine Esther) to Meetings of Ladies in Cincinnati, Washington, Baltimore, Philadelphia, New York, and Other Cities. Also an Address to the Protestant Clergy of the United States*. New York: Harper & Brothers, 1846.

Belknap, William W. *History of the Fifteenth Regiment, Iowa Veteran Volunteer Infantry, from October 1861 to August 1865, When Disbanded at the End of the War*. Keokuk, IA: 1887.

Bering, John A. and Thomas Montgomery. *History of the Forty-eighth Ohio Veteran Volunteer Infantry, Giving a Complete Account of the Regiment, from its Organization at Camp Dennison, Ohio in October, 1861, to the Close of the War, and its Final Muster Out, May 10, 1866*. Hillsboro, OH: 1880.

Bissell, J. W. "Sawing Out the Channel Above Island Number Ten." In *Battles and Leaders of the Civil War: From Sumter to Shiloh*. New York: Thomas Yoseloff, Inc., 1956.

Bolton, Channing M. "With General Lee's Engineers." *Confederate Veterans Magazine* 30, no. 8 (August 1922): 298-302.

Brady, Mathew. "Pontoon Bridge on the Rappahannock." In *Mathew Brady's Illustrated History of the Civil War*, edited by Benson J. Lossing, 234. Reprint, New York: Portland House, 1996.

Clausewitz, Carl von. *On War*. Edited and translated by Michael Howard and Peter Paret. Princeton: Princeton University Press, 1976.

Coleman, Herbert T. "The Status of Education in the South Prior to the War Between the States." *Confederate Veterans Magazine* 25, no. 10 (October 1907): 441-447.

Cullum, George W. *Biographical Register and Dictionary of Officers and Graduates of the United States Military Academy at West Point from its Establishment in 1802 to 1890*. 3 vols. New York, 1891.

\_\_\_\_\_. *Systems of Military Bridges in use by the United States Army: Those Adopted by the Great European Powers and such as are employed in British India with directions for the Preservation, Destruction, and Re-establishment of Bridges*. New York: D. Van Nostrand, 1863.

Duane, Captain J. C. *Manual for Engineer Troops*. New York: D. Van Nostrand, 1862.

*Fairfield North School District Journal, 1851-1861*. 1861.

Fehrenbacher, Don E. *Abraham Lincoln: Speeches, Letters, and Miscellaneous Writings, Presidential Messages and Proclamations*. 2 vols. New York: The Library of America, 1989.

Floyd, Dale E., ed. *Dear Friends at Home: The Letters and Diary of Thomas James Owen, 50<sup>th</sup> New York Volunteer Engineer Regiment*. Washington, DC: Government Printing Office, 1985.

Gates, Arnold, ed. *The Rough Side of War: The Civil War Journal of Chesley A. Mosman, First Lieutenant, Company D, 59<sup>th</sup> Illinois Volunteer Infantry Regiment*. Garden City, NY: The Basin Publishing Company, 1987.

Gorgas, Josiah. *The Civil War Diary of General Josiah Gorgas*. Edited by Frank E. Vandiver. Tuscaloosa: University of Alabama Press, 1947.

Grant, Ulysses S. *Personal Memoirs of U. S. Grant*. New York: Penguin Books, 1999.

Gross, Warren Lee. *Recollections of a Private*. New York: Thomas Y. Crowell, 1890.

Hammond, James H. *Selections from the Letters and Speeches of the Honorable James H. Hammond of South Carolina*. New York: John F. Trow & Company, 1866.

Harris, Henry Herbert. "H. H. Harris' Civil War Diary (1863-1865) Part II. Edited by W. Harrison Daniel. *The Virginia Baptist Register* 36 (1997).

Harris, Nicholas. *First Lessons in Book-Keeping: Exhibiting Simple and Approved Methods of Recording Farmers' and Mechanics' Accounts, By Single Entry Accompanied by Valuable Suggestions in Doing Business; Introductory Lessons in Double Entry, Followed by a Series of Mathematical Tables, and Rules for Performing Computations in Business, Designed for Common Schools*. Hartford, 1841.

Harwell, Richard and Philip N. Racine, eds. *The Fiery Trial: A Union Officer's Account of Sherman's Last Campaign*. Knoxville: University of Tennessee Press, 1986.

Haupt, Herman. *Military Bridges: With Suggestions of New Expedients and Constructions for Crossing Streams and Chasms*. New York: D. Van Nostrand, 1864.

\_\_\_\_\_. *Photographs, Illustrative of Operations In Construction and Transportation as Used to Facilitate the Movement of the Armies of the Rappahannock of Virginia and the Potomac Including Experiments Made to Determine the Most Practical and Expeditious Modes to be Resorted to In the Construction, Destruction and Reconstruction of Roads and Bridges*. Boston: Wright & Potter Printers, 1863.

\_\_\_\_\_. *Reminiscences of General Herman Haupt*. Milwaukee: Wright & Joys Company, 1901.

Hazen, William B. *A Narrative of Military Service*. Boston: Ticknor, 1885.

Henry, Guy V. *Military Record of Civilian Appointments in the United States Army*. 2 vols. New York: D. Van Nostrand, 1873.

Hewett, Janet B., ed. *The Roster of Confederate Soldiers, 1861-1865*. 16 vols. Wilmington, NC: Broadfoot, 1995-1997.

Hewett, Janet B., Noah Andre Trudeau, and Bryce A. Suderow, eds. *Supplement to the Official Records of the Union and Confederate Armies*. Wilmington, NC: Broadfoot, 1994-1999.

Hickenlooper, Brigadier General Andrew. "Our Volunteer Engineers." Vol. 3 of *MOLLUS, Ohio Commandery*. 1890.

\_\_\_\_\_. "The Vicksburg Mine." In *Battles and Leaders of the Civil War: Retreat From Gettysburg*. New York: Castle Books, 1956.

Hight, John J. *History of the Fifty-eighth Regiment Indiana Volunteer Infantry*. Princeton, IN: Press of the Clarion, 1895.

*History of the Forty-sixth Regiment Indiana Volunteer Infantry, September 1861-September 1865*. Logansport, Indiana, 1888.

Hotchkiss, Jedediah. *Make Me a Map of the Valley: The Civil War Journal of Stonewall Jackson's Topographer*. Edited by Archie P. McDonald. Dallas: Southern Methodist University Press, 1973.

*Historical Papers Relating to the Corps of Engineers and to Engineer Troops of the United States Army*. Washington, DC: Press of the Engineering School, 1904.

Hoffman, Wickman. *Camp Court and Siege: A Narrative of Personal Adventure and Observation During Two Wars*. New York: Harper & Brother, 1877.

Imboden, John D. "The Confederate Retreat from Gettysburg." In *Battles and Leaders of the Civil War: Retreat From Gettysburg*. New York: Castle Books, 1956.

Katcher, Philip. *Building the Victory: The Order Book of the Volunteer Engineer Brigade Army of the Potomac*. Shippensburg, PA: White Mane Books, 1998.

Kennedy, Joseph C. G. *Population of the United States in 1860 Compiled from the Original Returns of the Eighth Census*. Washington, DC: Government Printing Office, 1864.

Kundahl, George G. *Confederate Engineer Training and Campaigning with John Morris Wampler*. Knoxville: University of Tennessee Press, 2000.

Lane, Mills, ed. *"Dear Mother: Don't Grieve about Me. If I Get Killed, I'll Only Be Dead": Letters from Georgia Soldiers in the Civil War*. Savannah, GA: Beehive, 1972.

LeDuc, William G. "The Little Steamboat that Opened the Cracker Line." In *Battles and Leaders of the Civil War: Retreat from Gettysburg*. New York: Castle Books, 1956.

Lincoln, Charles Z., ed. *State of New York Messages from the Governors Comprising Executive Communications to the Legislature and Other Papers Relating to Legislation from the Organization of the First Colonel Assembly in 1683 to and Including the Year 1906*. Vol. 3, 1823-1842. Albany: J. B. Lyon Company, 1909.

Lockett, Samuel H. "The Defense of Vicksburg." In *Battles and Leaders of the Civil War: Retreat From Gettysburg*. New York: Castle Books, 1956.

Long, Armistead L. *Memoirs of Robert E. Lee*. New York: J. M. Stoddart & Company, 1886.

Loughlin, William P. "Detached Service." In *History of the Ninety-sixth Regiment, Illinois Volunteer Infantry*, edited by Charles Addison Partridge. Chicago: Brown, Pettibone, 1887.



Lyman, Theodore. *With Grant and Meade from the Wilderness to Appomattox*. Edited by George R. Agassiz. Lincoln: University of Nebraska Press, 1994.

Madison, James. *Letters and other Writings of James Madison*. Edited by Philip R. Fendall. 4 vols. Philadelphia, 1865.

Mahan, Dennis Hart. *A Complete Treatise on Field Fortifications*. New York: Wiley and Long, 1836.

\_\_\_\_\_. *An Elementary Treatise on Advanced-Guard, Out-Post and Detachment Service of Troops and the Manner of Handling Them in the Presence of an Enemy*. New York: John Wiley, 1861.  
Malles, Ed, ed. *Bridge Building in Wartime: Colonel Wesley Brainerd's Memoir of the 50th New York Volunteer Engineers*. Knoxville: University of Tennessee Press, 1997.

Marshall, Thomas B. *History of the 83<sup>rd</sup> Ohio Volunteer Infantry: The Greyhound Regiment*. Cincinnati, Ohio, 1912.

Maurice, Sir Frederick, ed. *An Aide-de-Camp of Lee, Being the Papers of Colonel Charles Marshall, Sometimes Aide-de-Camp, Military Secretary, and Assistant Adjutant General on the Staff of Robert E. Lee, 1862-1865*. Boston: Little Brown, 1927.

McCallum, Daniel. *United States Military Railroads. Report of Bvt. Brigadier General D. C. McCallum, Director and General Manager, from 1861 to 1866*. Washington, DC: United States Military Railroad Department, 1908.

McClellan, George B. *Report of the Organization and Campaigns of the Army of the Potomac: To which is added an account of the Campaign in Western Virginia with Plans of Battle-Fields*. 1864. Reprint, Freeport, NY: Books for Libraries Press, 1970.

Merrill, William. "The Engineer Service in the Army of the Cumberland." In *History of the Army of the Cumberland*, edited by Thomas B. Van Horne. 2 vols. Cincinnati: Robert Clarke, 1885.

Merwin, John W. *Roster and Monograph, 161<sup>st</sup> Regiment, New York State Volunteer Infantry*. Elmira, NY: Gazette Print, 1902.

Michigan Adjutant General. *Record of Service of Michigan Volunteers in the Civil War*. 46 vols. Kalamazoo, MI: Ihling Brothers and Everard, 1905.

Morton, James St. Clair. *Memoir Explaining the Situation and Defense of Fortress Rosecrans*. Fortress Rosecrans, TN: Pioneer Press, 1863.

National Archives and Records Administration, Washington, DC. Chief Engineer. Letters Sent to Engineering Officers, 1813-1869, Microfilm Publications T1255.  
First New York Engineers. Regimental Papers. RG 94.  
Fifteenth New York Engineers. Regimental Papers. RG 94  
Fiftieth New York Engineers. Regimental Papers. RG 94

*History of 1<sup>st</sup> Engineers Battalion During the Civil War*. Unpublished Manuscript, File 391, Entry 100, RG 77.

Kentucky Company of Mechanic and Engineers. Muster-Event Report. RG 397.

Michigan Engineers and Mechanics Regimental Papers. RG 94.

Records of the Office of the Chief of Engineers. RG 77.

Records of the Office of the Quartermaster General. Office of the United States Military Railroad, 1860-1867. RG 92.

Records of the U. S. Army Command, Regular Army Regiments. RG 98.

Neal, W. A. *An Illustrated History of the Missouri Engineer and the 25<sup>th</sup> Infantry Regiments*. Chicago: Donahue and Henneberry, 1889.

O'Sullivan, Timothy. "Meade's Pontoon Bridge at Fredericksburg." In *Civil War: A Complete Photographic History*, edited by William C. Davis and Bell L. Wiley, 326. New York: Tess Press, 2000.

Palladino, Anita, ed. *Diary of a Yankee Engineer: The Civil War Story of John H. Westervelt, Engineer, 1<sup>st</sup> New York Volunteer Engineer Corps*. New York: Fordham University Press, 1997.

Patterson, William F. Letters and Papers. Library of Congress. Washington, DC.

Phisterer, Frederick. *New York in the War of Rebellion, 1861 to 1865*. Albany: Weed, Parsons, and Company, 1890.

Porter, Horace. *Campaigning with Grant*. New York: The Century Company, 1897.

"Record of Events for Josiah W. Bissell's Engineer Regiment of the West, July 1861-April 1864." In *Supplement to the Official Records of the Union and Confederate Armies*, edited by Janet B. Hewett, vol. 36, no. 48. Wilmington, NC: Broadfoot Publishing Company, 1996.

"Report of Adna Anderson, General Superintendent, U. S. Government Railroad, Military Division of the Mississippi for the year ending June 30, 1864." In Record Group 92, Office of the Quartermaster General. Military Railroads. National Archives, Washington, DC.

"Report of the Committee on Education, Louisiana Constitutional Convention, 1845." In *American Writings on Popular Education: The Nineteenth Century*, edited by Rush Welter. Indianapolis: Bobbs-Merrill Company, Inc., 1971.

Rives, A. L. Papers. Virginia Historical Society, Richmond, Virginia.

Rogers, Emma Savage, ed. *Life and Letters of William Barton Rogers*. 2 vols. Boston: Houghton, Mifflin and Company, 1896.

Ross, David Papers. Library of Virginia, Richmond, VA.

*Roster of the 50<sup>th</sup> and 15<sup>th</sup> Regiment New York State Volunteer Engineers, Army of the Potomac*. New York: Union and Advertise Press, 1894.

Schiller, Herbert M., ed. *Autobiography of Major General William F. Smith, 1861-1864*. Dayton, OH: Morningside, 1990.

Scott, Winfield. *Memoirs of Lieutenant General Scott*. 2 vols. New York: Sheldon & Company Publishers, 1864.

Sears, Stephen W., ed. *The Civil War Papers of George B. McClellan: Selected Correspondence, 1860-1865*. New York: Ticknor & Fields, 1989.

Sherman, William T. *Memoirs of General William T. Sherman*. 2 vols. New York: D. Appleton and Company, 1875.

Sorrel, General G. Moxley. *Recollections of a Confederate Staff Officer*. Edited by Bell Irvin Wiley. Jackson, TN: McCowat-Mercer Press, Inc., 1958.

*Statistics of the United States Including Mortality, Property, etc. in 1860 Compiled from the Original Returns and Being the Final Exhibit of the Eighth Census*. Washington, DC: Government Printing Office, 1866.

Stevens, Hazard. *The Life of Isaac Stevens*. 2 vols. Boston: Houghton, Mifflin and Company, 1900.

Talcott, T. M. R. "Reminiscences of the Confederate Engineer Service." In *The Photographic History of the Civil War*, edited by Francis Trevelyan Miller. New York: Review of Reviews, 1911.

Taylor, Captain Jesse. "Defense of Fort Henry." In *Battles and Leaders of the Civil War*, edited by Robert U. Johnson and Clarence C. Buel. 2<sup>nd</sup> ed. New York: The Century Company, 1956.

Terrell, W. H. H. 49<sup>th</sup> *Indiana Infantry Officers Roster: Report of the Adjutant General of the State of Indiana*. 2 vols. Indiana, 1865.

*The New England Primer Improved: Being an Easy Method to Teach Young Children the English Language*. Lenox, MA: J. G. Stanly, 1829.

The Library of Congress. *Congressional Globe, 1833-1873*. American Memory. [memory.loc.gov/ammem/amlaw/lwcc.html](http://memory.loc.gov/ammem/amlaw/lwcc.html) (accessed May 15, 2013).

The Library of Congress. *Journal of the Congress of the Confederate States of America, 1861-1865*. American Memory. [memory.loc.gov/ammem/amlaw/lwcc.html](http://memory.loc.gov/ammem/amlaw/lwcc.html) (accessed May 19, 2013).

The University Memorial Biographical Sketches of Alumni of the University of Virginia Who Fell in the Confederate War. "Summerfield Smith, MA, Captain 1<sup>st</sup> Regiment Engineer Troops." The University Memorial, 1864. [www.fsu.edu/~ewoodwar/uva\\_mem.html](http://www.fsu.edu/~ewoodwar/uva_mem.html) (accessed July 15, 2013).

Transactions of the New York State Agricultural Society. *Second Report of the Special Committee for Promoting the Introduction of Agricultural Books in Schools and Libraries*. Albany, NY: State Library of New York. Microfilm.

U. S. Adjutant General's Office. *Official Army Register of the Volunteer Force of the United States Army for the Years 1861, '62, '63, '64, '65*. 8 vols. Gaithersburg, MD: Olde Soldier Books, 1987.

U. S. Bureau of the Census. *Census of Population*. 1840, 1850, 1860.

U. S. Department of the Interior. *Manufactures of the United States of America in 1860; Compiled from the Original Returns of the Eighth Census under the Direction of the Secretary of the Interior*. Washington, DC: Government Printing Office, 1865.

U. S. Department of State. *Statistics of the United States of America as Collected and Returned by the Marshals of the Several Judicial Districts under the 13<sup>th</sup> Section of the Act for taking the Sixth Census corrected at the Department of State June 1, 1840*. Washington, DC: Blair and Rives, 1841.

U. S. War Department. *The War of the Rebellion: A Compilation of the Official Records of the Union and Confederate Armies*. 128 vols. Washington, DC: Government Printing Office, 1880-1901.

Warmoth, Henry Clay. "The Vicksburg Diary of Henry Clay Warmoth, Part II (April 28, 1863-May 26, 1863)." Edited by Paul H. Hass. *Journal of Mississippi History* 32 (1970).

Webster, Noah. *The American Spelling Book*. 1783.

Whitworth, Joseph. "New York Exhibition. Special Report of Mr. Joseph Whitworth. Presented to the House of Commons by Command of Her Majesty, in Pursuance of Their Address of February 6, 1854." In *The American System of Manufactures*, introduction by Nathan Rosenberg. Edinburgh: Edinburgh University Press, 1969.

Wiley, Bell Irvin, ed. *"This Infernal War": The Confederate Letters of Sergeant Edwin H. Fay*. Austin: University of Texas Press, 1958.

Wiley, C. H. "First Annual Report of the General Superintendent of Common Schools." In *Documenting the American South*. Chapel Hill: University of North Carolina, 2003. [docsouth.unc.edu/nc/schools1854/schools1854.html](http://docsouth.unc.edu/nc/schools1854/schools1854.html) (accessed July 22, 2012).

Willett, James R. *Rambling Recollections of a Military Engineer*. Chicago: Illinois Commandery, Military Order of the Loyal Legion of the United States, 1888.

#### Newspapers and Periodicals:

*Atlanta Constitution*  
*Baltimore American*  
*Cincinnati Commercial*  
*Detroit Free Press*  
*Frank Leslie's Illustrated Newspaper*  
*Harper's Weekly*  
*Macon Telegraph*  
*New York Commercial Advertiser*  
*New York Herald*  
*New York Times*  
*Philadelphia Inquirer*  
*Railroad Gazette*  
*Richmond Daily Examiner*  
*Richmond Dispatch*  
*United States Gazette*  
*Vicksburg Daily Herald*  
*Wilmington Journal*

#### Secondary Sources: Articles

Allardice, Bruce. "West Points of the Confederacy: Southern Military Schools and the Confederate Army." *Civil War History* 43 (December 1997): 310-331.

Battison, Edwin A. "Eli Whitney and the Milling Machine." *Smithsonian Journal of History* 1 (1966): 9-34.

Browne, C. A. "Some relations of the New Harmony Movement to the History of Science in America." *Scientific Monthly* 42 (1936): 483-497.

Chandler, Alfred D. Jr. "The Railroads: Pioneers in Modern Corporate Management." *Business History Review* 39 (1965): 16-40.

Coggins, Jack. "The Engineers Played a Key Role in Both Armies." *Civil War Times Illustrated* 3 (January 1965): 40-47.

Faust, Drew Gilpin. "Altars of Sacrifice: Confederate Women and the Narratives of the War." *Journal of American History* 76 (1990): 1200-1228.

Ferguson, Eugene S. "On the Origin and Development of American Mechanical 'Know-How.'" *Midcontinent American Studies Journal* 3 (1962): 3-15.

Fitch, Charles H. "The Rise of a Mechanical Ideal." *Magazine of American History* 11 (June 1884): 516-527.

Green, Jennifer R. "Networks of Military Educators: Middle-Class Stability and Professional in the Late Antebellum South." *Journal of Southern History* 73 (February 2007): 39-74.

Gutman, Herbert G. "Work, Culture, and Society in Industrializing America, 1815-1919." *American Historical Review* 78 (1973): 531-587.

Hammond, M. B. "Correspondence of Eli Whitney relative to the Invention of the Cotton Gin." *American History Review* 3 (1897-1898): 90-127.

Hannum, Warren T. "The Crossing of the James River in 1864." *Military Engineer* 15 (May-June 1923): 227-237.

Hill, Forest G. "Government Engineering Aid to Railroads Before the Civil War." *Journal of Economic History* 11 (1951) 235-246.

Hoskin, Keith and Richard Macve. "The Genesis of Accountability: The West Point Connection." *Accounting Organization and Society* 13 (1988): 37-73.

Howard, Robert A. "Interchangeable Parts Reexamined: The Private Sector on the Eve of the Civil War." *Technology and Culture* 19 (1978): 633-649.

Hubbard, Guy. "Development of Machine Tools in New England." *American Machinist* 60 (February 1924): 255-258.

Huston, James A. "Grant's Crossing of the James with the Longest Pontoon Bridge Ever Built." *Military Engineer* 45 (January-February 1953): 18-22.

Lebborgott, Stanley. "Why the South Lost: Commercial Purpose in the Confederacy, 1861-1865." *Journal of American History* 70 (June 1983): 58-74.

Lovett, Bobby L. "Nashville's Fort Negley: A Symbol of Blacks' Involvement with the Union Army." *Tennessee Historical Quarterly* 41 (Spring 1982).

Nelson, Bernard H. "Confederate Slave Impressment Legislation, 1861-1865." *Journal of Negro History* 31, no. 4 (October 1946): 392-410.

Ness, George T. "Engineers of the Civil War." *The Military Engineer* 46 (May-June 1952): 179-186.

Noe, Kenneth W. "Jigsaw Puzzles, Mosaics, and Civil War Battlefield Narratives." *Civil War History* 53, no. 3 (September 2007): 236-243.

Pollard, Edward Alfred. "Hints on Southern Civilization." *Southern Literary Messenger* 32 (April 1861).

Prince, Carl E. and Seth Taylor. "Daniel Webster, the Boston Associates, and the United States Government's Role in the Industrializing Process, 1815-1830." Essay from the Lowell Conference on Industrial History, 1980 and 1981, eds. Robert Weible, Oliver Ford, and Paul Marion (Lowell, MA: Lowell Conference on Industrial History, 1981): 114-127.

Rosenberg, Nathan. "Technological Change in the Machine Tool Industry, 1840-1910." *Journal of Economic History* 23 (1963): 423-430.

Sinclair, Bruce. "At the Turn of a Screw: William Sellers, the Franklin Institute, and a Standard American Thread." *Technology and Culture* 10 (January 1969): 20-34.

Smith, Merritt Roe. "John H. Hall, Simeon North, and the Milling Machine: The Nature of Innovation among Antebellum Arms Makers." *Technology and Culture* 14 (1973): 573-591.

Thienel, Phillip M. "Engineers in the Union Army, 1861-1865: Part I. Engineer Organization." *The Military Engineer* XLVII, no. 315 (January-February 1955): 36-41.

#### Secondary Sources: Books

Ambrose, Stephen E. *Halleck: Lincoln's Chief of Staff*. Baton Rouge: Louisiana State University Press, 1962.

Angulo, A. J. *William Barton Rogers and the Idea of MIT*. Baltimore: Johns Hopkins University Press, 2009.

Arnold, James R. *Grant Wins the War: Decision at Vicksburg*. New York: John Wiley & Sons, Inc., 1997.

Bacevich, Andrew. *The New American Militarism: How Americans are Seduced by War*. Oxford: Oxford University Press, 2005.

Bacon, Benjamin W. *Sinews of War: How Technology, Industry, and Transportation Won the Civil War*. Novato, CA: Presidio Press, 1997.

Baker, R. P. *A Chapter in American Education: Rensselaer Polytechnic Institute, 1824-1924*. New York: Scribner, 1924.

Ball, Douglas B. *Financial Failure and Confederate Defeat*. Urbana, IL: University of Illinois Press, 1991.

Bartholomees, J. Boone. *Buff Facings and Gilt Buttons: Staff and Headquarters Operations in the Army of Northern Virginia, 1861-1865*. Columbia, SC: The University of South Carolina Press, 1998.

Bastian, David F. *Grant's Canal: The Union's Attempt to Bypass Vicksburg*. Shippensburg, PA: White Mane Books, 1995.

Bauer, K. Jack. *The Mexican War, 1846-1848*. New York: Macmillan Publishing Company, Inc., 1974.

Bearss, Edwin Cole. *The Campaign for Vicksburg*. 3 vols. Dayton, OH: Morningside House, Inc., 1985.

Beringer, Richard E., Herman Hattaway, Archer Jones, and William N. Still, Jr. *The Elements of Confederate Defeat: Nationalism, War Aims, and Religion*. Athens, GA: University of Georgia Press, 1988.

Beringer, Richard E., Herman Hattaway, Archer Jones, and William N. Still, Jr. *Why the South Lost the Civil War*. Athens, GA: The University of Georgia Press, 1986.

Berlin, Ira, Barbara J. Fields, Steven F. Miller, Joseph P. Reidy, and Leslie S. Rowland. *Slaves No More: Three Essays on Emancipation and The Civil War*. Cambridge: Cambridge University Press, 1992.

Berlin, Jean V. "Did Confederate Women Lose the War? Deprivation, Destruction, and Despair on the Home Front." In *The Collapse of the Confederacy*, edited by Mark Grimsley and Brooks D. Simpson. Lincoln: University of Nebraska Press, 2001.

Bernath, Michael T. *Confederate Minds: The Struggle for Intellectual Independence in the Civil War South*. Chapel Hill: University of North Carolina Press, 2010.

Bishop, J. L. *A History of American Manufactures from 1608 to 1860*. 3 vols. Philadelphia: E. Young, 1866.

Black, Robert C. III. *The Railroads of the Confederacy*. Chapel Hill: University of North Carolina Press, 1998.

Blake, Nelson Morehouse. *William Mahone of Virginia: Soldier and Political Insurgent*. Richmond: Garrett & Massie Publishers, 1935.

Blight, David W. *Beyond the Battlefield: Race, Memory, and the American Civil War*. Amherst: University of Massachusetts Press, 2002.

Boatner, Mark M., III. *The Civil War Dictionary*. New York: David McKay Company, Inc., 1959.

Bode, Carl. *The American Lyceum: Town Meeting of the Mind*. New York: Oxford University Press, 1956.

Broadus, Mitchell. *William Gregg, Factory Master of the Old South*. Chapel Hill: University of North Carolina Press, 1928.



Brodie, Bernard and Fawn M. Brodie. *From Crossbow to H-Bomb*. Bloomington, IN: Indiana University Press, 1973.

Brown, Kent Masterson. *Retreat from Gettysburg: Lee, Logistics & the Pennsylvania Campaign*. Chapel Hill: University of North Carolina Press, 2005.

Buell, Thomas B. *The Warrior Generals: Combat Leadership in the Civil War*. New York: Three Rivers Press, 1997.

Campbell, Jacqueline Glass. *When Sherman Marched North From the Sea: Resistance on the Confederate Front*. Chapel Hill: University of North Carolina Press, 2003.

Castel, Albert E. *Decision in the West: The Atlanta Campaign of 1864*. Lawrence, KS: University Press of Kansas, 1992.

\_\_\_\_\_. *Victors in Blue: How Union Generals Fought the Confederates, Battled Each Other, and Won the Civil War*. Lawrence: University Press of Kansas, 2011.

Catton, Bruce. *Reflections on the Civil War*. Edited by John Leekley. Garden City, NY: Doubleday & Company, Inc., 1981.

Chandler, Alfred D. Jr. *The Visible Hand: The Managerial Revolution in American Business*. Cambridge, MA: The Belknap Press of Harvard University Press, 1977.

Chittenden, R. H. *History of the Sheffield Scientific School*. 2 vols. New Haven: Yale University Press, 1928.

Clark, Christopher. *The Roots of Rural Capitalism: Western Massachusetts, 1780-1860*. Ithaca: Cornell University Press, 1990.

Clark, John E. Jr. *Railroads in the Civil War: The Impact of Management on Victory and Defeat*. Baton Rouge: Louisiana State University Press, 2001.

Clinton, Catherine and Nina Silber, eds. *Divided Houses: Gender and the Civil War*. New York: Oxford University Press, 1992.

Coddington, Edwin B. *The Gettysburg Campaign: A Study in Command*. New York: Simon & Schuster, 1968.

Cole, Philip M. *Civil War Artillery at Gettysburg: Organization, Equipment, Ammunition, and Tactics*. Cambridge, MA: DaCapo Press, 2002.

Collier, Christopher. *Connecticut's Public Schools: A History, 1650-2000*. Orange, CT: Clearwater Press, 2009.

Connelly, Thomas Lawrence and Archer Jones. *The Politics of Command: Factions and Ideas in Confederate Strategy*. Baton Rouge: Louisiana State University Press, 1973.

Connelly, Thomas Lawrence. *Army of the Heartland: The Army of Tennessee, 1861-1862*. Baton Rouge: Louisiana State University Press, 1967.

\_\_\_\_\_. *Autumn of Glory: The Army of Tennessee, 1862-1865*. Baton Rouge: Louisiana State University Press, 1971.

Cooling, Benjamin Franklin. *Forts Henry and Donelson: The Key to the Confederate Heartland*. Knoxville: University of Tennessee Press, 1987.

\_\_\_\_\_. *Symbol, Sword, and Shield: Defending Washington During the Civil War*. Hamden, CT: Archon Books, 1975.

Cornish, Dudley Taylor. *The Sable Arm: Negro Troops in the Union Army, 1861-1865*. New York: Longmans, Green, and Company, 1956.

Couvares, Francis G., Martha Saxton, Gerald N. Grob, and George Athan Billias, eds. *Interpretations of American History: Patterns and Perspectives*. 2 vols. Boston: Bedford/St. Martin's Press, 2009.

Cozzens, Peter. *Shipwreck of Their Hopes: The Battles for Chattanooga*. Urbana, IL: University of Illinois Press, 1994.

Creveld, Martin Van. *Supplying War: Logistics from Wallenstein to Patton*. Cambridge: Cambridge University Press, 1977.

Cronon, William. *Nature's Metropolis: Chicago and the Great West*. New York: W. W. Norton & Company, 1991.

Current, Richard N. "God and the Strongest Battalions." In *Why the North Won the Civil War*, edited by David Donald. Baton Rouge: Louisiana State University Press, 1960.

Daniel, Larry J. and Lynn N. Bock. *Island No. 10: Struggle for the Mississippi Valley*. Tuscaloosa: University of Alabama Press, 1996.

Daniel, Larry J. *Days of Glory: The Army of the Cumberland, 1861-1865*. Baton Rouge: Louisiana State University Press, 2004.

DeCredico, Mary A. *Patriotism for Profit: Georgia's Urban Entrepreneurs and the Confederate War Effort*. Chapel Hill: University of North Carolina Press, 1990.

Denson, C. B. "The Corps of Engineers and Engineer Troops." In *Histories of the Several Regiments and Battalions from North Carolina in the Great War, 1861-1865*, edited by Walter Clark. Goldsboro, NC: Nash Brothers, 1901.

Dew, Charles B. *Bond of Iron: Master and Slave at Buffalo Forge*. New York: W. W. Norton & Company, 1994.

\_\_\_\_. *Ironmaker to the Confederacy: Joseph R. Anderson and the Tredegar Iron Works*. New Haven: Yale University Press, 1966.

Donald, David. *Lincoln Reconsidered*. New York: Vintage Books, 1961.

Donald, David, ed. *Why the North Won the Civil War*. Baton Rouge: Louisiana States University Press, 1960.

Earle, Edward Mead, ed. *Makers of Modern Strategy: Military Thought from Machiavelli to Hitler*. Princeton: Princeton University Press, 1971.

Eaton, Clement. *The Growth of Southern Civilization, 1790-1860*. New York: Harper & Row Publishers 1961.

Ellet, Charles, Jr. *The Mississippi and Ohio Rivers*. Philadelphia: Lippincott, Grambo & Company, 1853.

Faust, Drew Gilpin. *This Republic of Suffering: Death and the American Civil War*. New York: Alfred A. Knopf, 2008.

Fennelly, Catherine. *Town Schooling in Early New England, 1790-1840*. Sturbridge, MA: Old Sturbridge Village, Inc., 1962.

Field, Ron. *American Civil War Fortifications (2): Land and Field Fortifications*. Oxford: Osprey Publishing, 2005.

\_\_\_\_. *American Civil War Fortifications (3): The Mississippi and River Forts*. Oxford, UK: Osprey Publishing, 2007.

Fitch, John. *Annals of the Army of the Cumberland*. Philadelphia: J. B. Lippincott, 1863.

Foote, Shelby. *The Civil War, A Narrative*. 3 vols. New York: Random House, 1974.

Freeman, Douglas Southall. *Lee's Lieutenants: A Study in Command*. New York: Charles Scribner's Sons, 1942.

Fryman, Robert J. "Fortifying the Landscape: An Archaeological Study of Military Engineering and the Atlanta Campaign." In *Archaeological Perspectives on the American Civil War*, edited by Clarence R. Geier and Stephen R. Potter, 46-48. Gainesville: University Press of Florida, 2000.

Fuller, Edmund. *Tinkers and Genius: The Story of the Yankee Inventors*. New York: Hastings House Publishers, 1955.

Gallagher, Gary W. "'Upon their Success Hang Momentous Interests': Generals." In *Why the Confederacy Lost*, edited by Gabor S. Boritt, 1-20.

Gates, Paul W. *The Farmer's Age: Agriculture, 1815-1860*. New York: Harper & Row, 1960.

Glatthaar, Joseph T. "Black Glory: The African-American Role in Union Victory." In *Why the South Lost*, edited by Gabor S. Boritt. New York: Oxford University Press, 1992.

Goff, Richard. *Confederate Supply*. Durham: Duke University Press, 1969.

Grabau, Warren E. *Ninety-Eight Days: A Geographer's View of the Vicksburg Campaign*. Knoxville: University of Tennessee Press, 2000.

Guerlac, Henry. "Vauban: The Impact of Science on War." In *Makers of Modern Strategy from Machiavelli to the Nuclear Age*, edited by Peter Paret. Princeton: Princeton University Press, 1986.

Hagerman, Edward. *The American Civil War and the Origins of Modern Warfare: Ideas, Organization, and Field Command*. Bloomington, IN: Indiana University Press, 1988.

Harris, William C. *Lincoln and the Border States: Preserving the Union*. Lawrence: The University Press of Kansas, 2011.

Hattaway, Herman and Archer Jones. *How the North Won: A Military History of the Civil War*. Urbana: University of Illinois Press, 1983.

Hendrickson, Robert. *The Road to Appomattox*. New York: John Wiley & Sons, Inc., 1998.

Hess, Earl J. *Field Armies and Fortifications in the Civil War: The Eastern Campaigns, 1861-1864*. Chapel Hill: University of North Carolina Press, 2005.

\_\_\_\_\_. *In the Trenches at Petersburg: Field Fortifications & Confederate Defeat*. Chapel Hill: University of North Carolina Press, 2009.

\_\_\_\_\_. *Into the Crater: The Mine Attack at Petersburg*. Columbia, SC: University of South Carolina Press, 2010.

\_\_\_\_\_. *Trench Warfare under Grant & Lee: Field Fortifications in the Overland Campaign*. Chapel Hill: University of North Carolina Press, 2007.

Hittle, James Donald. *The Military Staff: Its History and Development*. 3<sup>rd</sup> ed. Harrisburg, PA: Stackpole Company, 1961.

Hoffman, Mark. *"My Brave Mechanics": The First Michigan Engineers and Their Civil War*. Detroit: Wayne State University Press, 2007.

Holbrook, Josiah. "American Lyceum for Science and the Arts." In *The Massachusetts Lyceum During the American Renaissance: Materials for the Study of the Oral Tradition in American Letters: Emerson, Thoreau, Hawthorne, and Other New England Lectures*, edited by Kenneth Walter Cameron. Hartford: Transcendental Books, 1969.

Hollandsworth, James G. *The Louisiana Native Guards: The Black Military Experience During the Civil War*. Baton Rouge: Louisiana State University Press, 1998.

Howe, David Walker. *What Hath God Wrought: The Transformation of America, 1815-1848*. New York: Oxford University Press, 2007.

Huston, James A. *The Sinews of War: Army Logistics 1775-1953*. Washington, DC: Office of the Chief of Military History, United States Army, 1966.

Irwin, Richard B. *History of the Nineteenth Army Corps*. New York: G. P. Putman's Sons, 1893.

Jackson, Harry L. *First Regiment Engineer Troops P. A. C. S.: Robert E. Lee's Combat Engineers*. Louisa, CA: R. A. E. Design and Publishing, 1998.

Jaffee, David. *A New Nation of Goods: The Material Culture of Early America*. Philadelphia: University of Pennsylvania Press, 2010.

Joiner, Gary D. *Mr. Lincoln's Brown Water Navy: The Mississippi Squadron*. New York: Rowman & Littlefield Publishers, Inc., 2007.

Kaestle, Carl F. *Pillars of the Republic: Common Schools and American Society, 1780-1860*. New York: Hill and Wang, 1983.

Kamm, Samuel Richey. *The Civil War Career of Thomas A. Scott*. Philadelphia: University of Pennsylvania Press, 1940.

Keegan, John. *The Face of Battle: A Study of Agincourt, Waterloo, and the Somme*. New York: The Viking Press, 1976.

\_\_\_\_\_. *The Mask of Command*. New York: Penguin Books, 1988.

Kolchin, Peter. "Slavery and Freedom in the Civil War South." In *Writing the Civil War: The Quest to Understand*, edited by James M. McPherson and William J. Cooper, Jr. Columbia, SC: University of South Carolina Press, 1998.

Kreidberg, Marvin A. and Merton G. Henry. *History of Military Mobilization in the United States Army, 1775-1945*. Washington, DC: Department of the Army, 1955.

Krick, Robert E. L. *Staff Officers in Gray: A Biographical Register of the Staff Officers in the Army of Northern Virginia*. Chapel Hill: University of North Carolina Press, 2003.

Lewis, Ronald L. *Coal, Iron, and Slaves: Industrial Slavery in Maryland and Virginia, 1715-1865*. Westport, CT: Greenwood Press, 1979.

Linderman, Gerald. *Embattled Courage: The Experience of Combat in the American Civil War*. New York: The Free Press, 1987.

Livermore, Thomas L. *Numbers and Losses in the Civil War in America 1861-65*. Boston: Houghton Mifflin Company, 1901.

Luvaas, Jay. *The Military Legacy of the Civil War: The European Inheritance*. Lawrence: University of Kansas Press, 1988.

Majewski, John. *Modernizing A Slave Economy: The Economic Vision of the Confederate Nation*. Chapel Hill: University of North Carolina Press, 2009.

Major, Duncan K. *Supply of Sherman's Army during the Atlanta Campaign*. Fort Leavenworth, KS: Army Service School, 1911.

Marszalek, John F. *Commander of All Lincoln's Armies: A life of General Henry W. Halleck*. Cambridge, MA: The Belknap Press of Harvard University, 2004.

Maslowski, Peter. *Treason Must Be Made Odious: Military Occupation and Wartime Reconstruction in Nashville, Tennessee, 1862-1865*. Milwood, NY: KTO Press, 1978.

McDonough, James L. *Chattanooga: A Death Grip on the Confederacy*. Knoxville: University of Tennessee Press, 1984.

McElfresh, Earl B. *Maps and Mapmakers of the Civil War*. New York: Harry N. Abrams, Inc., Publishers, 1999.

McGaw, Judith. *Most Wonderful Machine: Mechanization and Social Change in Berkshire Paper Making, 1801-1885*. Princeton: Princeton University Press, 1987.

McNeill, William H. *The Pursuit of Power: Technology, Armed Force, and Society from A. D. 1000 to the Present*. Chicago: University of Chicago Press, 1982.

McPherson, James M. "American Victory, American Defeat." In *Why the Confederacy Lost*, edited by Gabor S. Boritt, 20. Oxford: Oxford University Press, 1992.

\_\_\_\_\_. *Battle Cry of Freedom: The Civil War Era*. New York: Oxford University Press, 1988.

\_\_\_\_\_. *Drawn With the Sword: Reflections on the American Civil War*. New York: Oxford University Press, 1996.

\_\_\_\_\_. *War on the Water: The Union and Confederate Navies, 1861-1865*. Chapel Hill: University of North Carolina Press, 2012.

McWhiney, Grady and Perry D. Jamieson. *Attack and Die: Civil War Tactics and Southern Heritage*. Tuscaloosa: University of Alabama Press, 1984.

Meier, Hugo A. "The Ideology of Technology." In *Technology and Social Change in America*, edited by Edwin T. Layton, Jr. New York: Harper & Row, Publishers, 1973.

Miller, William J. "'Scarcely Any Parallel in History': Logistics, Friction and McClellan's Strategy for the Peninsula Campaign." Edited by William J. Miller. Vol. 2 of *The Peninsula Campaign of 1862: Yorktown to the Seven Days*. El Dorado Hills, CA: Savas Publishing Company, 1997.

\_\_\_\_. "'Weather Still Execrable': Climatological Notes on the Peninsula Campaign March through August 1862." Edited by William J. Miller. Vol. 3 of *The Peninsula Campaign of 1862: Yorktown to the Seven Days*. El Dorado Hills, CA: Savas Publishing Company, 1997.

Millis, Walter. *Arms and Men: A Study of American Military History*. New York: Mentor Books, 1956.

Mindell, David A. *War, Technology, and Experience aboard the USS Monitor*. Baltimore: The Johns Hopkins University Press, 2000.

Mitchell, F. A. *Ormsby MacKnight Mitchell, Astronomer and General: A Biographical Narrative*. New York: Houghton Mifflin, 1887.

Neal, W. A. *An Illustrated History of the Missouri Engineers and the Twenty-Fifth Infantry Regiment*. Chicago: Donohue and Henneper, 1889.

Nichols, James L. *Confederate Centennial Studies Number Five: Confederate Engineering*. Tuscaloosa, AL: Confederate Publishing Company, Inc., 1957.

Nicolay, John G. and John Hay. *Abraham Lincoln: A History*. New York: The Century Company, 1890.

Nolan, Alan T. *Lee Considered: General Robert E. Lee and Civil War History*. Chapel Hill: University of North Carolina Press, 1991.

North, Douglas C. *The Economic Growth of the United States, 1790-1860*. New York: Prentice Hall, 1961.

Office of Coast Survey. "History of Coast Survey." National Oceanic and Atmospheric Administration. [www.nauticalcharts.noaa.gov/staff/hist.html](http://www.nauticalcharts.noaa.gov/staff/hist.html) (accessed February 5, 2014).

Otto, John Solomon. *Southern Agriculture during the Civil War Era, 1860-1880*. Westport, CT: Greenwood Press, 1994.

Parker, Arthur. *The Life of General Ely S. Parker*. 1919. Reprint, Buffalo: Buffalo Historical Society, 2005.

Phisterer, Frederick. *New York in the War of Rebellion, 1861 to 1865*. Albany: Weed, Parsons, and Company, 1890.

Pickenpaugh, Roger. *Rescue by Rail: Troop Transfer and the Civil War in the West, 1863*. Lincoln: University of Nebraska Press, 1998.

Plum, William Rattle. *The Military Telegraph During the Civil War in the United States*. Edited by Christopher H. Sterling. New York: Arno Press, 1974.

Potter, David M. "Jefferson Davis and the Political Factors in Confederate Defeat." In *Why the North Won the Civil War*, edited by David Donald. Baton Rouge: Louisiana State University Press, 1960.

Rable, George C. "Despair, Hope, and Delusion: The Collapse of Confederate Morale Reexamined." In *The Collapse of the Confederacy*, edited by Mark Grimsley and Brooks D. Simpson, 1-30. Lincoln: University of Nebraska Press, 2001.

\_\_\_\_\_. *Fredericksburg! Frederickburg!* Chapel Hill: University of North Carolina Press, 2002.

Raines, Rebecca Robins. *Getting the Message Through: A Branch History of the U. S. Army Signal Corps*. Washington, DC: Center of Military History, 1996.

Reed, Rowena. *Combined Operations in the Civil War*. Annapolis: Naval Institute Press, 1978.

Reid, Whitelaw. *Ohio in the War: Her Statesmen, Generals, and Soldiers*. 2 vols. Cincinnati: The Robert Clarke Company, 1895.

Reznek, Samuel. *Education for a Technological Society: A Sesquicentennial History of Rensselaer Polytechnic Institute*. Troy, NY: Rensselaer Polytechnic Institute, 1968.

Ridley, Bromfield L. *Battles and Sketches, Army of Tennessee 1861-1865*. Mexico, 1906.

Roark, James L. "Behind the Lines: Confederate Economy and Society." In *Writing the Civil War: The Quest to Understand*, edited by James M. McPherson and William J. Cooper, Jr., 213. Columbia, SC: University of South Carolina Press, 1998.

Robinson, Armstead L. *Bitter Fruits of Bondage: The Demise of Slavery and the Collapse of the Confederacy, 1861-1865*. Charlottesville: University of Virginia Press, 2005.

Roper, Peter W. *Jedediah Hotchkiss: Rebel Mapmaker and Virginia Businessman*. Shippensburg, PA: White Mane Publishing, 1992.

Rossiter, Margaret W. *The Emergence of Agriculture Science: Justus Liebig and the Americans, 1840-1880*. New Haven: Yale University Press, 1975.

Royster, Charles. *The Destructive War: William Tecumseh Sherman, Stonewall Jackson, and the Americans*. New York: Alfred A. Knopf, Inc., 1991.

Salsbury, Stephen. *The State, The Investor, and the Railroad: The Boston & Albany, 1825-1867*. Cambridge: Harvard University Press, 1967.



Shiman, Philip L. "Engineering and Command: The Case of General William S. Rosecrans, 1862-1863." In *The Art of Command*, edited by Steven E. Woodworth. Lincoln: University of Nebraska Press, 1998.

Shy, John. "Antoine-Henri Jomini." In *Makers of Modern Strategy from Machiavelli to the Nuclear Age*, edited by Peter Paret. Princeton: Princeton University Press, 1986.

Smith, Charles Lee. *The History of Education in North Carolina*. Washington, DC: Government Printing Office, 1888.

Smith, Harriette K. *History of the Lowell Institute*. Boston: Lamson, 1898.

Smith, Mark A. *Engineering Security: The Corps of Engineers in Third System Defense Policy, 1815-1861*. Tuscaloosa: University of Alabama Press, 2009.

Smith, Merritt Roe and Gregory Clancey, eds. *Major Problems in the History of American Technology*. Boston: Houghton Mifflin Company, 1998.

Smith, Merritt Roe. *Harper's Ferry and the New Technology: The Challenge of Change*. Ithaca: Cornell University Press, 1977.

Smith, Merritt Roe, ed. *Military Enterprise and Technological Change: Perspectives on the American Experience*. Cambridge, MA: MIT Press, 1985.

Soltow, Lee and Edward Stevens. *The Rise of Literacy and the Common Schools in the United States: A Socioeconomic Analysis to 1870*. Chicago: University of Chicago Press, 1981.

Still, William N. Jr. *Confederate Shipbuilding*. Athens, GA: University of Georgia Press, 1969.

Struik, Dirk J. *Yankee Science in the Making: Science and Engineering in New England from Colonial Times to the Civil War*. New York: Dover Publications, Inc., 1991.

Symonds, Craig L. *Lincoln and His Admirals*. Oxford: Oxford University Press, 2008.

Taylor, George Rogers. *The Transportation Revolution, 1815-1860*. New York: Harper & Row, 1951.

Taylor, Paul. *Orlando M. Poe: Civil War General and Great Lakes Engineer*. Kent, OH: The Kent State University Press, 2009.

Thienel, Phillip M. *Mr. Lincoln's Bridge Builders: The Right Hand of American Genius*. Shippensburg, PA: White Mane Books, 2000.

\_\_\_\_\_. *Seven Story Mountain: The Union Campaign at Vicksburg*. Jefferson, NC: McFarland & Company, 1998.

Thomas, Emory M. "Rebellion and Conventional Warfare: Confederate Strategy and Military Policy." In *Writing the Civil War: The Quest to Understand*, edited by James M. McPherson and William J. Cooper, Jr. Columbia, SC: The University of South Carolina Press, 1998.

Townsend, Mary Bobbitt. *Yankee Warhorse: A Biography of Major General Peter Osterhaus*. Columbia, MO: University of Missouri Press, 2010.

Trelease, Allen W. *The North Carolina Railroad, 1849-1871, and the Modernization of North Carolina*. Chapel Hill: University of North Carolina Press, 1991.

Tucker, Spencer C. *Unconditional Surrender: The Capture of Forts Henry and Donelson*. Abilene, TX: McWhiney Foundation Press, 2001.

Turner, George Edgar. *Victory Rode the Rails: The Strategic Place of the Railroads in the Civil War*. 3<sup>rd</sup> ed. Lincoln: University of Nebraska Press, 1992.

Vandiver, Frank E. *Plowshares into Swords: Josiah Gorgas and Confederate Ordnance*. Austin: University of Texas Press, 1952.

\_\_\_\_\_. *Rebel Brass: The Confederate Command System*. Baton Rouge: Louisiana State University Press, 1956.

Varon, Elizabeth R. *Appomattox: Victory, Defeat, and Freedom at the End of the Civil War*. Oxford: Oxford University Press, 2014.

Wagner, Margaret E., Gary W. Gallagher, and Paul Finkelman, eds. *The Library of Congress Civil War Desk Reference*. New York: Simon & Schuster, 2002.

Ward, James A. *That Man Haupt: A Biography of Herman Haupt*. Baton Rouge: Louisiana State University Press, 1923.

Weems, John Edward. *To Conquer a Peace: The War Between the United States and Mexico*. College Station, TX: Texas A & M University Press, 1974.

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

\_\_\_\_\_. *Quartermaster General of the Union Army: A Biography of M. C. Meigs*. New York: Columbia University Press, 1959.

\_\_\_\_\_. *The American Way of War: A History of United States Military Strategy and Policy*. Bloomington: Indiana University Press, 1977.

Welcher, Frank J. *The Union Army, 1861-1865: Organizations and Operations*. 2 vols. Bloomington: Indiana University Press, 1987-1992.

Welter, Rush, ed. *American Writings on Popular Education: The Nineteenth Century*. Indianapolis: Bobbs-Merrill Company, Inc., 1971.

Welter, Rush. *Popular Education and Democratic Thought in America*. New York: Columbia University Press, 1962.

Williams, T. Harry. "The Military Leadership of North and South." In *Why the North Won the Civil War*, edited by David Donald. Baton Rouge: Louisiana State University Press, 1960.

Wilson, James H. *Under the Old Flag*. New York: D. Appleton, 1912.

Wilson, Mark. *The Business of Civil War: Military Mobilization and the State, 1861-1865*. Baltimore: Johns Hopkins University Press, 2006.

Wise, Stephen R. *Lifeline of the Confederacy: Blockade Running during the Civil War*. Columbia, SC: University of South Carolina Press, 1988.

Woodley, Thomas Frederick. *Great Leveler: The Life of Thaddeus Stevens*. Reprint, Freeport, NY: Books for Libraries Press, 1969.

Woodworth, Steven, ed. *The Art of Command in the Civil War*. Lincoln: University of Nebraska Press, 1998.

#### Secondary Sources: Unpublished Theses and Dissertations

Cesari, Gene S. "American Arms-Making Machine Tool Development, 1789-1855." PhD diss., University of Pennsylvania, 1970.

Elam, Mark. "The Road to Atlanta: The Role of Geography in Command and Decision Making during the Atlanta Campaign." PhD diss., Florida State University, 1996.

Molloy, Peter M. "Technical Education and the Young Republic: West Point as America's *Ecole Polytechnique*, 1802-1833." PhD diss., Brown University, 1975.

Nettesheim, Daniel D. "Topographical Intelligence and the American Civil War." Master's thesis, U. S. Army Command and General Staff College, 1978.

Shiman, Philip. "Engineering Sherman's March: Army Engineers and the Management of Modern War, 1862-1865." PhD diss., Duke University, 1991.

Sokolosky, Johnny W. "The Role of Union Logistics in the Carolina Campaign of 1865." Master's thesis, U. S. Army Command and General Staff College, 2002.

Tull, Bruce K. "Springfield Armory as Industrial Policy: Interchangeable Parts and the Precision Corridor." PhD diss., University of Massachusetts, 2001.