

Forts and Blockhouses: Field Fortification in the Rear Area

**A Monograph
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The monograph investigates classical military theory and two historical examples to gain insights about past use of fortification. It considers four eminent military theorists who addressed fortifications: Sebastien Le Prestre de Vauban, Carl von Clausewitz, Baron Antoine Henri de Jomini, and Dennis Hart Mahan. Both of the historical examples illustrate rear area challenges in situations similar to force projection. The first example is the US Army's use of forts in the Indian campaigns in the Northwest Territory from 1790 to 1795. The second example studies the blockhouse system used by the British Army in 1901 and 1902, during the Boer War. After examining theory and history, the monograph reviews doctrinal manuals that cover field fortifications and rear operations, and analyzes them using criteria from FM 100-5.

The monograph concludes that rear area field fortifications were valuable historically. While field fortifications helped rear operations in the past, current doctrine concerning rear area field fortifications only partially meets the requirements of FM 100-5. The monograph recommends three specific improvements to doctrine. FM 90-14, Rear Battle, needs revision so that it clearly includes field fortification while reducing its emphasis on area damage control. A new manual is needed which covers doctrine for corps engineers. Finally, manuals dealing with rear area operations should include planning considerations for using field fortifications to help protect lines of communication and key terrain in the rear area.

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Section I -- Introduction

In past wars, field fortifications were a means by which armies dealt with enemy threats to their rear area. Today, US Army field manuals describe the Army's doctrine concerning field fortifications and rear areas, but is this doctrine appropriate? To answer that question, this monograph investigates classical military theory and two historical examples to gain insights about field fortification in rear areas. It then examines doctrinal manuals that cover field fortifications and rear operations, and analyzes whether these manuals satisfy rear area requirements found in the Army's keystone doctrinal manual, FM 100-5, Operations. In areas where they fail to meet requirements of FM 100-5, the monograph recommends improvements.

An examination of rear area fortification has current relevance for the US Army. The 1993 version of FM 100-5 provides for a force projection Army in place of the forward deployed Army of the Cold War; however, force projection may involve more challenging rear operations. In Europe during the Cold War, NATO allies provided rear area security assistance to United States forces, and rear areas were on friendly territory. In force projection operations, US forces may receive little rear area security assistance, and rear areas may be on neutral or hostile territory. One response to these increased threats in the rear is to fortify the rear area. An assessment of rear area fortification doctrine is therefore valuable.

A rigorous investigation of rear area fortification requires that several key terms be defined. One key term used throughout the

monograph is rear area. Some references simply describe the rear area as the area behind the forward combat area, while the combat area is where combat forces conduct the close fight. Unfortunately, this description suggests a linear battlefield with a clear front and rear; it is unsatisfactory for nonlinear situations. In all situations, combat support and combat service support units occupy rear area locations, and logistical support crosses the rear area on lines of communication to reach combat forces.¹ Thus a complete definition of rear area is that area which encompasses combat support and combat service support for the forces in the combat area.

The term fortification is unpopular in the US Army, and doctrinal publications often use other words like survivability and protection in its place.² Essentially, fortifications are strengthened defensive positions. They fall into three categories: fortresses, defensive lines, and field fortifications. Fortresses are permanent fortifications, and countries build them before a war begins using durable materials like steel and concrete. Defensive lines are long linear fortifications. Examples include the Great Wall of China and chains of forts like the Maginot Line. Field fortifications are "... defined as obstacles erected shortly before a battle and intended for temporary use while it is going on."³ Field fortifications are usually built with perishable material such as earth and wood. Armies occupy them only for short periods during a campaign.⁴ Despite their differences, field and permanent fortification have become less distinct since World War Two. For example, armies sometimes use durable material like concrete in modern field fortifications.⁵

Survivability is a new term often used in place of the term fortification. FM 100-5 defines this term as follows: "Survivability operations protect friendly forces from the effects of enemy weapon systems and from natural occurrences."⁶ Fortification is a major component of survivability, but survivability is more than just fortification. Survivability also includes camouflage, which conceals friendly forces from the enemy, and protective obstacles, which help keep the enemy from overrunning friendly positions.⁷ Although survivability includes other components, this monograph focuses only on fortification.

Protection is another term related to fortification. Protection is an element of combat power, along with firepower, maneuver, and leadership. Protection consists of all measures taken to conserve fighting potential. Actions that reduce the losses from enemy fire are a component of protection, and thus fortifications are a part of protection.⁸ With key terms defined, the monograph's criteria now need consideration.

The evidence in the monograph is evaluated using four criteria derived from FM 100-5. Initiative is the first criterion. Initiative means that the commander sets the terms of action rather than reacting to the enemy. In other words, he retains his freedom of action while limiting the enemy's options. Another criterion is continuity of sustainment. This criterion demands that the Army provide uninterrupted logistics through the rear area to combat units. A third criterion is protection. Rear area units, stockpiles of supplies, and lines of communication must be secure from enemy destruction. The final criterion is economy of force. This requires that rear operations

divert minimal combat assets from deep and close operations based upon the situation.⁹ These criteria provide the basis of analysis for evidence gathered in theory, history, and doctrine.

The evidence from theory and history provide insights from experience. Both historical examples were selected because they illustrate rear area challenges in a force projection situation. The first example considers the US Army's Indian campaigns in the Northwest Territory from 1790 to 1795. The second example studies the blockhouse system used by the British Army during the Boer War. Both examples concern armies that had to project their forces to remote theaters. In the first example, the US Army operated on the frontier, across the Appalachian Mountains. Travel to the theater of war from eastern cities usually took weeks. In the later case, the theater of war was thousands of miles from the home country. Both armies had significant threats to their lines of communication. Each army deliberately chose to use field fortifications as a part of their response to this threat. Although the examples have many similarities, they occurred in different centuries. This lends perspective by showing factors that remained constant over time.

The definitions and criteria explained above provide a basis for analyzing theory, history, and doctrine. The next section examines past rear area field fortification using military theory and the two historical examples.

Section 2 -- Theory and History

Fortification has been part of warfare since ancient times, and history is full of examples of its use. With an abundance of examples, classical military theorists have naturally included numerous references to fortifications in their works. Four prominent theorists who addressed fortifications were Sebastien Le Prestre de Vauban, Carl von Clausewitz, Baron Antoine Henri de Jomini, and Dennis Hart Mahan. An investigation of their writings provides insights into the modern use of fortifications.

Sebastien Le Prestre de Vauban was a renowned 17th century French military engineer. He rose to great prominence designing and inspecting fortresses, and supervising sieges conducted by France. As a result of his exceptional competence and loyalty he was the first engineer to become a marshal of France. Although Vauban never produced a book on fortification, he composed considerable correspondence. He wrote that fortifications should cover the nation's frontier. These fortifications would not only protect the frontier, but facilitate an offensive against a neighboring enemy. These fortresses should command routes of communication such as roads and rivers. This would protect friendly lines of communication while preventing the enemy from bringing up the supplies necessary for a sustained siege. Finally, the fortresses should serve as depots since supplies inside would not only allow the fortresses to withstand a siege, but could support an offensive.¹⁰ Although Vauban was most famous for building and besieging permanent fortresses, he also noted that field fortifications were valuable. He expressed concern that French field

armies were too willing to fight without taking advantage of entrenchments.¹¹

Born 74 years after Vauban's death, Carl von Clausewitz was a military theorist who had practical experience in war. He first saw combat in the Prussian Army as a boy, and was a corps chief of staff by the end of the Napoleonic Wars. As a result of his experiences and study, he developed theories that explained both new developments in warfare that began with the French Revolution and the more limited pre-Revolutionary wars. His major work, On War, was not completed at the time of his death; however, his notes indicated that he wanted to explain the nature of war and its characteristics. On War contains numerous passages about fortification, and as a whole, they affirm that fortifications are important and useful. For example, Clausewitz wrote that entrenched camps, a form of field fortification, are very difficult for an attacker to defeat.¹²

On War has several excerpts directly relating to fortification in rear areas. Clausewitz wrote that fortresses make secure depots; therefore, a defender should secure his supplies in fortified places. He recorded that this was particularly true in enemy territory and in places where the population was unfriendly. At a minimum, critical weapons, ammunition and equipment needed protection. Clausewitz noted that an army should protect extended lines of communication by fortifying appropriate points. The army should use available fortresses at these points, and build field fortifications where fortresses were not available. Like Vauban, Clausewitz wrote that fortifications commanding road and river routes are barriers to an enemy advance. Finally, he recorded that fortresses are secure staging areas and

refuges on friendly lines of communication for transiting units and supply convoys.¹³

Baron Antoine Henri de Jomini was a contemporary of Clausewitz. Although he was Swiss, he served as a staff officer in Napoleon's Army where he reached the position of corps chief of staff. He later accepted a commission in the Russian Army where he continued to study and write about war. One of his books, The Art of War, captures the essence of his theories. Like Clausewitz, Jomini referred to fortification throughout his work. Jomini wrote that forts are essential points of support for an army because they cover a nation's frontiers, and they aid in the conduct of a campaign. He cautioned against weakening the field army, however, by splitting it up into many garrisons.¹⁴

Jomini also had several excerpts concerning fortification in rear areas. He wrote that staff officers should plan for the fortification and security of depots and other important posts. As an army advanced, it should establish a system of depots on its lines of communications. Principal depots should occupy available fortresses, while secondary depots could be located in towns. If fortresses were not available, reserves should build entrenched camps to protect the depots. Detachments using convalescent soldiers should garrison the fortifications and provide active security along the lines of communication. Jomini noted that this system was especially important if the population was hostile. In friendly territory, fortifications were useful as depots and hospitals. Jomini believed these facilities needed to resist small rear area threats without

assistance. Ideally, militia would garrison fortifications in friendly territory so that front line troops could stay with the field army.¹⁵

The preceding theorists were Europeans; Dennis Hart Mahan was an American officer who served as a professor at the United States Military Academy from 1830 until his death in 1871. During his tenure at the academy, he published several textbooks on military subjects. One of these textbooks, A Complete Treatise on Field Fortification, is a manual describing in detail how to build field fortifications. Mahan's purpose for the book was to give American officers a guide for study and to carry with them in the field. In his book, Mahan wrote that field fortifications gave a significant advantage to a defender. His book insists that every officer should understand how to construct field fortifications. An officer in charge of a post or depot should fortify it using available troops as a routine matter.¹⁶

The classical military theorists had similar writings concerning fortifications. Clausewitz and Jomini in particular had virtually identical views concerning fortifications in rear areas. A synthesis of the theories illuminates several key points. First, fortresses are good places for storage of supplies. If fortresses are not available, then the army should build field fortifications to protect supplies. Next, armies should fortify appropriate points on the lines of communication, especially if they are long or if the surrounding population is hostile. These fortifications should command routes such as roads and rivers. This aids friendly supply columns and hinders enemy attempts to sever friendly lines of communication. Fortifications on commanding ground also impede enemy offensive action by blocking the enemy's

likely lines of communication. This either slows the enemy's offensive by causing him to bypass or besiege the fortifications, or forces the enemy into a costly assault on the fortifications. Fortifications can serve as a refuge for the army in case of serious setbacks. None of the theorists believed fortifications were a substitute for the field army, and cautioned against weakening the army by diverting too many troops to fortifications. Jomini in particular suggested ways to get the most out of available resources by using convalescent soldiers and militia to garrison rear area fortifications.¹⁷ Overall, the theorists believed that rear area fortifications were valuable points of support for the field army.

The four classical theorists had comparable writings about fortifications in rear areas, but they all wrote at least 150 years ago. The criteria from FM 100-5 give the requirements of modern rear area operations. Applying these criteria to the four theorists may verify the modern relevance of their theories.

The classical theories meet the imperative of initiative. Fortifications on routes that form lines of communication help preserve friendly freedom of action. They do this by protecting the lines of communication from harassing action by small enemy units or by hostile partisans. This allows the commander to conduct operations without having broken lines of communication limiting his options. At the same time, these fortifications degrade enemy freedom of action by impeding enemy potential for quick offensive action. The commander sets the terms of action by choosing his lines of communication and then fortifying them as appropriate.

The theories also promote continuity of sustainment. Fortified lines of communication allow replacements and supplies to continually move from the army's base. High value supplies such as ammunition and weapons are protected from catastrophic loss within fortified depots. The combination of fortified lines of communication and supplies stocked in forward depots safeguard continuity of sustainment to the field army.

The theories meet the requirement of protection for rear area units, supplies, and lines of communication. Fortifications are an inherent component of protection. All four theorists wrote that rear areas are important enough to warrant fortifications.

Finally, the theories satisfy economy of force. The use of rear area fortifications caused only a minor drain on the strength of the field army. Construction of field fortifications used available troop labor under the technical direction of trained officers. Soldiers unsuitable for front line duties then garrisoned these fortifications. Jomini recommended using militia for interior fortifications, which kept the regular soldiers free for front line duties. For rear area fortifications established on enemy territory, soldiers who were convalescing formed a ready pool for garrison duties.

The ideas of the classical theorists satisfy all four criteria of rear operations found in FM 100-5. Classical military theory is one way to gain insight from the past; historical examples are another way. The first historical example concerns the Indian campaigns from 1790 to 1795, during which the US Army built forts on its line of communications.

In 1790, the United States faced a difficult situation in the recently established Northwest Territory. The federal government of the United States claimed this land as part of the treaty ending the Revolutionary War. Unfortunately, the Native Americans living in the Northwest Territory believed that the land belonged to them, and they were determined to keep white settlers out. Indian tribes including the Shawnee and Miami had been skirmishing with white settlers in western Virginia, Kentucky, and what is now Ohio for years. The administration of President George Washington, despite its weak resources, decided to conduct a military campaign to bring the tribes under control.¹⁸ This began a war that lasted until 1795.

Brigadier General Josiah Harmar led the first campaign against the Shawnee and Miami. He received his instructions from President Washington and from Secretary of War Henry Knox. The Indian villages at Kekionga, which is the present site of Fort Wayne, Indiana, were Harmar's campaign objective. Knox understood the value of forts on the frontier, but he had no intention of building forts on this campaign. Harmar complied and conducted his campaign without building any significant fortifications.¹⁹

Harmar's force left Cincinnati (Fort Washington) on 30 September 1790 with 320 regular soldiers and 1,133 militia, and arrived at Kekionga on 15 October. The residents of Kekionga had fled, and Harmar's soldiers became overconfident. Indians ambushed and badly defeated a detachment on 19 October. This action undercut morale, and Harmar decided to withdraw to Cincinnati after burning the Indians' homes and corn harvest. During the withdrawal, Indians surprised and routed another detachment. This turned Harmar's

withdrawal into a fiasco, and the army retreated all the way back to Cincinnati without pause.²⁰

After Harmar's defeat, President Washington placed Major General Arthur St. Clair in command of the United States Army. Knox directed St. Clair to attack the Indians in 1791. Like Harmar, St. Clair's objective was Kekionga. As part of his plan, St. Clair wanted to build a chain of forts on his line of communication. This concept was not original with St. Clair since the French had originally introduced forts on lines of communication in North America.²¹

St. Clair had little time to prepare for his campaign, and he was only able to build a single fort before his offensive. This fort was about 20 miles north of the Ohio River, and St. Clair assembled supplies for his offensive inside it. As was typical of forts built throughout the war, logs were the principal building material. It had walls made of log pickets, and had bastions and blockhouses to protect its corners.²²

St. Clair began his offensive on 4 October 1791. His army started with about 2,300 soldiers including militia. The army moved slowly and progressed less than 60 miles in two weeks. The bulky baggage trains accompanying the army forced the army to build a wagon trail as it moved. At best, the army was as slow as its ox drawn wagons. St. Clair stopped the army on 19 October and built a fort that he named Fort Jefferson. Unfortunately, construction was slow because the expedition was short of tools such as saws. As the weather turned colder, the army's morale began to drop and desertions began to rise.²³ After several days, St. Clair decided Fort Jefferson was adequately complete, and pushed his army forward. He left a small

garrison at Fort Jefferson composed of soldiers who were unable to march due to injury or illness.²⁴

During the next week, St. Clair advanced only 20 miles further. On 3 November, the army marched until dusk and did not bother to entrench that night's camp. On the morning of 4 November, roughly 1,000 Indians conducted a surprise attack on St. Clair's camp and destroyed his army, which suffered 647 killed and 271 severely wounded while the Indian force lost only 21 killed and 40 wounded. Additionally, all the army's equipment was abandoned.²⁵ The survivors fell back on Fort Jefferson, and though the fort was too small to hold the remnants of the army, there was enough room for soldiers too badly hurt to continue the retreat. The wounded took refuge in the fort while the rest of the shattered army retreated to Cincinnati. These wounded soldiers would have been abandoned if the fort had not been built.²⁶

After St. Clair's disaster, President Washington conducted a careful search for a replacement. He chose a Revolutionary War general, Anthony Wayne. Knox gave Major General Wayne the time and resources to train a better army. Wayne made the most of this time and molded a force far superior to the army commanded by Harmar and St. Clair. He called this force the Legion of the United States.²⁷

Wayne's plan for his campaign included forts at convenient intervals on his line of communication. Unlike St. Clair, Wayne had the time to implement this plan. Wayne's deputy, Brigadier General James Wilkinson, built the first new fort between Forts Hamilton and Jefferson in 1792, while Wayne concentrated on training the legion.²⁸

The new fort reduced the journey between forts to a distance that pack horse convoys could travel in one day. As a result, supply convoys could go from Cincinnati to Fort Jefferson while staying inside a fort each night. In May 1793, Wayne wrote to Henry Knox that he needed to push logistics forward to the advanced posts before beginning an offensive.²⁹ After diplomatic efforts in summer 1793 failed, Wayne proceeded to push logistics out to his advanced forts.

In autumn 1793, Wayne moved the legion north to Fort Jefferson to pressure the Indians. He was dissatisfied with the size of Fort Jefferson, so he built Fort Greenville a few miles further north. This new fort was large enough to accommodate the legion, and it served as winter quarters. In December, Wayne pushed even further north, and built Fort Recovery on the site of St. Clair's defeat.³⁰ On 30 June 1794, while Wayne was making final preparations for his offensive, an Indian force with about 2,000 warriors conducted a preemptive attack on a pack train that had just left Fort Recovery. When the survivors of the pack train escaped to the safety of Fort Recovery, the Indians tried to attack the fort, but after sustaining about 30 casualties with no gains, the Indians broke off their attack.³¹

Wayne was at last ready to launch his offensive in July 1794. He had stockpiled supplies in his forward forts, and his legion was trained and disciplined. The legion began the offensive with 2,200 regular soldiers and 1,500 militia. After moving to Fort Recovery on 28 July 1794 and picking up supplies, Wayne pushed his army north, building entrenched camps each night. He stopped three times to build intermediate forts. The final intermediate fort was close to the place the Indians were apparently going to stand and fight. Wayne

named it Fort Deposit, and he left all the legion's baggage there. On 20 August 1794, the legion attacked the Indian forces and defeated them. This action, the Battle of Fallen Timbers, was a modest tactical victory, but its strategic effects were great.³² Wayne moved unopposed to Kekionga and built a powerful fort there which the legion named Fort Wayne. In 1795, Wayne negotiated a treaty on United States terms with the defeated tribes.

During his campaign, Wayne built seven new forts.³³ He was continually concerned that garrisoning these forts not reduce the strength of the army in the field. He wrote to Knox that he would garrison forts ". . . with those who are least capable of active service, . . . who in an active campaign would only be an incumbrance to the Legion . . ."³⁴ During his offensive, Wayne put this policy into practice. He garrisoned one fort with sick soldiers under the charge of a sick officer.³⁵ This policy turned the need to garrison forts to Wayne's advantage. Sick and injured soldiers reduced the legion's mobility. By shedding these soldiers, the legion could keep up a swift rate of march. The legion lost little combat strength because the soldiers left to garrison the forts were not fit for normal duty. Wayne was offensively oriented during his campaign. His use of forts on his lines of communication was completely compatible with an offensive spirit.

Field fortifications in the three campaigns from 1790 to 1795 have several common characteristics. All the forts built during these campaigns were field fortifications. The forts meet the definition of field fortification because they were made of a perishable material, wood. Also, they were built for campaign use; only Forts Washington

and Wayne had garrisons after 1797. The other forts were all abandoned.³⁶

The forts provided substantial protection. Forts, even with small garrisons, were nearly immune to Indian attack. The Indians could not successfully mount sieges of the forts. The Indian logistic system was austere, and involved hunting during the campaign. This meant that the Indians needed to keep moving to find food. If they tried to besiege a fort, they would deplete all the nearby wild game in a few days. This forced them to lift the siege.³⁷ Direct assault was also impractical. Without artillery, the Indians could not breach the walls or blockhouses of a fort. They simply lacked sufficient firepower to overcome the protection of a fort. The forts also provided refuge for the army when the wounded survivors of St. Clair's disaster took refuge in Fort Jefferson.

The forts were strong points on the lines of communication. They served as critical depots for supplies and protected logistic assets like pack convoys. To protect convoys at night, Wayne built his forts within a day's march from each other. The convoys still needed escorts; however, the escort requirement would have been much larger without forts along the line of communications.

The forts enhanced the mobility of the legion. St. Clair needed to carry all of his supplies with his army. His baggage train was thus big and slow. By staging supplies forward into forts, Wayne reduced the bulk of supplies in his baggage train. This made the legion much more agile than St. Clair's army. The forts also enhanced mobility by providing a way to leave sick and injured soldiers behind. Since the

legion moved forward only with healthy soldiers, its speed on the march stayed high.

Analysis of the fortification in these campaigns using the established criteria shows their relevance to today. Use of forts aided initiative. Compared with Harmar and St. Clair, Wayne was able to set the terms of the action during his campaign. He used forts to leverage his freedom of action. The forts improved the mobility of his legion. Once built, the forts restricted the Indian's freedom of action by limiting their ability to cut Wayne's supply lines. The forts dominated local areas, and the Indians could not eliminate them.

The forts allowed continuity of sustainment. Since the forts served as depots, the delay of a supply convoy was not serious. The army could use stockpiled supplies until the convoy arrived. Without these depots, the delay of a single supply column could have left the army critically short of food. Wayne's logistic situation was always greatly superior to St. Clair's.

The forts provided excellent protection. Forts protected supplies, supply convoys, and wounded soldiers. Although supply convoys still needed escorts, the forts gave substantial protection to the lines of communication.

Finally, the forts allowed Wayne to use economy of force in his rear. He garrisoned the forts at least cost by using convalescent soldiers. Although he did need to detach forces to garrison the forts and escort convoys, the escort size was smaller than it would have been without the forts. The forts were consistent with Wayne's desire to have the largest possible force with his main effort.

A century after Anthony Wayne concluded his campaign, Great Britain went to war in South Africa. Britain had gained possession of the Dutch Cape Colony in South Africa in 1806, but friction soon developed between the new British authorities and the original Dutch settlers, who referred to themselves as Boers. To escape British domination, some of the Boers trekked north and founded two new nations, Orange Free State and the Transvaal. This defused pressure until late in the 19th century, when the discovery of diamonds and gold in the Boer republics triggered a rush of British immigrants. The Boer republics withheld political rights from British immigrants, and rising tensions led to war in 1899. Great Britain's primary strategic aim was to annex the Boer republics. The alliance of Orange Free State and the Transvaal fought to maintain their independence.³⁸

Great Britain was vastly stronger than the Boer republics. Britain, however, had to project its army thousands of miles just to reach South Africa. Its army then had to travel hundreds of miles across South Africa to reach Orange Free State and the Transvaal. Still, by late 1900, Britain had defeated the main armies of the Boer republics. The British Army occupied the capitals of both countries; the war seemed all but over. To the dismay of the British, the Boers shifted to a guerrilla strategy when they could no longer fight conventionally.³⁹

The Boer guerrillas were a horse mounted force. They relied on a sympathetic rural population and on swift mobility in the wide open spaces of South Africa. The Boers had rifles and some machine guns, but they had lost nearly all of their artillery during the conventional

phase of the war. Opposing this force of about 20,000 Boers was a British army of 200,000.⁴⁰

In December 1900, just as the guerrilla phase of the war began, a new commander, General Horatio Herbert Kitchener, took charge of the British army. Kitchener initially attempted to defeat the guerrillas using mobile columns that scoured the countryside searching for Boer forces. After a few months, Kitchener realized that he was failing to capture enough Boers to end the war quickly. He devised the blockhouse system as a means to defeat the guerrillas.⁴¹

The British first used blockhouses in January 1901, and their original purpose was simply to protect the railways from the Boers. The long distances in South Africa made the rail lines vulnerable to guerrilla disruption.⁴² Kitchener saw the possibility for a greatly expanded use of blockhouses. Blockhouses would continue to protect the lines of communication. Now, however, blockhouse lines would function as fortified lines. Long lines of blockhouses would divide the country into manageable pieces. The fortified lines would work defensively by protecting areas that the mobile columns had cleared of guerrillas. They would work offensively by forming a line against which the mobile columns could drive the enemy. In this way intersecting lines could cage the guerrillas.⁴³ Kitchener's ideas formed the basic plan of the blockhouse system. He set his army to work implementing his plan.

The British army began building blockhouse lines on the railways in Orange Free State and the Transvaal. The blockhouses were 1,000 to 2,000 yards apart, depending on the terrain. The most common blockhouses were circular structures 12 feet in diameter.

Sheet metal formed inner and outer circular walls. These walls were about a foot apart. Gravel filled the space between the inner and outer walls which made the blockhouse proof to small arms fire. Loopholes in the walls allowed defenders to fire out in all directions. A ditch for sentries and wire obstacles surrounded each blockhouse to prevent the Boers from getting directly under the walls of the blockhouse. The lines of blockhouses often stretched for long distances with the longest line reaching 300 miles.⁴⁴

British engineers built the blockhouses. A section of 12 engineer soldiers and 20 native laborers could build the typical sheet metal blockhouse in eight hours. Key locations such as railway bridges had stronger blockhouses. These special blockhouses were often made of stone, and they took much longer to build. Engineers built a wire fence obstacle between blockhouses. Usually, this wire obstacle bowed outward so that each blockhouse could fire on the wire without hitting the next blockhouse down the line. A ditch sometimes backed up the wire obstacles. Although Boer horses could jump the ditch, wagons could not pass.⁴⁵

As the British implemented the blockhouse system, their situation improved. The lines effectively protected the British lines of communication. With secure railways the British could transport large amounts of supplies. Secure railways also allowed Kitchener to move troop units quickly from one area to another. Secure telegraph lines improved Kitchener's command and control, and his intelligence dissemination. Kitchener remained offensively oriented. He used horse mounted mobile columns to find, attack, and pursue the Boers. By October 1901, the Boer guerrillas' situation was worsening. The

British were capturing guerrillas each month, and replacements were not filling Boer ranks.⁴⁶ These events brought the Boers to the negotiating table, and Great Britain signed a peace treaty with the Boers in 1902.

Analysis of the blockhouse system shows that it had several advantages and some drawbacks. One advantage of the blockhouses was the protection that they provided. The blockhouses themselves were essentially impregnable to the Boers in this phase of the war. The blockhouses could not withstand artillery fire, but the Boers had virtually no remaining artillery.⁴⁷

The biggest advantage of the blockhouse system was that it effectively protected the British lines of communication. The railroads were essential to the British army. The army would have been logistically unable to advance into the Boer republics without the use of the railroads. Before the blockhouse system began, the Boers succeeded in destroying 45 major railroad bridges, 180 culverts, and 45 locomotives. Once the blockhouse system was in place, the Boers were virtually unable to sabotage the railways. As the blockhouse system spread, it effectively controlled key terrain across the Boer republics. The British built special blockhouses to control bridges and river fording sites.⁴⁸

The blockhouse system effectively used soldiers. J. F. C. Fuller, who served as a lieutenant in the Boer War, noted that a great advantage of the system was that it reduced the need for escort work.⁴⁹ Soldiers relieved from guarding railways joined the mobile columns that operated directly against the Boers. Still, the numbers of British soldiers on the blockhouse line were enormous. By early 1902,

the British were garrisoning 5,000 blockhouses with about 50,000 soldiers.⁵⁰ The British recruited native Africans, and by using thousands of them as guards on the blockhouse lines, allowed the British to reduce their garrisons, and thus freed more soldiers for mobile columns.⁵¹

The blockhouse system had mixed success in restricting Boer mobility. Fuller believed that the blockhouse lines successfully divided the theater into pieces small enough to clear the enemy. He observed that the Boers could not cross the lines with their supplies even if small parties of guerrillas got across. Since large groups of guerrillas could not live off the land, the blockhouse line effectively blocked passage by large groups of Boers. In effect, the lines worked against the Boer's logistics, and thus inhibited their mobility.⁵² The commander of the Orange Free State forces, General Christiaan De Wet, had a contrary viewpoint. De Wet did not think the blockhouse lines were effective in stopping his guerrillas. He believed that he could always force his way through the line and escape the British mobile columns.⁵³ The blockhouse lines were not impassable. In balance, it seems that they inhibited, but did not stop the guerrillas.

A definite disadvantage of the system was that blockhouse duty hurt the morale of British soldiers. Blockhouse duty was monotonous and very boring. Small unit leaders needed to take initiative to care for their soldiers and keep them in fighting condition.⁵⁴

Analysis of the blockhouse system using the established four criteria shows that the experience has relevance today. Kitchener designed the system to gain the initiative. The secure lines of communication resulting from the system allowed Kitchener to control,

move, and supply his army better than his enemy. The blockhouse lines limited the freedom of action of the guerrillas by hindering their mobility and disrupting their logistics. Rather than chase the guerrillas around South Africa, Kitchener devised a system that set the terms of the action.

The blockhouse system insured that the British army had continuity of sustainment. Supply trains moved reliably once the system was in place. British units had access to supplies any time they were in contact with a rail line. Units could carry enough supplies for the relatively short distances between fortified lines.

The system provided a maximum amount of protection for supplies, trains, and rail lines. Considering the guerrilla threat to the lines of communication, the system clearly met the requirement of protection.

The system marginally satisfied economy of force. British officers believed that the system used fewer soldiers than an escort system would have required. The army husbanded British soldiers by using native guards to supplement the blockhouse garrisons. Still, the British tied up a quarter of their force, a total of 50,000 soldiers, on static duties. Using such a large portion of the combat force on static duties barely fulfills economy of force.

Kitchener, like Wayne, deliberately used field fortifications in his campaign. A further analysis of both historical examples, along with the military theories, can illuminate their similarities.

The writings of the military theorists and the historical examples reveal several common threads. Perhaps the most important lesson from theory and history is that field fortification in rear areas is

valuable. Classical military theory suggests effective ways that an army can use fortification in rear areas. The historical examples show the results of actual use of fortifications. In both historical cases, fortification was initially ignored but was subsequently an important part of successful operations. After Harmar's campaign in 1790, the US Army included forts in both of its campaigns. Likewise, after the British had suffered substantial damage to their South African railroads in 1900, they devised blockhouses to protect their railways. Other insights from theory and history are arranged according to the monograph's four criteria.

Field fortifications helped commanders gain the initiative in the rear area. To set the terms of battle, commanders planned fortifications to contribute to their overall operations. Fortifications were completely compatible with offensive action. Wayne and Kitchener effectively used fortifications to support tactical and strategic offensives. Rear area fortifications commanding key terrain such as bridges and ford sites directly contributed to freedom of action by allowing uninhibited maneuver. Simultaneously, fortifications on key terrain reduced enemy initiative by limiting enemy options. Fortifications also enhanced initiative by assisting friendly mobility. Wayne increased the mobility of his legion by stockpiling supplies in advanced forts to reduce his baggage train, and by leaving sick and injured soldiers at the forts. Kitchener used blockhouses to protect the railroads that let him move his units and supplies faster than the Boers.

Fortifications contributed to continuity of sustainment in each historical example by helping secure vital lines of communication. In

the Indian campaigns, forts protected the road that formed the US Army's line of communication from Cincinnati. The railways that formed the British army's line of communication in the Boer War were protected by blockhouses. In both cases, secure lines of communication allowed supplies to move to the combat forces on a regular basis. Fortifications also promoted continuity of sustainment by acting as depots. The theorists wrote that this was a principal function of fortifications. Wayne used his forts as depots, and this reduced his vulnerability to delays in his supply columns.

Fortification provided significant protection for units, supplies, and lines of communication. Fortifications were highly resistant to direct assault and siege in both historical examples. Neither the Indians nor the Boers could successfully assault completed fortifications. With 2,000 warriors, the Indians had a numerical advantage over the defenders of Fort Recovery on 30 June 1794, but their weapons did not have sufficient firepower to overthrow the defenders. The Boers' rifled small arms similarly had insufficient firepower to defeat blockhouses. Without artillery, the Indians and the Boers could not overcome the protection provided by fortifications. A siege was also impossible for the Indians and Boers. Logistic constraints prevented the Indians and Boers from having the time necessary to besiege a fort or blockhouse. Clausewitz and Jomini wrote that the protection provided by fortifications was important in rear areas if the population was hostile. Hostile partisans could sabotage unprotected supplies, but would have little ability to attack fortifications. Overall, rear area fortifications provided good protection

whenever the enemy did not have the firepower to conduct an assault or the time to conduct a siege.

Fortifications were compatible with economy of force. In no case were field fortifications free of cost. They required time and effort for construction, personnel to garrison them, and often money to buy building equipment and material. Still, they were less costly than reasonable alternatives. During the Indian campaigns, an absence of forts would have drastically increased the escort requirements for supply convoys. During the Boer War, the blockhouse system freed many soldiers from train escort duties. Jomini and Mahan suggested ways to economize while using rear area fortifications. Jomini proposed using convalescent soldiers or militia to garrison fortifications, while Mahan wrote that all officers should have technical expertise in field fortification; this reduces the demand on the engineers. Wayne economized by actually garrisoning his forts with convalescent soldiers. Likewise, the British army hired native guards to replace British soldiers. Using these personnel reduced the manpower drain on the main fighting force.

The insights from this analysis of theory and history are a basis of comparison with current US Army doctrine. Before comparison is possible, however, the doctrine concerning rear area operations and field fortifications must be thoroughly examined. The next section investigates and analyzes current doctrine, and compares it with the insights from theory and history.

Section 3 -- Doctrine

Several doctrinal and training publications contribute to US Army doctrine concerning field fortification in rear areas. No single manual completely covers the subject because it crosses functional lines. Field fortification is an engineer issue while rear operations fall under combined arms. A comprehensive view of Army doctrine thus requires examination of field manuals that concern both engineer operations and rear operations. Current field manuals that address rear area field fortification divide into three groups, and each group has a different perspective. Rear operations manuals describe how the Army conducts rear operations. General operations manuals like FM 100-15, Corps Operations, describe operations at a particular echelon. Engineer manuals describe how engineer units plan and conduct operations. This section investigates doctrine in each group and then integrates the three perspectives to provide a complete view of the Army's rear area field fortification doctrine.⁵⁵

The principal rear operations manual is FM 90-14, Rear Battle. This manual tries to provide a comprehensive framework for rear operations, and it is the only field manual concerned solely with that subject. FM 63-21, Main Support Battalion, contains an appendix devoted to rear operations. This manual shows how one type of rear area unit, the division main support battalion, conducts rear operations. Army Pamphlet 525-14, Joint Operational Concept for Air Base Ground Defense covers a specific portion of rear operations.

FM 90-14 contains the Army's basic concepts for rear operations. The manual describes three levels of threat in rear areas. The

smallest threats, level I, include sabotage by enemy agents and terrorists. Level II threats are operations by enemy forces such as unconventional and reconnaissance units. Level III threats consist of actions by battalion sized or larger enemy forces. Friendly forces defend themselves against these threats by forming bases and base clusters in the rear area. A base is a position with a definite perimeter and can include one or more units. A base cluster is a collection of units grouped together for protection, and it does not have a definite perimeter. The rear command post has overall responsibility for the rear area, while the rear area operations center (RAOC) plans, coordinates, and directs rear operations. Bases and base clusters should defeat level I threats, but level II threats exceed base and base cluster capabilities. The RAOC uses response forces such as military police units to defeat level II threats. A tactical combat force, composed of combined arms combat units, defeats level III threats.⁵⁶

FM 90-14 does not include fortification as a consideration in rear operations. Base defense is the logical place to cite fortifications because fortifications can contribute directly to a base's protective strength, but the chapter on base defense ignores fortifications. The only reference to fortifications in that chapter is a single phrase that states individual training should include preparation of individual fighting positions.⁵⁷ The rest of the manual contains no significant reference to fortifications.

While FM 90-14 disregards fortifications, it has an entire chapter devoted to area damage control. Area damage control is described as measures taken to minimize damage from enemy action or natural disasters. Unfortunately, area damage control is reactive.

Essentially, the enemy chooses where to attack, and friendly forces respond by performing area damage control. Engineer contributions include fighting fires, clearing rubble, and reestablishing utilities. Only a single sentence in the chapter suggests that engineers can prevent damage by building fortifications.⁵⁸

FM 63-21 prescribes doctrine for division main support battalions, and it is an example of the doctrine for units that operate in rear areas. Like FM 90-14, this manual makes little mention of fortification. It contains only one obscure reference to digging in. Fortification is not included in detailed explanations of how to occupy the division support area or how to conduct base defense.⁵⁹ The description of rear operations in FM 63-21 closely resembles FM 90-14, as do rear operations in the Army's air base defense agreement with the Air Force.

Army Pamphlet 525-14, Joint Operational Concept for Air Base Ground Defense describes Army and Air Force procedures for defending air bases from ground attack. According to the pamphlet, an air base fits within the rear area as a base that works directly with the RAOC. The pamphlet makes no mention of fortifications.⁶⁰

The rear operations manuals essentially omit fortifications. A few scattered and disconnected allusions to survivability and digging are the only references to fortification. The manuals give no indication why or when fortifications can contribute to rear operations.

The operations manuals for major tactical commands describe the echelons' essential doctrine. Divisions and corps own the bulk of the rear area in the combat zone. Their operations manuals incorporate rear operations as part of the battlefield organization, and

fortifications as part of the mobility and survivability battlefield operating system.

FM 71-100, Division Operations, covers basic doctrine for all divisions. The manual describes rear operations in its introductory chapter, under offensive operations, and under defensive operations. The concepts for rear operations in this manual closely resemble those in FM 90-14. Unfortunately, there is no mention of fortification in any of the sections that deal with rear operations. The chapter on command and control does, however, prescribe the use of fortifications for division command posts when possible. The manual refers to engineers in several places. It states that division engineers provide equipment to prepare positions for maneuver units. This excludes combat support and service support units in rear areas. It also states that division engineer missions include area damage control and responding to level I or II threats.⁶¹ The manual implies that division engineers do not build fortifications in the division rear area. Although the text nearly ignores rear area fortification, two figures do address the issue. The division offensive employment matrix and the division defensive employment matrix both specifically focus rear area survivability efforts on protecting critical service support sites.⁶² Overall, FM 71-100 contains little information about fortification in rear areas.

FM 71-100-2, Infantry Division Operations: Tactics, Techniques, and Procedures, provides additional guidance for infantry divisions. Like FM 71-100, it has little information on rear area field fortifications. The section on rear operations has two references to rear area fortifications. In the first reference, the manual states that

base perimeter defense should include fighting positions. In the second reference, the manual states that engineers contribute to area damage control by constructing fortifications, clearing rubble and debris, and maintaining supply routes. The manual then cautions against diverting engineer units to area damage control because engineers fulfill critical missions such as survivability.⁶³ Since survivability by definition includes fortification, this passage is confusing. The problem seems to stem from the expansive definition of area damage control found in FM 90-14.

FM 100-15, Corps Operations, fulfills the same purpose at the corps level that FM 71-100 accomplishes at the division level. FM 100-15 incorporates rear operations into three different chapters, and has an appendix devoted to rear operations. Like FM 71-100, the concepts for rear operations match FM 90-14, and fortifications are ignored in rear operations sections. FM 100-15 includes a section that describes the battlefield operating systems. Under mobility and survivability, the manual states that corps engineers build fortifications when time and resources permit. Like FM 71-100, an employment considerations matrix links survivability with rear operations. This matrix prescribes survivability of key units and facilities in the rear area.⁶⁴ Overall, FM 100-15 provides some guidance on fortifying the rear area. Except for the matrix, however, the manual segregates rear operations from fortifications.

The operations manuals have limited information concerning rear area field fortifications. Sections of the text concerning rear operations do not refer to fortifications. Sections concerning engineers refer to rear area fortifications in FM 100-5, but not in FM 71-100.

Only the employment considerations matrices integrate the subject of rear operations with the subject of fortification.

The final group of manuals are engineer manuals, which describe how engineer units plan, direct, and execute operations. Several engineer manuals include information relevant to rear area fortification.

The keystone engineer manual is FM 5-100, Engineer Combat Operations. This manual contains the essence of engineer doctrine, and other engineer manuals provide more specific information. FM 5-100 fully covers rear area field fortification. It states that engineers provide hardened shelters and protective obstacles to protect rear operations. Engineers provide this fortification support to reserves, aviation units, combat support units, and combat service support units. Corps combat engineer battalions are the units responsible for survivability in division and corps rear areas. Combat heavy engineer battalions are responsible for survivability in the communications zone. The manual states that in the offense, engineers build fortifications based on the situation. Command and control facilities and logistics facilities are especially suitable for fortification. In the defense, engineer fortification effort focuses on forward combat elements, but engineers also fortify critical rear area facilities.⁶⁵ The manual shows that engineers are needed for a variety of tasks throughout the battlefield. Units must balance fortification effort in the rear with support for deep and close operations, and with rear area mobility efforts such as building and repairing roads. Finally, the manual advocates using host nation support to extend engineer effort.

Host nation support can include construction of fortifications and providing construction materials.

FM 5-103, Survivability, and FM 5-114, Engineer Operations Short of War, provide technical information concerning how to build fortifications. FM 5-103 includes the specifications for a wide variety of shelters, fighting positions, and other fortifications. These fortifications provide protection for almost all Army rear area assets from threats such as bombing, artillery, and small arms fire. The manual fully describes how to build fortifications, but it does not explain how to prioritize engineer effort.⁶⁶ FM 5-114 includes force protection measures for the threat posed by terrorists, guerrillas, commandos and spies. These measures include fortifications such as predetonation screens for rocket propelled grenades and protective walls. They complement the fortifications found in FM 5-103.⁶⁷ Together, the two manuals provide an appropriate fortification for virtually any enemy rear area threat.

FM 5-71-100, Division Engineer Combat Operations is the principal reference for divisional engineer operations. First published in 1993, the manual comprehensively covers fortifications in the division rear area. It assigns responsibility for rear area fortifications to corps combat engineer battalions. Corps engineers fortify combat support and combat service support units, command and control nodes, and base clusters. In particular, fortifications for communications assets may be critical. The manual states that the engineer staff in the division rear command post controls rear engineer operations, plans fortifications for the rear area, and coordinates logistics for

engineers working in the rear area. This staff is responsible for identifying critical fortification requirements.⁶⁸

According to FM 5-71-100, rear area fortifications have utility in both offensive and defensive operations. In the offense, engineers plan and execute fortifications and obstacles to help protect bases and base clusters. Rear area survivability is critical in light infantry division offensive operations. Corps engineer units provide both fortification expertise and earth moving equipment in the light division rear area. Heavy division engineer brigades have much more equipment, but heavy divisions have more equipment needing protection. Heavy divisions also use corps engineer units to fortify the rear area.⁶⁹ In the defense, the division engineer allocates resources to the rear area based on the division commander's priorities and the threat assessment. The engineer staff in the rear command post does survivability planning for all rear area units. The staff uses four factors to determine priority. First, it estimates the vulnerability of each rear area unit. Next, it assesses each unit's ability to defend themselves. Third, it evaluates the criticality of the unit to the division's mission. Finally, the staff estimates the ability of the unit to recuperate. The rear command post allocates engineer assets based on unit priorities. Like the offense, engineers give technical advice to units and build fortifications.⁷⁰ FM 5-71-100 clearly incorporates rear area fortification. It explains how to prioritize fortification effort, and how to balance competing requirements for engineer assets.

FM 5-100 and FM 5-71-100 indicate that corps combat engineer battalions are responsible for rear area fortification. The mission training plan for these battalions' engineer platoons incorporate

appropriate fortification tasks. These tasks include digging protective positions for trucks, constructing protective earth walls and berms, and building bunkers and shelters.⁷¹ The training manuals for corps engineer units support the engineer doctrine.

Collectively, the engineer manuals consider most aspects of rear area field fortifications. FM 5-100 sets out basic concepts and assigns responsibility for construction of rear area fortifications. FM 5-103 and FM 5-114 explain how to build appropriate fortifications. FM 5-71-100 is undoubtedly the most valuable manual on this subject. It explains how to plan, resource, and execute division rear area fortifications. It also provides guidance for the engineer in prioritizing fortifications, and in balancing fortification effort with other engineer tasks such as mobility and sustainment engineering. Finally, the mission training plans mesh with the doctrinal manuals.

Unfortunately, there is a missing piece in the engineer manuals. There is no manual that covers the corps rear area in the same way that FM 5-71-100 covers the division rear area. FM 5-71-100 is the only field manual that explains how to prioritize rear area fortification. Thus, the Army does not have doctrine that shows how to choose where to expend fortification assets in the corps rear area. The division level manual, FM 5-71-100, is therefore the best manual available for the corps rear area.

A complete understanding of current Army doctrine requires a synthesis of all three groups of manuals. Responsibility for fortifications clearly rests with the engineer. Unfortunately, rear area fortifications are too exclusively the province of the engineer. The rear area operations manuals virtually ignore the entire subject. The

general operations manuals recognize the subject, but put fortifications in the "engineer" parts of the manuals. The rear operations sections of these manuals are devoid of the subject. Engineer manuals have the only thorough treatment of rear area fortification. As a result, staffs of rear area units must study engineer manuals to understand rear area fortification. Unless the staff has its own engineer officer, the rear area commander and operations officer will probably not even realize that their rear operations manuals lack important information.

Army doctrine includes designs for a variety of fortifications that can help protect the rear area. At the division level, doctrine explains how to plan and resource rear area fortifications, but this guidance does not exist in a corps level manual. Essentially, Army doctrine answers the question of who builds fortifications and how to build them at all echelons. Doctrine does not fully answer the question of when and why to build rear area field fortifications at the corps level.

Section 4 -- Evaluation of Doctrine and Recommendations

The last section presented the Army's current doctrine for rear area field fortification. This section analyzes this doctrine using the criteria derived from the Army's keystone doctrinal manual, FM 100-5. It also applies the insights of military theory and the two historical examples to current doctrine. In areas where doctrine does not measure up to the criteria, it recommends improvements to doctrine.

Rear area field fortification doctrine promotes initiative in several ways. Doctrine guides engineers in using fortifications to support the commander's overall plan. Field manuals indicate uses for fortifications in both offensive and defensive operations. At the division level, doctrine explains how to prioritize and allocate resources to help set the conditions for victory. Doctrine also emphasizes using fortifications to protect command and control facilities. Secure command and control directly assists friendly freedom of action.

Doctrine fails to satisfy initiative in a number of ways. The absence of guidance on fortification in the rear area operations manuals forces the commanders and staffs of rear area units and headquarters to rely heavily on engineers for technical advice and for planning. The information in these manuals does not even prompt rear area units to ask for engineer assistance. At the corps level, doctrine has no guidance on prioritizing fortifications. These shortcomings harm effective planning and thus detract from initiative.

Area damage control also fails to satisfy initiative because it is reactive. The emphasis of area damage control is on making preparations to limit and repair rear area damage. It forfeits initiative because the enemy decides where to attack and friendly units then respond to the damage. In the Boer War, General Kitchener used blockhouses to prevent the Boers from successfully attacking his railways. More emphasis on rear area fortification, and less emphasis on area damage control would better achieve initiative.

Doctrine does not advocate using rear area fortification to limit the enemy's freedom of action. None of the doctrinal manuals

recommend using fortifications to help hold key terrain. Vauban, Clausewitz, and Jomini all recommended using fortifications for this purpose. In the Boer War, fortifications on key bridges and river fords limited the Boer's freedom of action, while preserving British freedom of action. Doctrine might be enhanced if it commended fortification of key terrain.

Current fortification doctrine promotes continuity of sustainment by providing fortifications for bases and base clusters. These areas include the combat service support units and supply points that provide continuous logistic support to combat units.

Continuity of sustainment is undermined by doctrine's failure to consider fortification on lines of communication. None of the manuals advocate using fortifications to protect roads, rivers, railways, or air bases. Clausewitz and Jomini wrote that fortifications should protect lines of communication, and commanders in both historical examples made good use of fortifications on lines of communication. Under modern conditions, key points on the land lines of communication such as bridges merit consideration as fortification sites. Air lines of communication also deserve consideration. FM 5-103 has two different fortification designs specifically for aircraft, yet doctrine does not recommend fortifying air bases.⁷² Consideration of fortification on lines of communication would improve doctrine.

Except for lines of communication, doctrine fully meets the protection criteria. The fortification designs found in the field manuals provide protection for soldiers, supplies and equipment. Engineers provide the technical advice to choose among the various designs. Whether the enemy threat includes direct fire weapons,

artillery, or explosive filled trucks, the field manuals have an appropriate fortification. The theorists wrote that rear area fortifications were particularly important in areas with a hostile population. FM 5-114 has numerous fortification designs suitable for protection against partisans and guerrillas. The fortifications in the historical examples were very resistant to enemy attack. The fortifications in current field manuals are equally strong against modern enemies.

Doctrine encourages economy of force in rear operations through the prudent use of engineer assets. Field manuals explain how to balance available engineers against requirements for deep, close, and rear operations. They also show how to balance fortification tasks with other engineer tasks. In the Indian campaigns and in the Boer War, armies used innovative ways to enhance economy of force by using convalescent soldiers or native workers to build and garrison fortifications. Doctrine for host nation support encourages the modern US Army to employ innovative economy of force measures. For instance, the Army can employ contract workers and equipment to help build rear area field fortifications. The Army can also request that host nation forces assist in building or manning fortifications. If used, these solutions could free US Army engineer assets for use elsewhere.

Unfortunately, doctrine needs improvement to fully satisfy economy of force. In the Boer War, fortifications freed forces for other duties. Both forts and blockhouses allowed a relatively small force to successfully defend against attackers. The lack of emphasis on fortifications in the rear operations manuals leads rear area units to

consider more costly alternatives such as putting more soldiers on base perimeters or accepting risk of enemy attack. If rear operations manuals put more emphasis on rear area fortifications, rear area units could devote more soldiers to unit missions.

The evaluation of current US Army doctrine shows that subordinate doctrinal manuals support FM 100-5 only partially, and some of these subordinate manuals need improvement. The research and analysis of this monograph suggest three specific recommendations for improving Army doctrine.

First, FM 90-14 needs revision so that it clearly includes field fortification, while reducing its emphasis on area damage control. The absence of field fortification from this manual diminishes rear area initiative and economy of force. The current manual's chapter on area damage control is confusing and prescribes reactive procedures that are directly at odds with initiative. Area damage control is essentially a form of damage repair. A revised FM 90-14 should incorporate field fortifications in the chapter on base defense, and it should clarify the chapter on area damage control.

Second, the Army needs an engineer manual at the corps level that fulfills the same role that FM 5-71-100 fulfills at the division level. Current doctrine does not explain how to prioritize fortification effort in the corps rear area. Without a corps level manual, the corps staff must either use division level doctrine for its rear area planning, or use expedient planning and execution procedures that are not addressed in any doctrinal manual.

Third, all the manuals dealing with rear area operations should include planning considerations for using field fortifications to help

protect lines of communication and key terrain in the rear area. None of the current manuals include these uses for fortifications even though historical experience found them to be effective. Doctrine should endorse planning and executing rear area fortifications that protect ground lines of communication, air bases, and rear area key terrain.

Rear area field fortifications are important; they are not just for engineers. All rear area commanders and staffs should know how to exploit the potential of field fortifications, even if engineer equipment and soldiers actually build them. Fortifications have the potential to enhance initiative while degrading the enemy's initiative, and they improve rear area protection while contributing to economy of force. Doctrinal manuals should incorporate this study's three recommended improvements in order to give commanders and staffs the information they need to fully exploit rear area field fortifications.

ENDNOTES

1. US Army, FM 101-5-1, Operational Terms and Symbols (Washington, DC: Department of the Army, 1985), p. 1-59.
2. Christopher Bellamy, The Evolution of Modern Land Warfare: Theory and Practice (New York: Routledge, 1990), 26. Bellamy notes that the word 'fortification' has an anachronistic ring. Another example of the unpopularity of the term is shown by the Army's replacement of FM 5-15, Field Fortification, with FM 5-103, Survivability in 1985.
3. Martin Van Creveld, Technology and War: From 2000 BC to the Present (New York: The Free Press, 1991), 25.
4. D. H. Mahan, A Complete Treatise on Field Fortification (New York: Wiley and Long, 1836; New York: Greenwood Press, 1968), 2.
5. Ian Hogg, The History of Fortification (New York: St. Martin's Press, 1981), 249.
6. US Army, FM 100-5, Operations (Washington, DC: Department of the Army, 1993), p. 2-14.
7. FM 5-100, 10. In addition to FM 5-100, the term survivability is addressed in US Army, FM 5-103 (Washington, DC: Department of the Army, 1985), p. 1-1, and in US Army, FM 5-71-100 (Washington, DC: Department of the Army, 1993), p. 4-26.
8. FM 100-5 defines protection on pages 2-10 and 2-11. FM 5-100 provides a similar definition on page 5. A full explanation of the combat power model is found in Huba Wass de Czege, "Understanding and Developing Combat Power" (Unpublished Paper, US Army Command and General Staff College, 1984). He wrote that protection is a function of concealment (the enemy cannot find you), exposure limitation (the enemy cannot hit you), and damage limitation (the enemy's fires are ineffective). Field fortification is a component of damage limitation.
9. FM 100-5 is the source of all of the criteria. Initiative is addressed on pages 2-6 and 2-9. Continuity of sustainment is on pages 6-15 and 12-9. Protection is on pages 7-13 and 12-9. Economy of force is on pages 6-15 and 12-9.

10. Henry Guerlac, "Vauban: The Impact of Science on War" in Makers of Modern Strategy, ed. Peter Paret (Princeton: Princeton University Press, 1986), 86-87. This essay provides a short but comprehensive overview of Vauban's life and his work. Also valuable is Christopher Duffy, The Fortress in the Age of Vauban and Frederick the Great 1660-1789 (Boston: Routledge and Kegan Paul, 1985), 71-97. Duffy's excellent book covers fortification from the time of Louis XIV until the French Revolution. The section on Vauban focuses on Vauban's contributions to the art of building, attacking, and defending fortifications. For a complete bibliography of Vauban, see F. J. Hebbert and G. A. Rothrock, Soldier of France: Sebastien Le Prestre de Vauban, 1633-1707 (New York: Peter Lang, 1989). Although Vauban did not publish a book about fortification, he did write a book explaining in detail how to attack and defend a fortress. See Sebastien Le Prestre de Vauban, A Manual of Siegecraft and Fortification, trans. George A. Rothrock (Ann Arbor: The University of Michigan Press, 1968).

11. Duffy, The Fortress in the Age of Vauban and Frederick the Great 1660-1789, 84-85.

12. Carl von Clausewitz, On War, trans. Michael Howard and Peter Paret (Princeton: Princeton University Press, 1984), 536. The introductory essays of this book by Michael Howard, Peter Paret, and Bernard Brodie provide additional information on Clausewitz' background and on the impact of his book.

13. Clausewitz, On War. See pp. 342-347 and pp. 395-399.

14. Baron Antoine Henri de Jomini, The Art of War, (Philadelphia: J. B. Lippincott, 1862; Novato, Ca.: Presidio Press, 1992), 146-151. For a short biography of Jomini see John Shy, "Jomini," in Makers of Modern Strategy, ed. Peter Paret (Princeton: Princeton University Press, 1986), 143-185. This essay is a good, compact summary of Jomini's writings and his impact. Shy also compares Jomini somewhat unfavorably to Carl von Clausewitz.

15. Jomini, The Art of War. See pp. 135, 152, and 254-263.

16. Mahan, A Complete Treatise on Field Fortification.

17. Jomini, The Art of War, 152 and 262-263.

18. Bil Gilbert, God Gave Us This Country: Tekamthi and the First American Civil War (New York: Atheneum, 1989), 130-134.

19. Wiley Sword, President Washington's Indian War (Norman: University of Oklahoma Press, 1985), 89-101. For further background on Secretary of War Henry Knox see Duffy, The Fortress in the Age of Vauban and Frederick the Great 1660-1789, 276. Knox was a Boston bookseller before the Revolutionary War, and he was familiar with European works on both permanent and field fortifications.

20. Gilbert, God Gave Us This Country: Tekamthi and the First American Civil War, 137-139. See also Francis Paul Prucha, The Sword of the Republic: The United States Army on the Frontier, 1783-1846 (London: Macmillan, 1969), 21. Gilbert's account portrays Harmar's campaign as a clear defeat, while Prucha portrays a more ambiguous loss.

21. Sword, President Washington's Indian War, 131-150. See also David A. Simmons, The Forts of Anthony Wayne (Fort Wayne: Historic Fort Wayne, 1977), 7. For background information on the use of forts by the French see Duffy, The Fortress in the Age of Vauban and Frederick the Great 1660-1789, 272. Duffy describes an operation during the French and Indian War in which the British Colonists copied French tactics by building a chain of forts. British Brigadier John Forbes built depots every forty miles in this operation to take Fort Duquesne from the French. Fort Duquesne was located at the confluence of the Allegheny and Monongahela Rivers on the site of modern Pittsburgh, Pennsylvania.

22. Simmons, The Forts of Anthony Wayne, 7-9. Simmons explains the difference between bastions and blockhouses on page 21. Bastions were open strong points, usually on the corners of a fort, that could place enfilading fire on the curtain walls. Bastions were resistant to artillery fire by their nature. Blockhouses were closed wooden structures. They were very effective against enemy infantry, but could not withstand artillery fire. Blockhouses were sometimes situated on corners as a substitute for bastions. In this war, the US Army usually built forts with blockhouses because the Indians did not have any artillery.

23. Sword, President Washington's Indian War, 150-165. For another account see Prucha, The Sword of the Republic: The United States Army on the Frontier, 1783-1846, 22-25.

24. Ebenezer Denny, Military Journal of Major Ebenezer Denny, (Philadelphia: J. B. Lippincott, 1859; New York: The New York Times and Arno Press, 1971), 159. Denny provides personal

accounts of both Harmar's and St. Clair's expeditions. He was Harmar's adjutant in the first campaign, and after Harmar was relieved he served as St. Clair's adjutant.

25. Sword, President Washington's Indian War, 171-99. For other accounts see Gilbert, God Gave Us This Country: Tekamthi and the First American Civil War, 145-152, and Prucha, The Sword of the Republic: The United States Army on the Frontier, 1783-1846, 25-27.

26. Denny, Military Journal of Major Ebenezer Denny, 169.

27. Glenn Tucker, Mad Anthony Wayne and the New Nation (Harrisburg, Pa.: Stackpole Books, 1973), 226.

28. Sword, President Washington's Indian War, 218-236. Paul David Nelson, Anthony Wayne, Soldier of the Early Republic (Bloomington: Indiana University Press, 1985), 232-233 explains Wayne's plans for building forts. See also Prucha, The Sword of the Republic: The United States Army on the Frontier, 1783-1846, 34.

29. Anthony Wayne to Henry Knox, 27 May 1793, Anthony Wayne, A Name in Arms: Soldier, Diplomat, Defender of Expansion Westward of a Nation; The Wayne - Knox - Pickering - McHenry Correspondence ed. Richard C. Knopf (Pittsburgh: University of Pittsburgh Press, 1960; Westport, Conn.: Greenwood Press, 1975), 242.

30. Simmons, The Forts of Anthony Wayne, 12-14.

31. Prucha, The Sword of the Republic: The United States Army on the Frontier, 1783-1846, 36. For more information from the Indian perspective see Gilbert, God Gave Us This Country: Tekamthi and the First American Civil War, 174-176.

32. Gilbert, God Gave Us This Country: Tekamthi and the First American Civil War, 176-183.

33. Simmons, The Forts of Anthony Wayne, 3. Wayne's predecessors had built three forts: Fort Washington (Cincinnati), Fort Hamilton, and Fort Jefferson. The seven forts built by Wayne before the peace treaty were Fort St. Clair, Fort Greenville (named after Wayne's friend Nathanael Greene), Fort Recovery, Fort Adams, Fort Defiance, Fort Deposit, and Fort Wayne.

34. Anthony Wayne to Henry Knox, 5 April 1793, Anthony Wayne, A Name in Arms: Soldier, Diplomat, Defender of Expansion Westward of a Nation; The Wayne - Knox - Pickering - McHenry Correspondence, 214.
35. Nelson, Anthony Wayne, Soldier of the Early Republic, 262.
36. Simmons, The Forts of Anthony Wayne, 22.
37. Gilbert, God Gave Us This Country: Tekamthi and the First American Civil War, 175.
38. T. R. H. Davenport, South Africa: A Modern History (Toronto: University of Toronto Press, 1991). Davenport covers the early years of British rule in South Africa on pages 37-48. The formation of the Boer republics is on pages 68-87, and events directly leading to the Boer War are on pages 183-191.
39. Thomas Pakenham, The Boer War (New York: Random House, 1979), 485-486.
40. Pakenham, The Boer War, 511-526.
41. Pakenham, The Boer War, 527-529.
42. Pakenham, The Boer War, 569.
43. Pakenham, The Boer War, 569.
44. J. F. C. Fuller, The Last of the Gentlemen's Wars (London: Faber and Faber, 1937), 107-110.
45. R. M. Holden, "The Blockhouse System in South Africa," The Journal of the Royal United Service Institution 46 (April 1902): 484-486.
46. Pakenham, The Boer War, 569-580.
47. Pakenham, The Boer War, 528.
48. Holden, "The Blockhouse System in South Africa," 483.
49. Fuller, The Last of the Gentlemen's Wars, 108.

50. Holden, "The Blockhouse System in South Africa," 482-485.

51. Pakenham, The Boer War, 580-581.

52. Fuller, The Last of the Gentlemen's Wars, 262.

53. Pakenham, The Boer War, 574.

54. Fuller, The Last of the Gentlemen's Wars. 107-111.

55. The doctrine section of the monograph does not examine the Army's keystone doctrine document, FM 100-5. That manual cannot be objectively analyzed using this monograph's criteria, since it is the source of the criteria.

56. US Army, FM 90-14, Rear Battle (Washington, DC: Department of the Army, 1985). Pages 1-2 to 1-6 cover threat levels. The glossary defines bases and base clusters. Pages 3-1 to 3-28 assign responsibilities in rear operations.

57. US Army, FM 90-14, Rear Battle, pp. 4-1 to 4-7.

58. US Army, FM 90-14, Rear Battle, pp. 8-1 to 8-6. Page A-11 describes area damage control in central Europe. The German Army term for area damage control translates as damage repair. This is another indication that area damage control, while important, is reactive in nature. The enemy has the initiative.

59. US Army, FM 63-21, Main Support Battalion (Washington, DC: Department of the Army, 1990), pp. A-1 to A-9.

60. US Army and US Air Force, Army Pamphlet 525-14, Joint Operational Concept for Air Base Ground Defense (Washington, DC: Departments of the Army and the Air Force, 1986).

61. US Army, FM 71-100, Division Operations (Washington, DC: Department of the Army, 1990). Rear operations is specifically addressed on pages 1-10 through 1-16, 4-8, 5-4, and 5-20. Fortification of command posts is found on page 3-4. Engineer missions are described on pages 2-8, 2-9, 2-21, 4-18, and 5-7.

62. US Army, FM 71-100, Division Operations, pp. 4-21 and 5-5. These matrices display battlefield organization (deep, close, rear) on the vertical axis and the battlefield operating systems on the

horizontal axis. An advantage of this type of matrix is that it tends to cover every facet of an issue. For instance, the matrix has a space that matches rear operations with mobility and survivability. This prompts consideration of rear area fortification in the matrix, even though the issue is essentially ignored in the manual's text.

63. US Army, FM 71-100-2, Infantry Division Operations: Tactics, Techniques, and Procedures (Washington, DC: Department of the Army, 1993), pp. 5-8 to 5-12.

64. US Army, FM 100-15, Corps Operations (Washington, DC: Department of the Army, 1989). Rear operations is specifically addressed on pages 3-3 to 3-4, 5-12 to 5-13, and 6-9. Appendix D is devoted to rear operations. The battlefield operating systems are described on pages 3-4 to 3-19. The employment considerations matrix is on page B-2.

65. US Army, FM 5-100, Engineer Combat Operations (Washington, DC: Department of the Army, 1988). Basic concepts and responsibilities are covered in pages 8 to 17. Rear area fortification in offensive operations is on page 49. Rear area fortification in defensive operations is on page 58.

66. US Army, FM 5-103, Survivability (Washington, DC: Department of the Army, 1985). See chapter 4 to find various fortification designs.

67. US Army, FM 5-114, Engineer Operations Short of War (Washington, DC: Department of the Army, 1992). See appendix A for specific force protection measures.

68. US Army, FM 5-71-100, Division Engineer Combat Operations (Washington, DC: Department of the Army, 1993). Basic concepts and responsibilities are on pages 1-5 to 1-16. Engineer staff responsibilities are on pages 2-9 to 2-11.

69. US Army, FM 5-71-100, Division Engineer Combat Operations, pp. 3-5 to 3-30.

70. US Army, FM 5-71-100, Division Engineer Combat Operations, pp. 4-26 to 4-42.

71. US Army, ARTEP 5-145-11-MTP, Mission Training Plan for the Combat Engineer Platoon, Heavy Division/Corps/Armored Cavalry

Regiment (Washington, DC: Department of the Army, 1989), pp. 5-117 to 5-124.

72. US Army, FM 5-103, Survivability, p. 4-39.

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