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FIRE SUPPORT FOR IRREGULAR WARFARE

by

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March 2008

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FIRE SUPPORT FOR IRREGULAR WARFARE

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Submitted in partial fulfillment of the
requirements for the degree of

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ABSTRACT

More than six years after the terrorist attacks on the United States and the initial invasion of Afghanistan, the U.S. military finds itself fully engaged in two large-scale combat operations and numerous smaller-scale operations around the globe. The U.S. military that went to war in 2001 was not optimally designed to fight against well entrenched insurgent forces, often fighting in urban terrain. The enemy's ability to adapt to our tactics has been impressive, which in turn drives our need for innovation. Advances made in precision guided munitions, satellite imagery available to the foot soldier, and networked fires have increased the lethality of indirect fires. At the same time, these advances have reduced the risk of collateral damage as well as improved the safety margins for friendly troops. The purpose of this thesis is to examine how artillery has been used in irregular conflicts over the past century, and how our current capabilities can be best utilized by applying the lessons learned from these previous conflicts. The combination of new technologies and applied lessons from previous irregular conflicts will help us develop the most appropriate application of artillery assets when conducting irregular warfare.

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I. INTRODUCTION

*“Artillery lends dignity to what might otherwise be a vulgar brawl”
Frederick the Great*

A. BACKGROUND

After more than six years at war against an irregular but well organized, technologically savvy enemy that hides among the population, the US military has a greater need than ever before to be as surgically precise in how we conduct operations against such an enemy. The conflicts in Afghanistan and Iraq are only two examples of the type of warfare that we are likely to encounter in the foreseeable future. Our ability to build and maintain the support of the populace is crucial to our success; therefore we must strive to keep from destroying their critical resources and injuring innocent civilians. In a report by the International Crisis Group, the authors say that “fighting an insurgency and nation-building are mutually reinforcing,” emphasizing the need to continue both activities at the same time, and that one cannot work without the other.¹ Still, as we work on building the support of the populace, we need to be able to actively prosecute those who challenge the security in these developing nations as precisely and effectively as possible.

In the course of fighting against a non-traditional enemy, Colonel C.E. Calwell says that “tactics favor the regular army while strategy favours the enemy – therefore the object is to fight, not maneuver. It is a singular feature of small wars that from the point of view of strategy the regular forces are upon the whole at a distinct disadvantage as compared to their antagonists.”² Fighting against insurgent forces is by nature a ‘nasty’ business, but when technology can be utilized as a tool to give coalition forces an advantage, small, incremental victories can be attained. John Nagl says that “the essential features of guerrilla warfare are avoiding the enemy’s strength – his main

¹International Crisis Group, *Countering Afghanistan's Insurgency: No Quick Fixes*. (Brussels: International Crisis Group, 2006),ii.

²C. E. Callwell, *Small Wars: Their Principles and Practice*, 3rd ed. (Lincoln: University of Nebraska Press, 1996), 85.

fighting forces – while striking at outposts and logistical support from unexpected directions.”³ The United States military has fought this war to date with an ebb and flow of both conventional and unconventional tactics, but the time has come that we learn to exploit the enemy’s methods and networks, and strike him where it will hurt most.

The U.S. military has seen many advances in technology since the start of the Global War on Terrorism, not least of all in the realm of field artillery. One of the goals of this thesis is to examine how best to integrate new artillery technology with tactics, techniques and procedures for how fire support is best provided in an irregular warfare environment. To the ground soldier engaged in combat, accurate and timely fire support can mean the difference between life and death.

It is hard to quantify the magnitude of advances made in precision fire support that have been applied to artillery systems in the past six years. These advances are similar to the revolutionary changes of how warfare was conducted after the introduction of rifled barrels in muskets. We are once again at a point in time where we must re-evaluate how we conduct combat with certain weapon systems in the various environments that we find ourselves.

According to Nagl, “the indirect approach of defeating an insurgency by focusing on dividing the people from the insurgents, removing the support that they require to challenge the government effectively, is rather different from the direct approach and in the long term is usually more effective. Winning that support is the critical battle in a counterinsurgency campaign.”⁴ The very nature of battling an insurgent enemy is that we must gain the support and confidence of the populace while at the same time actively engaging the insurgents. This is not possible using indiscriminate bombing and drive-by patrols; it requires precise intelligence that can only be gained by placing trained personnel on the ground that interact with the populace on a daily basis and conducting surgical strikes when necessary.

³John A. Nagl, *Learning to Eat Soup with a Knife Counterinsurgency Lessons from Malaya and Vietnam* (Chicago: University of Chicago Press, 2005), 15.

⁴Ibid., 28-29.

While the “shock and awe” campaign that started Operation Iraqi Freedom was effective at neutralizing critical targets and defeating the majority of the Iraqi Armed Forces, the overall negative impact on the Iraqi people still reverberates today. “The U.S. Army already has a well established doctrine for main force battle. Unfortunately, at least in the case of Iraq, we chose to fight the war we wanted to fight, not the one the enemy wanted to fight.”⁵ Although there are certainly times that call for massed fires and large quantities of ordnance being dropped on enemy positions, this cannot be the only model of conducting business. The ability to provide fire support through accurate and timely fires while minimizing collateral damage and risk to friendly forces is just one tool the military can use which allows us to continue to fight insurgents while not turning to populace against us.

The initial impetus for this thesis came from a question posed by one of my professors about the ability to conduct networked fire support over significant distances. Following my experiences in Afghanistan, I was aware of several “non-standard” uses of cannon artillery, dispersed throughout the battlefield, providing fire support to maneuver units located in close proximity to the artillery pieces. But these fires were not really networked. Following a trip to Fort Sill, Oklahoma in the fall of 2007, I was reintroduced to the Multiple Launch Rocket System (MLRS) community where I had at one point served as a platoon leader and battalion assistant operations officer. The capabilities of MLRS had changed significantly since I departed the community, as well as the potential for applications. Hence this thesis.

For the purposes of this thesis, I will examine precision fire support provided by organic mortar, cannon artillery and rocket artillery assets in irregular conflicts over the past century. Although there are no absolutes when it comes to the way in which a war is fought, one of the goals of this thesis is to explore some capabilities and tactics that will enable commanders to make better informed decisions about some of the assets at their disposal.

One of the more significant advances made in the past three years that has given coalition forces an unprecedented level of precision and firepower through developments

⁵Eric L. Haney, *Beyond Shock and Awe* (Berkley Caliber Press: New York, 2006), 12-13.

such as Guided Multiple Launch Rocket System (GMLRS) munitions. “For the first time in the history of any military, the U.S. war fighting ground commander has *organic* surface to surface, all-weather fires options for rapidly and precisely taking out a wide array of targets ranging from as far away as 270 km.”⁶ The precision is possible through technological improvements in the rockets themselves as well as an improved ability of trained observers on the ground to determine target location with almost pinpoint accuracy; to the degree of +/- 1 meter with the help of stereo imaging computer software and target location devices. The combination of mensurated target location and inertial and Global Positioning System (GPS) guided munitions bring a whole new definition to precision fire support. These advances are just as important when compared to the “perceived advances at the turn of the century which allowed fire support artillery to be as flexible and mobile as assault artillery had once been: modern instruments made indirect aiming an exact science; improvements in cartography and topographic maps made it possible to shoot from map measurements with enough precision to his unseen targets.”⁷

B. THESIS OUTLINE

The goal of this thesis is to explore the role artillery has played in irregular conflicts over the past one hundred plus years, and to try to gain some insights as to how these lessons learned can be applied to our efforts today in conjunction with new technologies that are available. Many of these capabilities are available to both special operations forces and conventional forces, who both find themselves operating in similar modern irregular warfare environments. The finding of this thesis is that we can incorporate lessons learned about the use of artillery from previous irregular conflicts, and when combined with the new technologies available, develop a better understanding of how these systems can complement one another to be more effective on the irregular battlefield.

⁶Gary S. Kinne, John A. Tanzi and Jeffrey W. Yaeger, "FA PGMs: Revolutionizing Fires for the Ground Force Commander," *Field Artillery Journal* (May-Jun 2006), 16.

⁷Robert H. Scales, *Firepower in Limited War* (Novato: Presidio, 1998), 7.

Chapter II examines case studies concerning the use of artillery in irregular warfare during the first half of the twentieth century. This time period is important because it is basically the start of the modern age of artillery. The cases represented in this time period take the experiences of numerous nations, the United States is but one of many players in the conflicts during these periods, and it would be foolish to ignore the experiences of other nations in their endeavors with irregular warfare.

Chapter III is a continuation of the history of artillery in irregular warfare, focusing on conflicts starting with the American experience in Vietnam, the Soviet-Afghan War, the ongoing Israeli-Palestinian conflict up to the present conflicts in Afghanistan and Iraq. As in Chapter II, it is recognized that the American experience in irregular conflict provides a rather limited perspective; hence the experiences of other nations with regard to irregular warfare are considered as well.

Chapter IV will examine the current capabilities that the United States military has at this time for providing fire support. Since the beginning of the Global War on Terror, there have been numerous technological developments that make artillery fires more effective on the irregular battlefield. The examination in this chapter will include mortars, cannon artillery and rocket artillery; as all three systems are currently in use by U.S. forces. Some of the specific technological developments that will be examined are Precision Guided Mortar Munition (PGMM), Excalibur, and GMLRS.

Chapter V summarizes the findings of this study, applying the current capabilities to the lessons learned over the last one hundred plus years of irregular warfare.

As the wars continue in both Afghanistan and Iraq, we should work to refine our war fighting tactics, techniques and procedures to minimize collateral damage while at the same time reducing risks to allied personnel. Precision munitions are but one asset that provides ground commanders with a flexible and organic alternative to close air support, which should be utilized to its fullest capability.

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II. ARTILLERY IN IRREGULAR WARFARE, 1899-1954

A. OVERVIEW

The purpose of this chapter is to explore the role that artillery systems (including mortars) have played on the irregular battlefield in the first half of the twentieth century. To accomplish this, a sampling of historical examples will be considered as to how artillery was utilized in irregular warfare environments and highlight potential pitfalls to avoid. The cases examined will look at how artillery was used by unconventional units as well as by units more conventional in nature. From these cases, perhaps we can draw some lessons as to how the U.S. military might utilize artillery on irregular battlefields both today and in the future. Some of the cases that will be examined from the first half of the twentieth century include the Second Boer War, the Boxer Rebellion, the Arab Revolt, the East Africa Campaign (World War I), the Chaco War, and the Algerian War for Independence.

The reputation of artillery as being the deciding factor on the field of battle goes back a long way. The Romans often used ballistae to physically, psychologically, and emotionally crush their opponents; Josef Stalin called artillery the true “God of War.” Significant developments over time in the physics of launching large projectiles include the catapult, gunpowder, rifled barrels, and recoil mechanisms; all of which have led up to the present time with artillery systems that launch laser or GPS guided precision munitions over 30 kilometers away for cannons, over 70 kilometers for rockets, and over 300 kilometers for missiles. “Artillery first became a decisive factor in land warfare in the fifteenth century, through its role in sieges, where demands on mobility were less severe than in field operations. The mere arrival of a siege gun was in itself sometimes enough to cause capitulation.”⁸ To counter the effects of the siege gun, the Italians developed the ‘trace italienne’ (literal translation: the “Italian style” or “technique”) or star fort; which consisted of a geometrically shaped design with multiple walls,

⁸Major General J.B.A. Bailey, *Field Artillery and Firepower*, (Annapolis: Naval Institute Press, 2004), 146.

eliminating the ability of a siege gun to easily breach the walls of a fort. This design in effect created a defense in depth, making defending the fort easier, and attacking a fort a significantly more difficult task.

As artillery technology improved, the concept of mobility became more important to waging warfare, particularly in the offense. “As the mobility of the supported arm increased, the techniques that had produced fire mobility and artillery concentrations in static operations proved wanting, pointing to the need for tactical as well as strategic mobility of artillery to match.”⁹ At one time, the force with the heaviest artillery pieces may have had an advantage. That is not necessarily the case today. Now, the side that has the most mobile, most accurate and longest ranging systems is likely to be the side that has the advantage.

The role of artillery in irregular warfare was well documented by C.E. Calwell in his book *Small Wars*, in which he said “the moral effect of artillery is very great against irregular armies. The primary duty of artillery in warfare of this nature is to ensure that it is at hand at the critical moment and well to the front. If the guns are kept concentrated at one spot, none of them may be able to get to the point where they are really wanted at the proper moment, and for this reason it will generally be best to keep them to a certain extent dispersed.”¹⁰ What can be carried over from C.E. Calwell’s work, originally published in 1896, is that when conducting warfare against irregular forces, conventional tactics may not be the most appropriate. Calwell mentioned the importance of keeping guns dispersed over 100 years ago, and the same principle applies today when fighting in an irregular environment.

The cases studied in this chapter are by no means an all-inclusive look at irregular conflicts which have seen the use of artillery. Other smaller conflicts that involved limited use of artillery in the first half of the twentieth century include: Philippine-American War (1899-1902), the Moroccan Rif War (1921-1927), and Chinese Civil War (1920’s-1930’s). The methodology used for examining the cases in both Chapters II and III comprises of a brief overview to familiarize the reader with the conflict, an account of

⁹Bailey, 273.

¹⁰Calwell, 431-434.

the types and general characteristics of the weapons used by each side, the methods of employment of the weapons and their effects, and finally a discussion of lessons learned from the conflict regarding the use of artillery by or against irregular forces.

B. THE SECOND BOER WAR (1899-1902)

1. Introduction

The First Boer War, fought in South Africa between the December 1880 and March 1881, was a relatively short war between two independent Boer republics (The Orange Free State and The South African Republic) and the British who desired to annex the Transvaal. The Boers claimed that the annexation was in violation of the Sand River Convention of 1852 and the Bloemfontein Convention of 1854. In the First Boer War, the Boers decisively defeated the British, the latter realizing that without a significant commitment of troops, they could not defeat the Boers. The British desire to possess the Transvaal was based on the belief that it held significant mineral deposits. This led to the Second Boer War, as the British believed there to be enough gold present to warrant a large commitment of troops.

The Second Boer War was again fought between the British and the two independent Boer republics of The Orange Free State and The South African Republic. “The earlier part of the campaign was largely fought according to the patterns of nineteenth-century military operations, whereas the latter and lengthier period of this war developed many modern characteristics, resembling the guerrilla conflicts that have become so prevalent in the twentieth century.”¹¹ Despite the guerrilla nature of the war, both the British and the Boers frequently used artillery on the field of battle.

2. Boer Artillery Uses and Effects

The Boers had limited numbers of modern French-made artillery pieces and ammunition. Early in the war, the Boers used the 75 mm Creusot and Krupp gun with a maximum range of 8,500 yards as well as the 115 mm Creusot gun with a maximum

¹¹Eversly Belfield, *The Boer War* (London: Leo Cooper LTD, 1975), xxiii.

range of 11,000 yards.¹² Later in the war, the Boers received four 155 mm versions of the Creusot “Long Tom” gun, which were used in the conventional role of defending forts near Pretoria. The Boers had a very limited ammunition supply for the “Long Tom” guns however, so when the ammunition was gone, they destroyed the guns to prevent them from falling into the hands of the British. While the Boers enjoyed a range advantage over the British, the British had substantially more guns and ammunition than the Boers did. Examples of the numerical advantage of guns enjoyed by the British over the Boers were at the Battle of Colenso 44 to 5, the Battle of Pieters Hill 70 to 10, and at the Battle of Paardeberg it was 91 to 6.¹³

Although outnumbered, the Boer artillery had a distinct range advantage over the British. The Boers often shelled British camps from the maximum range of their weapons, 8,500 yards (75 mm) and 11,000 yards (155 mm), which was outside the range of British guns; 5,500 yards (15 pdrs). During an engagement at Brakfontaine on February 5, 1900, “three Boer 75 mm guns shelled thirty-six British guns for many hours, with the British outraged and unable to reply. The ability of the Boers’ guns to range farther than the British guns helped offset the difference in the number of guns. The Boers had some heavy artillery that proved painfully effective, and as a result, by 1906 each division of the British Army had a heavy battery of four 60 pounders.”¹⁴

The Boers excelled at using terrain to camouflage and conceal their positions, which resulted in the British not knowing where their attackers were located. This coupled with utilizing the maximum range of their weapons resulted in confusion amongst the British troops. However, despite having guns with longer range, the lack of experience and inability to mass fires prevented the Boer artillery from inflicting crippling losses on the British.¹⁵

¹²Belfield, 163.

¹³Bailey, 222.

¹⁴Ibid.

¹⁵Ibid.

3. British Artillery Uses and Effects

The British Army used three different types of cannons: 12 pounders with a maximum range of 5,200 yards, 15 pounders with a maximum range of 5,500 yards, and five inch howitzers with a maximum range of 4,800 yards.¹⁶ The British answer to the “Long Tom” gun that the Boers received later in the war was to remove 4.7 inch guns from naval vessels and affix them to improvised carriages for use on land. This brought the range of British guns closer to the range of the Boers’ guns, but the Boers still had a clear range advantage.

In coastal areas, the British had an additional resource that the Boers lacked in the form of fire support from naval vessels. These ships provided artillery fire when land engagements were in proximity to the coast. This naval gunfire capability gave the British extended ranges over their ground artillery pieces out to distances of 10,000 yards.¹⁷ The presence of British naval vessels caused the Boers to move their operations further inland, just outside the range of the British naval guns. This simple change in Boer strategy was an easy and effective counter to the British material advantage.

The British also used aerial observers from balloons which were in contact with the artillery commander on the ground via wire and telephone or a megaphone. This allowed the British to adjust their fires more quickly than the Boers were able to, as well as to report Boer troop movements which were not visible to the British commanders on the ground.

One weapon used by both the British and the Boers was the 37mm Maxim Vickers (Pom Pom) gun. Although it was technically an artillery piece, it worked more like a heavy machine gun, as it shot a one pound projectile from 25 round cotton linked belts for approximately 3,000 yards. This weapon gave an added versatility to both sides in that it provided additional mobile firepower when heavier artillery pieces were not available or suitable.

¹⁶Belfield, 163.

¹⁷Ibid.

4. Lessons Learned

From a tactical perspective, the Second Boer War resulted in new methods of employment for artillery on the battlefield by the British. The first lesson learned by the British was the importance of integration of artillery fire and movement of maneuver forces. During the battle for Ladyfield in February 1900, the British realized that “the artillery’s role was being revolutionized; instead of merely supplying the first act in a three-act drama, the gunners would be in demand, day after day, throwing a creeping barrage ahead of the advancing infantry.”¹⁸ To counter the guerrilla tactics of the Boer fighters, British General Buller realized that “the proper use of cover, of infantry advancing in rushes, coordinated in turn with creeping barrages of artillery were the tactics of truly modern war.”¹⁹ This integration of artillery fire and maneuver of troops was an important step in transitioning war from conducting a frontal assault of an objective to fighting against a more agile enemy using guerrilla tactics.

Following the war, the British took away a great deal of knowledge from the type of warfare conducted in the Boer War. “Without the Boer War, the British Army could never have evolved to become the Army it was in 1914, one of the most efficient forces for its size in the world.”²⁰ The second valuable lesson learned was from a technological perspective for the British, primarily that their artillery needed to have greater range than their current guns. This led to increasing the caliber of the British field gun in 1909.²¹ With increased range often comes the cost of weight and mobility however. Unfortunately, the guns that the British acquired after the war were still intended to be used in a direct fire mode, which most often occurred at shorter ranges, negating the recently gained range advantage. Although the concept of indirect fire had been used against the Boers, it was still not been widely accepted by senior leaders in the British Army after the war.

¹⁸Thomas Pakenham, *The Boer War* (New York: Random House, 1979), 363.

¹⁹Ibid., 485.

²⁰Belfield, 150.

²¹Pakenham, 610.

C. THE BOXER REBELLION (1899-1901)

1. Background

The Boxer Rebellion was an uprising aimed against foreign influence in China that lasted nearly two years. During this time, the majority of the fighting involved a multi-national rescue force focused on relieving the siege of numerous foreign legations in Peking by Boxer rebels in the late spring of 1900. There were two attempts to relieve the residents of the legation section of Peking; the first attempt was ultimately unsuccessful, while the second was successful in defeating the Boxers. In May of 1900, Boxer rebels had increased the violence and frequency of their attacks to the point that numerous foreign ministers in Peking were forced to call their governments for troops to guard their legations.

The initial reaction force, known as the Seymour Column, was led by British Admiral Sir Edward H. Seymour.²² The second reaction force that was assembled was collectively known as the “eight-nation alliance,” and included forces from Japan, Russia, England, France, Germany, Italy, Austria, and the United States and had significantly more resources than the Seymour Column.

The short amount of notice given to the Seymour Column which assembled in Tien-Tsin resulted in considerable confusion for some of the forces, and led them to forget valuable equipment. “In the confusion of entraining, the Russians loaded a thousand rounds for their field gun on board the train, but they forgot the field gun and left it at the station in Tien-Tsin.”²³ The Seymour Column assembled in Tien-Tsin on June 10th with a total of 2,129 troops, seven field guns, and ten machine guns.²⁴ Unfortunately, the railroad which was being used to move the Seymour Column had been damaged by the Boxers, which forced the rescue force to move by junks on the Pei Ho

²²Kenneth G. Clark, “The Boxer Uprising 1899-1900.” *The Russo-Japanese War Research Society*, Available from www.russojapanesewar.com/boxers.html, Internet, accessed on 26 January 2008.

²³Chester M. Biggs, *The United States Marines in North China, 1894-1942*, (Jefferson, North Carolina: McFarland & Company, 2003), 30.

²⁴“The Boxer Uprising 1899-1900.”

River. Due to the shallow depth of the river, the junks kept running aground, so the artillery pieces were dumped overboard so that the boats could continue on.²⁵ This left the Seymour Column without any artillery. En route to Peking, the Seymour Column was repeatedly engaged and diverted from their course by Boxer rebels and subsequently never actually made it to the legations in Peking. The second rescue force, having had time to assemble and prepare, moved more methodically towards Peking, and relieved the Seymour Column along the way.

2. Boxer/Chinese Artillery Uses and Effects

The main artillery piece used by Chinese and Boxer rebels was the French made 75 mm Krupp gun, which at that point in time was one of the most formidable artillery pieces available. On the offensive, the Chinese used their artillery to attack the Seymour Column when they were retreating in early June after their failed attempt to reach Peking, resulting in 62 killed and 218 wounded.²⁶

In keeping the legations under siege, the Boxers persistently fired upon the guards in the legations section. “The Chinese mounted several pieces of artillery near Chien Men and built a series of barricades that put them even closer to the Marines’ barracks. From these positions, the Chinese kept the Marine sector of the Wall under continuous artillery and rifle fire as they burned and burrowed their way closer to the legations.”²⁷ The Chinese used artillery and sniper fire to harass the inhabitants of the legations section and prevent them from mounting guards on the insides of the walls, as well as to destroy specific buildings within the legations section such as the hospital. In addition to keeping the besieged at bay, the Boxers also used their artillery to prevent the second rescue force and interdiction force from reaching the legations section.

²⁵ “The Boxer Uprising 1899-1900.”

²⁶John B.B. Trussell, Jr., “At the Gates of the Manchus”, *Field Artillery Journal*, (Mar-Apr 1950), 72-75.

²⁷Biggs, 82.

3. Allied Artillery Uses and Effects

Artillery pieces used by the multi-national rescue forces were varied. As part of the Seymour Column, the U.S. Marines brought with them 3-inch landing guns as well as the 6 mm Colt machine guns. Later on, as a part of the second rescue force, F Battery, of the 5th U.S. Artillery, brought with them six 3.2-inch cannons. One significant advantage of the American guns of F Battery was that they were breech loaded instead of the bore loaded like most other cannons of the time. This enabled the crew to operate faster as well as behind the protection of steel shields on the sides of the cannons, providing them a slightly safer position than in front of the cannon. Other artillery pieces used against the Boxers included Italian-made one pounders, British-made six pounders, and various Russian and Japanese guns. For the second rescue force, the primary use of their artillery was to enable them to gain entry into the barricaded legations by shooting the thick wooden doors and walls to establish a foothold. This was a coordinated attack on multiple walls and gates to facilitate the quick takeover of the Boxers.

4. Lessons Learned

The multi-national composition of forces that fought the Boxers brought several different types of artillery to the battlefield. The ad hoc nature of the forces sent to help put down the Boxer Rebellion meant that there was little uniformity or interoperability across the forces fighting against the Boxers. The non-uniformity of weapons used by the various nations meant that different types of ammunition had to be carried for each different gun. The lesson learned of interoperability of equipment is significant to our modern coalition forces who often work side by side in various combat environments.

Another result of this ad hoc multi-national force was a significant amount of confusion on the battlefield, including several instances of fratricide. During the assault on the Boxer held village of Yang-tsun there was a costly episode of fratricide for the Americans. Shortly after the British and American forces had silenced the enemy and entered the village, "Russian artillery, ignorant that the position had been taken, opened fire on them. General Chaffee, the commander of the American contingent estimated that at least half of the 14th Infantry Regiment's losses that day (seven killed and fifty-seven

wounded) were caused by the Russian fire. Accidents like this were probably inevitable in such a force until it has had time to develop coordination.”²⁸ This one example highlights the importance of proper coordination and communication when conducting operations in the vicinity of other coalition forces. Ironically, many of the countries represented in the multi-national rescue force would be fighting against one another a decade later in World War I.

D. PHILIPPINE-AMERICAN WAR (1899-1902)

The U.S. military’s involvement against Philippine insurgents during the Philippine-American War (1899-1902) saw limited use of artillery on the irregular battlefield. The Philippine-American War was actually an offshoot war from the Spanish-American War where possession of the Philippines was to go to the United States as a result of the Treaty of Paris in 1898. The Filipinos no longer wanted to be ruled by an outside empire, and revolted two days prior to the Treaty of Paris being signed. There were two distinctly different phases of the Philippine-American War; from February to November 1899, it was an unsuccessful conventional campaign. From November 1899 until the war ended in July 1902, the Filipinos turned to guerrilla tactics to fight the better trained and equipped U.S. forces.²⁹ At the start of the war, the U.S. forces had inferior small arms to the Filipinos until they were issued the more modern Krag-Jorgensen rifles. There was no comparison between the artillery each side possessed; the Americans had the most modern equipment available, while the Filipinos had field pieces that were “downright primitive.”³⁰ The advantage of the modern U.S. artillery was negated once the Filipinos turned to guerrilla tactics and fought the U.S. unconventionally.

The shift to guerrilla warfare led the Americans to change their tactics as well; they fought a much more brutal and unforgiving war, burning complete villages and

²⁸Trussell, 72-75.

²⁹Glenn A. May, “Why the United States Won the Philippine-American War,” *The Pacific Historical Review*, Vol 52, No. 4. (Nov., 1983), Available from <http://www.jstor.org/view/00308684/ap060200/06a00030/0>, Internet, accessed 13 February 2008.

³⁰May, 358.

imprisoning the villagers as a form of retaliation for the guerrilla style terror tactics used by the Filipinos. In the conduct of their guerrilla campaign, the Filipinos resorted to tactics such as physical dismemberment and torture of both civilians and captured Americans. The Americans' tactical and material advantages and use of 'heavy handed' tactics ultimately led to the surrender of most Filipino guerrillas. Although the war officially ended in 1902, there were sporadic uprisings which were led by small resistance groups until 1913. War atrocities were committed by both sides, and in this case, the Americans used all of the weapons they had to commit some of these atrocities. The roles of artillery during the guerrilla phase of the war were as a weapon of destruction as well as a psychological weapon with effects on the insurgents and their families. U.S. artillery was often used to lay siege to and destroy villages before the infantry went in to kill whoever was still alive.³¹ Although this was not the most productive use of artillery, it ultimately contributed to the surrender of the guerrillas. The fact that Americans resorted to fighting guerrilla tactics with extreme violence is disturbing, but also speaks to the degree of violence that the Filipinos used against the Americans.

E. WORLD WAR I (1914-1918)

There are two specific cases that will be examined during the World War I timeframe; operations conducted by T.E. Lawrence in the Arab Revolt against the Ottoman Turks, and then operations conducted in the East Africa Campaign by then Colonel Paul von Lettow-Vorbeck against the British. Both of these cases are examples of leaders who excelled in the art of guerrilla warfare, and used mobility and firepower to defeat numerically superior forces. One of the hallmarks of irregular warfare that both of these leaders employed was tying up large numbers of their opponents' troops by effectively attacking critical nodes in their lines of communications. Although both of these leaders fought on different sides in the war, they both shared common limitations; lack of supplies and war materials due to requirements in Europe. For both the Germans

³¹Veltisezar Bautista, "The Philippine-American War (1899-1902), *www.Filipino-Americans.com*, Available from <http://www.filipino-americans.com/cgi-bin/redirect.cgi?url=filamwar.html>, Internet, accessed 14 February 2008.

and the British, these backwater conflicts in Africa and the Middle East were seen as efforts to draw resources from the main battlefields in Europe. As such, both Lawrence and Lettow-Vorbeck became masters of battlefield recovery and making do with what they had.

F. THE ARAB REVOLT

When the Arab Revolt began in 1916, the chances of success did not look good. The forces assembled by Sharif Husayn that besieged Mecca, Yanbu', Ta'if, and Medina had inadequate artillery, and untrained Bedouins for fighters. The large-scale support that had been promised by the British had not yet materialized. The Arab Revolt as a whole lacked tactical organization, a chain of command, coordination efforts, and guidance from the British High Command or Sharif Husayn. The Sharif was in dire need of supplies and experienced leaders from the British.³² The Sharif divided his forces into three groups all led by his sons; a Northern Army commanded by Faisal, a Southern Army commanded by Ali, and the Eastern Army commanded by Abdullah. Each of the armies had some irregular troops assigned to them, although the tactics each army used varied.³³ Prince Faisal preferred to use guerrilla tactics for his Bedouin fighters, whereas his two brothers preferred more conventional tactics.

The British officer sent to assist Prince Faisal, was the now famous T.E. Lawrence. The concept of conducting guerrilla warfare was not very popular with the Sharif, but Faisal insisted on his Bedouin operating along tribal lines. One of the most frequent requests by Faisal to Lawrence and the British was for artillery support. The Arabs seemed to be obsessed with obtaining artillery, for two possible reasons: they were both impressed and terrified by the power of high explosives utilized by artillery and they felt that artillery would make them victorious over the Turks. From writings in Lawrence's "*Seven Pillars of Wisdom*," he said of the Bedouin, "the only theme of their

³²Maxwell Orme Johnson, "The Arab Bureau and the Arab Revolt: Yanbu' to Aqaba," *Military Affairs*, (Dec., 1982), available from <http://links.jstor.org/sici?sici=00263931%28198212%2946%3A4%3C194%3ATABATA%3E2.0.CO%3B2-E>, Internet, accessed 30 January 2008.

³³Philip J. Haythornthwaite, *The World War One Source Book*, (London: Arms and Armour Press, 1992), 130.

talk was artillery, artillery, artillery; the power and terror of which they have on the brain. The report of the coming of the five inch howitzer to Rabugh nearly restored the balance of their last retreat from Bir Abbas in their own minds.”³⁴ The psychological impact of artillery as seen in this case is one of its greatest characteristics; for both those who have it and those it is being used against.

1. British/Arab Artillery and Effects

Lawrence and Faisal had artillery pieces that were made by the French, British, and Egyptians in addition to Turkish pieces captured on the battlefield. Specifically, the cannons that they had were Egyptian 2.95-inch mountain-guns, 76 mm Hotchkiss guns, and French made quick fire (QF) 65 mm guns.³⁵ Lawrence also had several Egyptian Stokes guns, which were actually mortars. These were frequently employed in ambushes upon railroads and trains.³⁶ One of the most important attributes of the artillery pieces that they used was the ability to be broken down into multiple pieces and lashed onto the backs of camels. Mobility was paramount to the survival and success of Lawrence and Faisal’s efforts.

The actual effectiveness of the Arabs’ use of artillery was moderate at best; they derived more psychological gain from its use than actual damage to enemy in many instances. The mere presence of artillery on their side made them feel more confident going into battle. Faisal and almost every one of his men believed that if they’d only had two artillery pieces for their first attack on Medina, they would have been successful. Lawrence did not have as much faith as Faisal in the Bedouin fighter’s capabilities at the time of their assault on Medina, but he did acknowledge the ability of even a few artillery pieces to boost the spirits of the Arabs.³⁷ Lawrence did however see the potential in the abilities of the Bedouin as fighters. Considering the highly mobile nature of their tactics and the associated costs of hauling around large artillery pieces, he did not necessarily

³⁴Malcolm Brown, *T.E. Lawrence in War and Peace*, (London: Greenhill Books, 2005), 70-71.

³⁵*Ibid.*, 161-167.

³⁶T.E. Lawrence, *Seven Pillars of Wisdom*, (Garden City, NY: Doubleday, Doran & Co, 1926), 362-368.

³⁷Brown, 68.

desire to have a significant amount of artillery with them. He did however accept the fact that bringing along a few mountain guns as motivational pieces would help restore confidence among the Bedouin fighters as necessary.³⁸

2. Turkish Artillery and Effects

The Turks had several different types of artillery that they used against the Arabs. The Turks had the venerable French made 75 mm Krupp gun, 75 mm Schneider mountain guns and a few pieces of fortress artillery, whose effectiveness was limited as they were from the 1880's.³⁹ The Krupp gun was well known for its accuracy and extended range. The Turks used their guns both for defense of fortifications as well as for offensive actions, and towed them behind camels. The Turkish guns had a significant range advantage over the few modern guns that the Arabs did have. Lawrence was frustrated that "for the technical reason that (we) could not keep down the Turkish artillery because (their) guns outranged ours by three or four thousand yards."⁴⁰ The Turks predominantly used their artillery in the direct fire mode against the Arabs. In terms of the effectiveness of the Turkish artillery, the psychological impact of their guns was as effective, if not more so than any physical damage they inflicted. As noted earlier, the Arabs had a profound appreciation for the destructive power of artillery, and desired it as much as they were afraid of it. Lawrence noted

The Arabs have a living terror of the unknown. This includes at present aeroplanes and artillery. The sound of the discharge of a cannon sent every man within earshot to cover. They are not afraid of bullets, or of being killed-it is just the manner of death by artillery that they cannot stand. They think guns much more destructive than they really are, but their moral confidence is probably as easily restored, as it is shaken. A few guns-useful or useless-on their (Arab) side would encourage them to endure the Turkish artillery, and once they get to know it, most of their terror will pass.⁴¹

³⁸Brown,78.

³⁹Haythornthwaite, 304.

⁴⁰Lawrence, 166.

⁴¹Brown, 76-77.

Tactically speaking, the Turks were well aware of the Bedouins' fear of artillery, and were cautious in deploying their forces where they did not have artillery support.⁴² This knowledge may however have actually limited the Turks operations unduly.

3. Lessons Learned

The reputation of artillery as the pivotal weapon of the battlefield in World War I was derived from the carnage it caused on the entrenched battlefields of Europe more so than other battlefields. Demand for artillery and mortars in the European theater also made it difficult to meet demands for these items in other theaters. The British commander of the Egyptian Expeditionary Force and the Palestinian Front, General Edmund Allenby, did have a significant amount of artillery, but it was dedicated to support the main British combat forces in the region. The vast distances traveled by the Bedouins on camels made it impractical to bring artillery to battle unless in close proximity to staging bases. During the attack on Deraa in October 1918, Lawrence brought with him "four Arab Vickers, twenty Arab Hotchkiss, four French mountain QF 65 mm guns and other heavy equipment."⁴³ Based on the distance from their base though, it was a one way journey; if they had lost the battle, they had no way of getting the equipment back to their base.

However limited a role, artillery did see use on the irregular battlefield of the Arab Revolt. It was successfully used by the Bedouins against Turkish fortifications to gain entry and by the Turks as a defensive weapon from the forts. The Bedouins used their light artillery (specifically mortars) when conducting ambushes, particularly upon railroads. There are not many comments by T.E. Lawrence about the accuracy of the Turkish artillery in his writings, most notable though, as mentioned earlier is the psychological fear and terror it created among the Bedouins. As the war went on, Lawrence made fewer comments in his writings about the Arabs' fear of artillery. The Turks used the knowledge of the Arabs' fear of artillery to shape the battlefield,

⁴²Brown, 78.

⁴³Ibid., 167.

accepting risk where they had artillery, and limiting offensive actions where they did not.⁴⁴ Lawrence said about the Turks that “to break the determination of the Arabs, the Turks have their artillery—and I do not see how that will help them much in the hills.”⁴⁵ As far as artillery being a deciding factor on the battlefield in the Arab Revolt, its role was at most moderate. The use of artillery was effective as a psychological weapon; by Lawrence to motivate and inspire confidence in the Bedouin, and by the Turks to frighten them.

G. EAST AFRICA CAMPAIGN/COLONEL PAUL VON LETTOW-VORBECK

1. Background

In an attempt to divide the efforts of the Allies in World War I, the Germans opened additional fronts in Africa to try to keep as many allied troops as possible tied up outside of the European battlefields. The Prussian-born German commander, then Colonel Paul von Lettow-Vorbeck, waged a successful guerrilla campaign in eastern Africa against the British. On the field of battle, he was undefeated until the end of the war when he surrendered after finding out the war was over. In 1914, Lettow-Vorbeck assumed command of the *Schutzgruppe*, which was assigned to protect German interests in German East Africa. The *Schutzgruppe* was comprised of German officers and non-commissioned officers who led a force composed mostly of natives who were called “askaris.”⁴⁶ Once war was declared in Africa on August 5, 1914, Lettow-Vorbeck started on his guerrilla warfare campaign with about 200 officers and noncommissioned officers and 2,500 askari troops. Lettow-Vorbeck would continue this guerrilla campaign until the very end of the war. The guerrilla campaign was in direct contradiction to the orders from the governor of German East Africa, Heinrich Schnee, who was more concerned with protecting his financial interests in the colony than contributing to the

⁴⁴Brown, 78.

⁴⁵Ibid., 69.

⁴⁶Peter J. Williams, “Joint Fires in the East Africa Campaign,” *Field Artillery Journal*, (Jul-Aug 2001), 11.

German war effort.⁴⁷ Lettow-Vorbeck realized that he would be on his own logistically and without much contact from German High Command for tactical guidance for the duration of the war, which is one reason why he chose to pursue an unconventional campaign. Lettow-Vorbeck decided that best way to protect the interests in German East Africa would be to threaten nearby British interests in the region. One of his primary targets in his guerrilla campaign was the Ugandan railway between Nairobi and Mombasa, which was a critical piece in the British supply system.⁴⁸ As is common among guerrilla fighters, he was a master of battlefield recovery, and his prior experience as an artillery officer facilitated the integration of recovered cannons into his campaign plans.

2. German Artillery and Effects

At the start of the war, the only artillery that the *Schutztruppe* had were two .56 caliber guns that dated from the 1870's. However, just off the coast of the colony was a German warship called the *Koenigsberg*. Onboard the *Koenigsberg* were ten 105 mm guns, which would be recovered and utilized by Lettow-Vorbeck after the *Koenigsberg* was damaged extensively by British warplanes. The *Koenigsberg* was a source of tension for the British, as they hunted for it down along the coast. The British eventually chased the *Koenigsberg* up the Rufiji River and inflicted sufficient damage to cause the Germans to scuttle the boat. After the guns of the *Koenigsberg* were recovered from the river, they were distributed throughout German East Africa to make the most of this material gain. Along with the guns, went the crew from the *Koenigsberg* as well as any ammunition that was recovered. The guns were mounted on improvised carriages and placed into service against the British. One of the preferred methods of employment by the Germans was to practice "shoot and scoot" tactics to deceive the British as to the true number of guns. Lettow-Vorbeck realized the importance of his German cadre and strictly prohibited them

⁴⁷Edward Paice, *Tip and Run*, (London: Weidenfeld & Nicolson, 2007), 15-17.

⁴⁸Williams, 11.

from becoming decisively engaged in pitched battles. The German soldiers and sailors were far too important a resource for continuing the guerrilla campaign.⁴⁹

In addition to the guns recovered from the *Koenigsberg*, additional resources were acquired or recovered by Lettow-Vorbeck's forces. Some of the other artillery pieces they used were 3.7 cm revolving cannons, 9 cm field guns, 6 cm field guns, 4.7 cm field guns, 10.5 cm field guns, and mountain guns. To make the best use of his limited resources and limit the risk of losing the few artillery pieces he did have, Lettow-Vorbeck kept his artillery dispersed across the battlefield. By distributing his guns throughout the area, he accomplished two goals: one, he supported the mobile hit-and-run tactics of guerrilla warfare instead of staging an all out artillery brawl, and two, he deceived the British as to the actual size and strength of the German force.⁵⁰ The inability of the British to capture or force Lettow-Vorbeck's guerrillas to capitulate was a constant source of frustration. As an indicator of the importance of this campaign to the British, Lettow-Vorbeck noted that from a conversation with an English officer after surrendering, that the British High Command had sent 137 different general officers to the region to deal with Lettow-Vorbeck and his band of guerrillas.⁵¹ Lettow-Vorbeck was no stranger to British tactics; after fighting alongside them in the Boxer Rebellion in China just a decade earlier, he had a good deal of insight as to how British commanders would behave on the battlefield and used this to his advantage.

Despite being outnumbered by the Allied forces and several near losses on the battlefield, the avoidance of becoming decisively engaged in large battles proved to be an effective strategy for Lettow-Vorbeck. "The undoubted success of von Lettow-Vorbeck's opposition to the Allied forces was attributed solely to his ability to withdraw and the use of terror to ensure local support."⁵² Lettow-Vorbeck's guerrilla warfare

⁴⁹Williams, 12-13.

⁵⁰Ibid., 14.

⁵¹General Paul von Lettow-Vorbeck, *East Africa Campaigns*, (New York: Robert Speller & Sons Publishers, Inc., 1957), 300.

⁵²Paice, 400.

campaign allowed him to retain freedom of maneuver, focus valuable firepower at the decisive point in a battle, remain elusive and tie up precious Allied resources for the duration of the war without being defeated or captured.

3. British Artillery and Effects

At the outbreak of the war in August 1914, the closest British territory to German East Africa was British East Africa. In addition to the limited number of British troops present, there were two Indian Expeditionary Forces (IEF) (B and C) totaling over 10,000 troops, which were sent to the East Africa campaign as a rapid reaction force to protect the interests of the British in the region. IEF B brought with it six mountain guns to augment its infantry troops, and IEF C brought six mountain guns as well as six 15 pounders.⁵³ By 1916, British artillery assets included South African 13 pounders, British 10 pounders, 12 pounders, 15 pounders, 5-inch howitzers, 5.4-inch howitzers.

In addition, the British used the guns on their naval vessels in coastal areas to influence the Germans and their colonists. British warships that patrolled the coastal waters were a persistent threat using their 128 mm and 152 mm guns to place large volumes of fire on suspected insurgent locations close to the shore. The British also had several shallow draft boats which were able to navigate the inter-coastal rivers, giving them a limited ability to penetrate inland. The British used their naval gunfire more as harassment fire as they had no observers on land who could communicate back to the ship with adjustments for the fire. The gunfire from the British vessels did have a psychological impact on the natives in the region, often causing feelings of terror and fear among the German East Africa natives. The British guns often waited to hear the sound of gunfire from the Germans and would begin to bombard the general vicinity with naval gunfire as a response. These retaliatory strikes were usually ineffective against Lettow-Vorbeck's guerrillas as they had moved on by the time the British shells were falling.

⁵³Paice, Appendix Two.

The negative impact of this type of indiscriminate firing is that they often hit civilian targets, including a hospital which housed British troops who were being treated by the Germans.⁵⁴

The British capacity for being resupplied was not much better than Lettow-Vorbeck's, and although the British did outnumber the Germans in terms of troops in some battles by as many as eight to one, they were not able to stop Lettow-Vorbeck's guerrilla campaign over the course of four years. Lettow-Vorbeck's hit-and-run guerrilla tactics constantly kept the British on the move and guessing as to his whereabouts.

4. Lessons Learned

In his book *Tip and Run* by Edward Paice, the author says that there was a rather dismissive attitude by the British about fighting in Africa. "Many a British general of the Great War had cut his teeth on the African continent – Kitchener, Haig, French, Roberts, Hamilton, Allenby, and Smith-Dorrien, to name but a few-and yet the collective experience of the British military establishment had not resulted in many lessons being learnt about African warfare. The German General Staff on the other hand studied that same war closely, with the result that German *Schutztruppe* commanders and NCO's in Africa were instructed to become well versed in fighting 'mobile', as opposed to static, wars and dealing with the Sisyphean logistical and medical challenges inherent in such warfare."⁵⁵ This brief commentary sheds some light on the fact that the British did not put a great deal of emphasis on fighting 'by, with, and through,' particularly on the African continent, while the Germans did exactly the opposite.

Of particular importance to the success of this campaign by the Germans was the ability to retain mobility and maneuver, while applying as much firepower whenever possible. There is a very thin line that exists when balancing firepower and mobility, and Lettow-Vorbeck understood that principle implicitly. He wisely spread out his artillery assets to deceive the British, maximize their effectiveness, and prevent the loss of his artillery should his forces become decisively engaged in battle and lose. Lettow-Vorbeck

⁵⁴Lettow-Vorbeck, 41.

⁵⁵Paice, 5.

was a consummate artilleryman who understood how artillery worked, and made use of every available resource, including the guns recovered from the *Koenigsberg*. The indiscriminate use of firepower by the British was an error that many other militaries would emulate over the years. While firepower can be effective as a psychological weapon, when fighting an insurgency, in this case it ultimately alienated the population that the British should have been trying co-opt against the Germans.

H. MOROCCAN RIF WAR (1921-1927)

The Second Moroccan Rif War was fought between Spain and the Moroccan Rifain and J'bala tribes. The people who inhabit the Rif area of Morocco live in the mountainous northern portion of the country and are Arab and Berber in descent. The war in particular was a part of a longer ongoing series of wars between Spain and the Rif tribes from Morocco. In 1925, the French joined the war on the side of the Spanish turning the tide of the war to Spain's favor. Both sides made use of artillery during the war. The Rif fighters primarily used artillery pieces they captured from the Spanish throughout the war. Some of the Rif leaders had received formal military training from the Spanish earlier, so they understood how to integrate artillery fires into battle plans. The Spaniards enjoyed a material advantage of a larger array of field guns as well as the support of naval gunfire over the Rif fighters. However, the Rif fighters were successful at employing captured artillery against the Spaniards (battles at Igueriben in July 1921 and Dar Hamed in September 1921). On other occasions, the Rifs fought fiercely, but were limited by quantities of artillery, ammunition and manpower (Melilla in September 1921 and beach landing at Alhucemas Bay in September 1925). The Rif fighters use of guerrilla tactics allowed them initial victories to secure Spanish artillery and other arms, allowing the war to continue. This war was a good example of artillery being a battlefield multiplier for irregular forces when significantly outnumbered by conventional forces.⁵⁶

⁵⁶Steven Thomas, "1911-1927 Rif War." *www.balagan.org.uk*, Available from <http://www.balagan.org.uk/war/iberia/1909/index.htm>, Internet, accessed on 14 February 2008.

I. THE CHACO WAR (1932-1935)

1. Background

The Chaco War fought on the northern plains of Paraguay (virtually a “dry jungle,”) is an example of what is possible when a nation that has a smaller population and is financially inferior to its foe, selectively educates its leaders and equips its forces with weapon systems most appropriate for the terrain likely to be fought upon. At the time of the Chaco War, Bolivia and Paraguay were two of the poorest nations in South America, but Paraguay much more so than Bolivia. “It could not have been expected that Paraguay, lacking the relatively vast economic base of her antagonist, and with less than a million people, would be able to match Bolivia in the field. In total, Paraguay spent only \$4,730,733 for arms and equipment from 1926 to 1932 to ultimately defeat Bolivia.”⁵⁷ By comparison, Bolivia had spent over \$200,000,000 for arms and equipment by the end of the war.⁵⁸ The years 1926 and 1927 saw a military build-up in both Paraguay and Bolivia in anticipation of a confrontation and building tensions over control of the Chaco region. The dispute over ownership of the Chaco region was started over rumors that the area held large deposits of minerals and it was not until these rumors began to circulate that ownership of the region became an issue. Ironically, no large mineral deposits were ever found.

2. Bolivian Artillery and Effects

In preparing for war, in 1926 Bolivia placed a significantly sized order for 196 artillery pieces of several different calibers and models with the Vickers Armstrong Company in the United Kingdom. The order from the Vickers Company was curtailed significantly in 1927, and ultimately ended in a total order of just 64 new artillery systems. Unfortunately for the Bolivians, many of the new artillery pieces ordered from

⁵⁷David H. Zook, Jr., *The Conduct of the Chaco War*, (New Haven, Conn: United Printing Services, 1960), 63.

⁵⁸Adrian J. English, “The Bolivian Army 1825-1995 History and Orbat.” *www.orbat.com*, Available from www.orbat.com/site/history/historical/bolivia/army1825-1995.html, Internet, accessed on 28 January 2008.

the Vickers Company did not make it to the battlefield until after the first four months of combat, leaving the Bolivian troops to fight with antiquated equipment and minimal ammunition supplies.⁵⁹ Throughout the course of the war, various artillery pieces used by the Bolivians included the Vickers 75 mm gun, Krupp 75 mm mountain gun, 65 mm infantry gun, type C 105 mm mountain gun, type B 105 mm field piece, 81 mm Stokes Brandt mortar and the Schneider MP5 75 mm mountain gun.

3. Paraguayan Artillery and Effects

The Paraguayan build-up to war went somewhat differently than from the Bolivians. In 1926, Paraguay had no standing army to speak of, nor a significant financial base to build an army, so they secretly sought and received funding and material backing from Argentina. “While the Paraguayan troops fought the first skirmishes of the war armed with machetes and one castoff Argentine Mauser rifle for every three to seven men, a civilian purchasing commission frantically shopped the arms bazaars of Europe for bargain equipment. While Bolivia’s professionals spent lavishly on “serious” weapons like heavy Schneider howitzers, water-cooled machine guns, tanks, and the all but useless little Vickers mountain gun, the Paraguayan amateurs bought poor man’s artillery—light and cheap Stokes-Brandt mortar, three of which could be had for the price of one field gun. Cartridges and artillery shells could be had clandestinely, free of charge, from the Argentine army. In the heat, dense brush, and mud of the Chaco, lightness, mobility, and a high trajectory were the dominant requirements.”⁶⁰

The Paraguayans used the 81 mm Stokes-Brandt mortars, the Schneider 75 mm mountain gun, the Schneider 105 mm howitzers, as well as any other equipment that they captured from the Bolivians. Of significant benefit to the Paraguayans was the fact that

⁵⁹“The Bolivian Army 1825-1995 History and Orbat.”

⁶⁰Robert Craig Johnson, “The Gran Chaco War: Fighting for Mirages in the Foothills of the Andes.” *Chandelle: A Journal of Aviation History*. Available from www.worldatwar.net/chandelle/v1/v1n3/chaco.html, Internet, accessed on 28 January 2008.

they had substantial material support from nearby Argentina in the form of ammunition, where the Bolivians depended on long supply lines that were often overstretched across the ‘Altiplano’ or high desert plain region of Bolivia.⁶¹

The equipment used by the Paraguayans proved to be better suited for the environment in which they operated, whereas the Bolivians’ attempt to use tanks and large artillery pieces when supply lines were overextended and stressed ultimately proved to be a mistake. The mortar systems employed by the Paraguayans also allowed for excellent mobility and facilitated the use of guerrilla tactics which they often favored over long drawn out engagements. Both the Paraguayans and the Bolivians used their artillery and mortars for defending fortified positions. For the Paraguayans, they utilized a technique they learned from French of “creating entrenched islands armed with mortars, machineguns, wire and mines, with interlocking fields of fire which channelized infiltrators”⁶² and as a result killed many Bolivian attackers.

Following the battle at Boquerón in September 1932, the more experienced Paraguayan military commanders led a “poorly trained but better equipped army with thrice the firepower, over the cream of Bolivia’s forces, and in the experience had changed from raw country boys to veteran troops. Their Stokes-Brandt mortars were the surprise of the battle—the tactically decisive weapon—while the automatic rifle was proven for firepower in the brush.”⁶³ The combination of the best-suited weapon system for the type of combat and experienced leaders who knew how to integrate fire and maneuver, resulted in numerous victories for the Paraguayans.

4. Lessons Learned

In terms of tactics used in the Chaco War, despite the fact that the Paraguayan Army was young and relatively untested in combat, the majority of the army was composed of indigenous people from the Chaco region, who were very familiar with the terrain, which gave them an advantage over the Bolivians. The tactics used by many of

⁶¹Zook, 193.

⁶²Ibid.

⁶³ Ibid., 102.

the French trained Paraguayan leaders had been learned and practiced on the battlefields of World War I, where many of them had volunteered with the French Army.⁶⁴ The integration of artillery fire and infantry movement was by no means a new concept to the Paraguayan leaders.

The Bolivian leaders on the other hand were slow to adopt the practice of coordinated artillery fire and movement of ground troops. The Bolivians did have the benefit of combat advisers from Germany, who educated them in these new concepts (fire and maneuver) in ground warfare. “While her (Bolivia’s) soldiers were excellent, the Bolivian command was uniformly awful.”⁶⁵ In July 1933 during a Bolivian assault on the fortified Paraguayan base at Nanawa, “improper coordination brought a frontal assault before the artillery had softened the defense; then the infantry was victimized when the guns belatedly opened up. By noon, the Andean artillery was out of the battle for lack of shells.”⁶⁶ The failure to understand the concepts of coordinated fire and maneuver on the part of the Bolivian commanders was seen time and time again, and led to the death of many of Bolivia’s fighters.

The war ended in June 1935 with Paraguay the clear winner following a treaty signed in Argentina. Unfortunately, both countries were in near ruin financially and materially. The treaty left Paraguay retaining possession of almost 90% of the contested Chaco region, giving Bolivia a small section of access on the Rio Paraguay. From the beginning of the war, “Bolivia’s underestimation of her opponent was astonishing. The General Staff theorized that Paraguay could mobilize and equip only small forces and that she lacked war plans and intelligence.”⁶⁷ This underestimation of Paraguayan capabilities plagued the Bolivians from the start of the war until the end. The Paraguayans were masters of battlefield recovery, and by the end of the war, nearly all of their combat equipment had been captured from the Bolivians. The combat-tested

⁶⁴“The Gran Chaco War: Fighting for Mirages in the Foothills of the Andes.”

⁶⁵Ibid.

⁶⁶Zook, 146.

⁶⁷Ibid., 90.

Paraguayan leaders understood the importance of the coordinated and distributed application of firepower and maneuver, and used these principles to defeat the Bolivians.

J. WORLD WAR II

The use of artillery in World War II was widespread, particularly in the European theater. Its uses here though were for the most part either by or against large conventional forces. The China/Burma/India Theater of operations saw examples of unconventional warfare and the occasional use of artillery, more specifically mortars. Getting valuable supplies to the units in the remote locations in this theater was a daunting challenge, and artillery is not a very easily moved piece of equipment. Although there was an important unconventional campaign in European theater, the use of artillery by the irregulars was not widespread. Partisan units in Europe did use mortars throughout the war, as they were cheaper, easily transported, and relatively easy to operate. Mobility, low cost, and ease of operations are recurring themes for indirect armaments for insurgent or irregular forces.

K. THE MALAYAN EMERGENCY (1948-1960)

1. Background

The Malayan Emergency was a conflict declared by the British colonial government in response to activities of the Malayan National Liberation Army (MNLA) in 1948. The Malayan Communist Party (MCP) was a significant movement in Malaya that the British government desired to stop. During the Malayan Emergency or Malayan War, the British practiced numerous counterinsurgency techniques to disrupt the insurgent activities of the MLNA and the MCP. Special police forces were given broad liberties to stop, detain, and question potential suspects. “Notably, the Malayan counterinsurgency approach was not primarily military. Instead, the United Kingdom and Government of Malaya employed a mixed strategy encompassing civil, police, military, and psychological warfare programs, which effectively robbed the insurgency of

much of their political appeal.”⁶⁸ Although it took twelve years to defeat the insurgents, this campaign was ultimately successful in establishing a democratic government, with a very lean military force.

2. British Artillery and Effects

Unlike most counterinsurgency efforts in the twentieth century, the British response to the Malayan Emergency was unique in that they sent small numbers of forces and resources to combat the insurgents, but they did allow ample time for the countermeasures to take effect and did not interfere with the Briggs plan (The Briggs Plan was developed by British retired Lt Gen Harold Briggs to return control to Malaya). There were two artillery batteries assigned in Malaya, one which known as the Singapore Regiment which had 25-pound guns and the other unit had 5.5-inch guns. “Instead of being sited in static positions, they were almost invariably attached to battalions on operations.”⁶⁹ The artillerymen who manned these guns did so as a secondary duty, as their primary duty was to serve as infantrymen.

During the earlier years of the conflict (1948-1951), artillery fire was “often unobserved or was used against fleeting or ill-defined targets.”⁷⁰ British leaders began using aerial observers to direct fire in remote jungle regions to limit collateral damage. By 1953-54, the rules of engagement for artillery had started to change. Several historical accounts by members of the Singapore Regiment remark about the frequency of movement of the guns and the types of missions they were used in, specifically raids and ambushes, but also defensive fires. The artillerymen in fact received orders in 1953 that directed them to cease harassment fires; that they were to “kill the Communists, not harass them.”⁷¹ Comments by British officials after the war noted that there was no evidence of artillery or air strikes actually killing anyone, but that they did have an

⁶⁸R.W. Komer, *The Malayan Emergency in Retrospect: Organization of A Successful Counterinsurgency Effort*, (Santa Monica, CA: Rand Corporation, 1972), v.

⁶⁹Komer, 51.

⁷⁰Bailey, 364.

⁷¹Captain Peter Head, “‘O’ Field Troop – 1st Singapore Regiment Royal Artillery Malaya 1953-1955,” *Journal of the Royal Artillery*, 129 (Spring 2002): 57-59.

undeniable negative psychological impact on the populace. The British had improved their methods of waging a counterinsurgency and realized the ineffectiveness of indiscriminant fires. It was not until after September 1957 that the 1,000,000th artillery round was fired in Malaya, after a period of almost nine years.⁷² As for the Malayan insurgents having or using artillery, that was a capability that they did not possess.

3. Lessons Learned

The limited use of artillery in the Malayan Emergency can be best associated with its psychological effects on the population. The psychological effects of artillery can be both negative and positive, depending on its application. It can have a negative impact on the population by causing feelings of terror, particularly when it is used against the population, either intentionally or accidentally. Artillery can also have a positive impact when used effectively against enemy forces, reinforcing the fact that there are forces in the area to protect them against the enemy. Dense jungles make artillery operations difficult at best, and the British found more success engaging the population than killing them. In 1951, “it was observed that artillery fire often caused damage and casualties in friendly villages, working against British interests,”⁷³ which caused the British to rethink the role of artillery in counterinsurgency. Nonetheless, artillery was in fact employed on the battlefield, notably only by the British. Ultimately, the role of artillery in the Malayan Emergency was not significant in the overall outcome of the conflict. The take away from this conflict is that artillery may not be appropriate for all conflicts, as the British were successful without significant amounts of it. This is not to say that the techniques used by the British in Malaya will apply to fighting all insurgencies, but it did work for this one. Although the British were not successful at restoring colonial rule in Malaya, they were able to effect the creation of a working democracy and root out the Communist forces from the country.⁷⁴

⁷²Komer, 51.

⁷³Bailey, 365.

⁷⁴Donald Mackay, *The Malayan Emergency 1948-60, The Domino That Stood*, (London: Brassey's, 1997), 150.

L. THE ALGERIAN WAR FOR INDEPENDENCE (1954-1962)

1. Background

The roots of the Algerian War of Independence trace back to one hundred years of colonial rule by the French, starting back in 1830 when they invaded Algeria in an attempt to exert control and reduce piracy in the region. This move by the French to colonize Algeria was far from peaceful however, and the tactics the French used to conquer the Algerians were often extremely violent in nature. In 1848, the French declared Algeria part of France and divided it into three departments; Alger, Oran, and Constantine. “Despite this official incorporation, the local population was not completely subjugated until well into the 1870’s. Banditry persisted in the border regions of Algeria well into the 20th century.”⁷⁵

In 1954, the French had just withdrawn from their war in Indochina, where they had been defeated by Giap’s artillery at Dien Bien Phu. Faced with the prospects of losing the grip of their empire, the French used tactics in the Algerian War that were often brutal in effort to hold on to what they had left. Unlike smaller scale insurgencies, the conflict in Algeria was also victim of wider global circumstances. Insurgencies and other small wars were ‘popping up’ all across the globe, and sentiments of anti-colonialism were a common thread among many of them. France’s problems with Algeria were not important solely to France. “France’s Algerian problem after 1956 became increasingly an American concern, hampering Washington’s relations with the Arab world, Africa, and Asia, to the extent that American support of France was perceived as the main ingredient that enabled France to carry on the Algerian struggle.”⁷⁶

The Algerian War for Independence ended in 1962 with the Evian Agreements whereby the French ceded control of Algeria, recognizing Algeria as a sovereign country and contributing to the end of French colonialism. This agreement was by no means the

⁷⁵Lou DiMarco, “Losing the Moral Compass: Torture and Guerre Revolutionnaire in the Algerian War,” *Parameters*, (Summer 2006), 65.

⁷⁶Irwin M. Wall, *France, the United States, and the Algerian War*, (Los Angeles: University of California Press, 2001), 4.

end of violence in the region, as religious based violence would soon take hold. Conflicts amongst the Muslim, Jewish and Catholic communities in Algeria would continue to make headlines for years to come.

2. French Artillery and Effects

Although a relatively unknown war, and until 1999, a war that France was seemingly in denial over; there were over two million French soldiers who fought in this eight yearlong campaign. Similar to the war the French had just lost in Indochina, the war in Algeria was an insurgency. Based on the highly mobile nature of the Algerian insurgent groups, the French adopted the technique of conducting aerial reconnaissance to locate insurgent units and then moved ground units to that location. Due to the extremely rugged terrain in some areas, the French used airpower to attack insurgent positions that even half-tracks and horse drawn artillery were unable to reach.⁷⁷ When the French were able to utilize their artillery, they effectively used coordinated fire and maneuver tactics to eliminate the insurgent forces.

Besides the use of airpower, another one of the technological advantages that the French made use of was ground-based fire finding radars. With this capability, they could quickly respond to insurgent mortar attacks with their artillery, often destroying the insurgents.⁷⁸ Although the French Navy had the ability to conduct naval gunfire missions from the coastal regions, the small size of the enemy units were never large enough “to justify the use of naval artillery”⁷⁹ based on their target engagement criteria.

In an effort to control the insurgency, the French constructed the Morice Line along the Tunisian border. The Morice Line consisted of fences, minefields and guard

⁷⁷Martin S. Alexander and J.F.V. Keiger, *France and the Algerian War: Strategy, Operations, and Diplomacy*, ed. Martin S. Alexander and J.F.V. Keiger (London: Frank Cass, 2002).

⁷⁸Bernard Estival, *France and the Algerian War: Strategy, Operations, and Diplomacy*, ed. Martin S. Alexander and J.F.V. Keiger (London: Frank Cass, 2002), 89.

⁷⁹*Ibid.*, 93.

towers which were reinforced with roving patrols and artillery fire bases. “Attempts to breach Algeria’s borders were decisively defeated by French air power, artillery, and reaction forces.”⁸⁰

3. Algerian/Insurgent Artillery and Effects

The French faced at least four different insurgent groups in Algeria; the National Liberation Front (FLN), the Algerian National Movement (MNA), the French Algerian Front (FAF), and *Organisation armee secrete* (lit Organization of the Secret Army)(OAS). None of these groups had access to large quantities of foreign arms during the war. The FLN resorted to making homemade mortars and grenades and small improvised explosive devices to help offset the material advantages of the French. The existence of the Morice Line effectively kept these insurgent groups from being supplied by outside forces with equipment such as artillery.

4. Lessons Learned

At the start of the Algerian War, the French had just left Indochina defeated. Although the French had improved on their counterinsurgency techniques from those used in Indochina, they ultimately relinquished control of Algeria in 1962 as Charles de Galle realized that fighting the insurgency in Algeria could continue on for the next one hundred years without dealing with the issues at hand.⁸¹ From the perspective of effective use of artillery in irregular warfare, coordinated observation from aerial observers sent to ground artillery units was effective at engaging isolated insurgent elements. Counter-battery fires made possible by ground radars proved to be an effective way to engage an elusive enemy who practiced hit-and-run tactics, as they did not want to become engaged in a decisive battle. The French also integrated and distributed their artillery along the Morice Line in an attempt to secure the border of Algeria from external influences (security of the population is a key component in fighting an insurgency). The

⁸⁰DiMarco, 68.

⁸¹Raymond F. Hain, “The Use and Abuse of Technology in Insurgent Warfare,” *Air & Space Power Journal* (Aug., 1999), available from <http://www.airpower.maxwell.af.mil/airchronicles/cc/Hain.html> ; Internet; accessed 4 February 2008.

French use of artillery was not a direct contributing factor in their loss in Algeria, on the contrary; the presence of French artillery was successful in prohibiting the external supplying of insurgent elements and maintaining control and security of Algeria's borders. The security provided by the Morice Line was one of the key instruments in physically isolating the FLN from external assistance, eventually causing them to fade away due to lack of weapons and resources. The dispersion and integration of artillery into the Morice Line was one of key components in France's ability to secure the border of Algeria and prevent groups such as the FLN from receiving critical resources from outside sources. The success of the Morice Line as an effective tool in a counterinsurgency effort should not be overlooked, despite the fact that France eventually left Algeria. In the end, France may have won the military war in Algeria, but they lost the much more publicized political war.

M. CONCLUSIONS

This chapter looked at several irregular conflicts in the first half of the twentieth century, and examined how artillery systems played a role in these conflicts. The time period covered in this chapter was critical to the development of new technologies associated with artillery as well as new tactics used on the battlefield. As an example of the shift in technology, at the turn of the century the machine gun was new to warfare; by the end of World War II it had become integral to how warfare was conducted. There was a notable shift in the tactics of how artillery was deployed on the battlefield in this time period in that instead of assembling all artillery pieces in one location, artillery pieces were distributed across the battlefield to deceive the enemy as to the true number of artillery pieces, facilitate the most responsive fires for troops who were not massed in one location on the battlefield, and to prevent the loss of a force's artillery should a unit be overrun or captured. The coordination of artillery fires and maneuver of ground troops was another significant development of this period. At the end of the nineteenth century, conventional military tactics taught that artillery fought several 'artillery duels,' followed by the infantry on infantry fight; resembling an almost pre-agreed upon order of battle. Conflicts against irregular forces spawned developments in tactics which removed

that level of predictability of how ground warfare was to be conducted, particularly when fighting against irregular forces as they have no formal order of battle.

The next chapter will cover examples of uses of artillery in irregular warfare during the second half of the twentieth century, as well as current conflicts that the U.S. and her allies are involved with in support of the Global War on Terrorism.

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III. ARTILLERY IN MORE RECENT IRREGULAR WARS, 1959-2008

A. OVERVIEW

This chapter will examine irregular conflicts that have occurred in the second half of the twentieth century, as well as ongoing conflicts that form part of the Global War on Terror. The primary cases that will be examined in this chapter include the Second Indochina War (Vietnam), the long running conflict between the Palestinians and Israelis, and Operations Enduring Freedom and Iraqi Freedom. Other irregular conflicts that occurring during this period that saw the use of artillery include the Salvadoran Civil War (1980-1992), the Sri Lankan Civil War (1983-present), the Soviet Afghan War (1979-1989), and the numerous civil wars that have taken place and are ongoing in Africa. As the capabilities of weapons improved over the years, mortars have become the “poor man’s artillery system of choice;” they’re cheap, they’re highly mobile, and they’re easy to operate. A single soldier can effectively and accurately fire a 60 mm mortar whereas even the smallest cannon artillery piece requires a crew of at least three soldiers to be even remotely efficient. Mobility and ease of operation are critical characteristics for weapon systems used by irregular forces. Advances in guided munitions also allow for greater accuracy and the ability to minimize collateral damage; both are critical attributes of employing weapon systems, particularly during an irregular conflict.

B. SECOND INDOCHINA WAR (VIETNAM) 1959-1975

1. Background

Attempts to stop the spread of Communism after World War II were numerous and unfortunately, not always successful. The French fought a counterinsurgency war against the Communists in the First Indochina War from 1946 to 1954 and lost. The North Vietnamese Army’s use of artillery was the deciding factor in their victory over the French at the Battle of Dien Bien Phu in 1954. Following the loss by the French, the

United States became involved in Indochina in 1959 as we began sending advisors to the assist the people of the Republic of Vietnam (South Vietnam) who were fighting against their Communist backed neighbors to the north in the Democratic Republic of Vietnam (North Vietnam).

From 1959 to 1965, the role of the United States military was primarily advisory, helping train and assist the South Vietnamese. U.S. Special Forces soldiers had been training with the South Vietnamese Army since the early 1950's, but the first deployment of Special Forces soldiers in direct support of combat operations was not until 1961. Due to the deteriorating situation in the country however, in February 1965, General Westmoreland, Commander, United States Military Assistance Command, Vietnam (MACV), requested that Army and Marine combat units be sent to help provide security for U.S. bases in South Vietnam. By June 1965, General Westmoreland had requested forty-four combat battalions be sent to South Vietnam to help defeat the Communist Viet Cong (VC) guerrillas and the North Vietnamese (NVA).⁸²

The issues to be discussed in this section will focus on the techniques of how artillery was used, not necessarily the specific artillery pieces that were used. The significance of how American artillery was employed against irregular forces in Vietnam and the 'perceived' expectations of U.S. commanders with regards to ammunition expenditures and an ever increasing body count, led artillery units to provide fire support which was counter-intuitive for fighting a counterinsurgency. While the North Vietnamese had material backing from the Soviet Union including artillery and ammunition, the focus of this section is how U.S. forces used their artillery against the Viet Cong (VC) who were the primary fighters in the guerrilla war (at least until 1968); and what went wrong.

2. American Fires and Effects

The U.S. had no shortage of artillery during the war in Vietnam; U.S. artillery units fired as many artillery rounds during the war in Vietnam as had been used in all of

⁸²Andrew F. Krepinevich, Jr., *The Army and Vietnam*, (Baltimore: Johns Hopkins University Press, 1986), 3.

World War II; all in a country three fourths the size of the state of California.⁸³ U.S. artillery systems included 60 mm mortars, 81 mm mortars, 4.2-inch mortars, 105 mm towed howitzers, 155 mm towed and self propelled howitzers, 175 mm self propelled howitzers, and 8-inch self propelled howitzers. The predominant method of positioning artillery systems was from the fire support base or firebase. Firebases ranged in size from small with two 105 mm towed howitzers which were either towed or airlifted into position, up to large fortified firebases with a mix of artillery and mortars, often secured by a company of infantry or more. Smaller firebases were usually less permanent, whereas larger firebases were heavily fortified positions usually located near decisive terrain or areas of high enemy activity.

The purpose of the firebase was to provide fire support for maneuver elements that came in contact with enemy guerrilla units. This had the ancillary effect of “tethering” ground patrols to conducting operations within the range of artillery systems. “When guerrillas were located, the infantry took cover while massive firepower support attempted to destroy the insurgents.”⁸⁴ While the idea for the firebase was good in that it provided support for nearby maneuver elements, this was not always how artillery was used in Vietnam. The greatest percentage of artillery that was fired in Vietnam in the early years was fired under the title of what was called Harassment and Interdiction (H&I) fires. H&I missions were frequently fired routinely (ex. every night at 11p.m. for 3 hours), sometimes based on intelligence gathered in the field, but generally with the specific intent of keeping the enemy on the move and denying them rest. It did not take the enemy guerillas long to find ways to make U.S. fires ineffective though; the enemy began “hugging” friendly forces to the point that firing artillery at enemy forces often meant inflicting casualties on friendly forces as well. H&I fires were almost always conducted as unobserved fire missions, and as a result, these unobserved fires often landed in close vicinity to innocent villagers. The effect of unobserved H&I fires was ultimately counterproductive to the counterinsurgency task of breaking the villagers’

⁸³Bailey, 377.

⁸⁴Krepinevich, 197.

loyalty to guerrillas and often drove them to side with the guerrillas. Although the effects on the enemy may never be known, H&I fires clearly had an adverse impact on the civilian population.⁸⁵

Based on the ever competitive nature of U.S. military leaders, commanders correlated combat effectiveness with two metrics that were not very effective in a counterinsurgency campaign: total number of rounds expended and body count. Based on the inability to verify the effects of H&I fires, artillery commanders were often evaluated on the overall ammunition expenditures as a measure of their effectiveness.⁸⁶ As an example of the ineffectiveness of H&I fires, during the months of August 1969 to February 1970, the approximate kill ratio for artillery units in the Central Highlands of Vietnam where over 1,600,000 rounds of artillery was fired, was 4,800 enemy killed; this equates to 1,000 artillery rounds for one enemy combatant killed.⁸⁷

Using the body count as a measure of effectiveness was an equally flawed idea for fighting a counterinsurgency. “During the years of intervention, the Army’s preoccupation with reaching the crossover point made the body count the enemy of traditional counterinsurgency doctrine, which dictates that protection of the people must come before destruction of the enemy. Success in counterinsurgency was made a function of the rate at which U.S. forces killed VC.”⁸⁸

Despite these misguided reasons for shooting as much artillery as possible, there were many occasions where artillery was effective in saving the lives of U.S. soldiers. Artillery and mortars played a vital role in the defense of smaller encampments typical of where U.S. Special Forces soldiers operated from throughout the war. The combination of air mobility platforms such as the helicopter enabled artillery support to be airlifted to the vicinity of an infantry unit when they were decisively engaged or in preparation for a large scale operation such as the Battle of the Ia Drang Valley.

⁸⁵Scales, *Firepower in Limited War*,142.

⁸⁶Krepinevich, 202.

⁸⁷Scales, *Firepower in Limited War*,143.

⁸⁸Krepinevich, 202.

3. North Vietnamese Fires and Effects

Both the NVA and VC were both equipped with modern Soviet technology, from small arms such as the AK-47 to the most modern artillery systems, including 152 mm howitzers and tanks. The NVA had the full complement of Soviet made mortars and artillery systems as well as ammunition at their disposal. The NVA artillery actually had a range advantage over medium sized U.S. artillery pieces. The NVA followed the Soviet doctrine of positioning their heavy artillery pieces just beyond the range of the U.S. artillery, which meant that the NVA could safely fire on most American firebases with little threat of counter-battery fire.⁸⁹ The NVA artillery often went toe to toe with the Army of Vietnam (ARVN) and U.S. artillery forces. Static firebases by both sides and the use of counter-battery radars turned a battlefield with no real front lines into full blown artillery on artillery duels. The NVA use of artillery was often used in retaliation for U.S. fires or in preparation for a NVA attack on a U.S. base. The NVA and Viet Cong rarely used artillery in the H&I fashion that the U.S. preferred in the earlier years of the war; the NVA and VC seemed to have a better understanding of the importance of winning the population over to their cause.

4. Lessons Learned

The axiom quoted by many military leaders ‘of victory through superior firepower’ is not always the best suited policy for conducting war; particularly a counterinsurgency. General Westmoreland was quoted in a press conference as saying that “firepower” was the answer to fighting an insurgency.⁹⁰ Unfortunately, that was the policy of most U.S. military officials throughout most of the war in Vietnam. Understanding that the principles of counterinsurgency and full-scale conventional combat operations do not always match up was a critical flaw in U.S. military policy in

⁸⁹Peter Brush, “Big Guns of Camp Carroll,” *Vietnam*, August 1997, 28.

⁹⁰Krepinevich, 197.

Vietnam. Following the First Indochina War, one of the French commanders commented on the complexities of 'limited war' in saying: "success is fundamentally more dependent upon political action than upon firepower."⁹¹

Even though the U.S. ultimately lost the war in Vietnam, "the firepower of artillery and aircraft ensured that (the) U.S. forces never suffered a military defeat in Vietnam."⁹² While this was true on a tactical level, strategically we lost the war due to misdirection in many areas. The way forward for the application of artillery fires in irregular warfare is through timely, precision fires; fires applied at the right place, at the right time, and used with the safety and security of the population in mind.

C. THE SOVIET/AFGHAN WAR

The Soviet-Afghan War waged from 1979 to 1989 is another example of how not to conduct an effective counterinsurgency campaign. While both the Soviets and Mujahedeen had artillery, they used it for different purposes. The Soviets used their artillery to "de-populate" areas that they deemed troublesome and support major combat operations; whereas the Mujahedeen used their artillery and mortars to make a statement to the Soviets or the Government of Afghanistan; that they could strike whenever and wherever they wanted to. The Soviets deployed their artillery in mutually supportive firebases, similar to the American deployment in Vietnam. "During the war in Afghanistan, like the United States in Vietnam, the Soviets chose to expend massive firepower in order to save Soviet lives and to compensate for their lack of infantry. It was expensive, indiscriminate, and ultimately an ineffective practice."⁹³

The Mujahedeen quickly developed a countermeasure to Soviet artillery as previously used by the VC to counter the effects of American artillery. To deny the Soviets the use of their artillery in support of their forces in an engagement, the Mujahedeen would hug Soviet positions so that calling in artillery meant risking

⁹¹Scales, *Firepower in Limited War*, 36.

⁹²Bailey, 378.

⁹³Lester W. Grau, *The Bear Went Over the Mountain*, 2nd ed. Lester Grau (Washington D.C.: National Defense University Press, 1996), 52.

fratricide.⁹⁴ The Soviets also used a lesson learned from Vietnam by the Americans by projecting firepower forward via helicopter when troops were outside of the range of the static firebases. These air-mobile operations were often conducted in conjunction with large mechanized operations, which unfortunately had little lasting effects in the mountains of Afghanistan.⁹⁵ Ultimately, the Soviets' heavy reliance on firepower did not lead them to victory. "The effects of indiscriminate fire on the civilian population militated against hopes that the Soviets and the Afghan government allies might gain the support of the people. Oddly enough, it was the specific intention of the Soviets to attack the civilian population."⁹⁶ Between the wars in Vietnam and Afghanistan, we have seen several methodologies which have been unsuccessful for fighting an insurgency. Two valuable lessons learned from the American experience in Vietnam and the Soviet experience in Afghanistan are that the indiscriminate application of firepower and firepower used against the population are roads which lead to failure.

D. THE ISRAELI/PALESTINIAN/LEBANESE CONFLICT (1960'S - PRESENT)

The conflict over the land in this region goes back for centuries. Disputes amongst the Israelis, Lebanese, and the Palestinians have gone on for years and each side has their reasons for why they believe the land 'belongs' to them. Needless to say, there is a long history of warfare over the ownership of the land in this region. The most recent incident occurred between June 2006 and November 2006 between Israeli forces and Palestinian and Lebanese insurgents. The primary actors in this conflict were the Israeli Defense Forces (IDF), Hamas from Palestine, and Hezbollah from Lebanon. Both Hamas and Hezbollah have been formally identified as terrorist organizations and are reported to receive material aid and training from several different Middle Eastern countries.

⁹⁴Bailey, 388.

⁹⁵Lester W. Grau, *The Bear Went Over the Mountain*, 2nd ed. Lester Grau (Washington D.C.: National Defense University Press, 1996), 204.

⁹⁶Bailey, 389.

The usually short-lived nature of the conflicts in this region since the 1960's has followed similar trends over time, specifically that artillery has been no stranger to the battlefield. Historically, Israel has generally employed its artillery in a more conventional manner, whereas Israel's opponents have developed ever more sophisticated ways of employing their artillery, maximizing its psychological impact. The Israelis' tough responses to enemy attacks have become rather predictable over time, and Israel's Arab enemies often conduct attacks in anticipation of harsh retaliation by the Israelis. The hope here is that the harsh retaliation by the Israelis will draw the ire of the international community and shed light on the plight of those countries surrounding Israel.⁹⁷

The following is a brief rundown of the conflicts between Israel and their neighboring Arab enemies since the end of World War II: guerrilla war between 1945 and 1948, the Six Day War (June 5 through June 10, 1967), the Phony War 1968 through 1973, The Yom Kippur War (October 6 through October 24, 1973), Israeli-Lebanon War 1982-2002, Israeli-Palestinian War 2001, and the latest conflict in 2006. In all of these conflicts, artillery barrages were traded by both sides, for the Arabs as a psychological weapon hoping to draw an Israeli response; and for the Israelis, usually in retaliation or retribution for strikes by Arab countries.

In recent years, a commonly practiced tactic used by Hamas fighters was to launch Qassam rockets from Palestine into Israel. This served as a sort of harassment fire, but Hamas was also trying to provoke a reaction from Israel. Hamas fighters were aware that the world was watching and wanted to use the media to bring attention to the situation, particularly to the perceived injustices in Gaza at the hand of the Israelis. Israel often retaliated with counter-battery artillery fire to the location from where the rockets were launched from using fire finding radars. Between the September 2000 and December 2006, it is estimated that there were over 1,300 Qassam rockets fired into Israel from Palestine. Israeli retaliatory fires between September 2005 and June 2006 were estimated between 7,000 and 9,000 artillery rounds in an attempt to prevent

⁹⁷Bailey, 394-395.

Palestinians from conducting further rocket attacks. In conducting these fire missions into areas with high population densities, an estimated 80 Palestinians were killed during this period.⁹⁸ From a self-defense perspective, the Israelis felt that they had the right to defend themselves against these Palestinian rocket launches. However, the sometimes disproportionate Israeli levels of retaliation were often seen as unjustified in the minds of many Palestinians and others in the global community.

On June 25th, 2006, Hamas attacked an Israeli checkpoint, killing two Israeli soldiers and kidnapping one (Corporal Gilad Shalit). The actual ground combat between the Israelis and Palestinians started on the night of June 28, 2006 when Israeli forces entered the Gaza Strip with the intent of searching for Israeli Corporal Shalit. Israelis were also on the hunt for any Hamas fighters that they could find in order to stop the terror attacks and rocket launchings against Israel. The Israeli invasion of the Gaza Strip was no small affair; they entered Gaza with tanks, artillery, armored personnel carriers, and close air support.⁹⁹ The Palestinians did not take this lightly and fought back violently. Israeli warplanes and artillery bombed designated targets in Gaza day and night. Unfortunately, the Israeli bombs and artillery often ended up injuring and sometimes killing innocent civilians. Palestinians continued to launch rockets into Israel and the West Bank during the occupation of the Gaza Strip by Israel. "Israeli operations in Gaza intensified steadily during the second week of July, provoked in part at least by Palestinian Qassam rockets which began to target the Israeli city of Ashkelon. To the aim of rescuing Corporal Shalit, Israel added the goal of stopping rocket attacks by creating a buffer zone in northern Gaza."¹⁰⁰ Israel's actions continued to draw the ire of the global community as being over aggressive and heavy handed.

⁹⁸"AIPAC vs Norman Finklestein: A Debate on Israel's Assault on Gaza." *Democracy Now*, Available from www.democracynow.org/2006/6/29/aipac_v_norman_finkelstein_a_debate, Internet, accessed on 8 February 2008.

⁹⁹"Israeli-Palestinian conflict in Gaza Strip 2006." *Gaza Conflict 2006*. Available from <http://www.palestinehistory.com/issues/gaza2006/gaza2006.htm>, Internet, accessed on 8 February 2008.

¹⁰⁰Ted Thornton, "War: Israel-Gaza-Lebanon Summer 2006." *History of the Middle East Database*. Available from www.nmhschool.org/tthornton/mehistorydatabase/war_summer06.php, Internet, accessed on 8 February 2008.

To further complicate the situation, Hezbollah militants in Lebanon seized this opportunity to antagonize Israel by firing several Katyusha rockets into Israel, as well as conducting a raid into Israel and capturing two Israeli soldiers. “Hezbollah had a history of launching attacks against Israel in support of Palestinians and shared many of the same aims as Hamas.”¹⁰¹ In retaliation for the acts by Hezbollah, Israel conducted artillery attacks against Hezbollah positions in Lebanon, while also sending in ground troops to hunt down Hezbollah operatives. Military action by the Israelis and rocket attacks by both the Palestinians and Hezbollah in Lebanon continued through August 2006. On August 11, 2006, the United Nations Security Council passed a resolution calling for a ceasefire by all parties by August 14. Aside from occasional violations of the ceasefire, a near cessation of offensive operations by all parties was in place by November 2006.

The issue of artillery used against insurgents or irregular fighters in this situation has some direct correlations to the current conflict in Iraq. Both Hezbollah and Hamas fighters attacked Israel from positions surrounded by civilian populations. This put the Israelis in a difficult position; do nothing and let the attacks continue or, strike back to where the attack originated from and risk civilian casualties. The use of civilians as human shields or deterrents from retaliatory strikes poses a difficult decision. In this case, the Israelis chose to strike back, sometimes injuring and killing truly innocent civilians. It is uncertain if a more discrete use of firepower would have resulted in a different outcome; it certainly would have meant fewer civilian casualties and resulted in less media attention. If anything, the liberal use of firepower by Israel only further exacerbated the situation, which was temporarily resolved with a cease-fire, but this conflict will undoubtedly continue on for years to come.

The nature of the conflicts in this region is not likely to change significantly anytime soon. The Israelis feel that they have a right to protect themselves and the land that they feel is theirs, and the neighboring countries will continue to antagonize Israel in

¹⁰¹“War: Israel-Gaza-Lebanon Summer 2006.”

hopes of drawing retaliatory strikes. The answer to the conflict in this region has eluded world leaders for decades, and there is no reason to think that peace will prevail here anytime soon.

E. CURRENT OPERATIONS

The examination of current operations will be relatively generic in nature due to security classification of current tactics, techniques, and procedures (TTP's) as well as ongoing operations. Even so, there still exists a significant amount of knowledge that can be gleaned from examining these current operations without going into the classified realm. In the next chapter, specific emphasis will focus on new technologies that will further facilitate fighting against irregular forces in Afghanistan and Iraq, as well as other potential future adversaries. A more detailed accounting of ongoing operations in Afghanistan and Iraq will be addressed at the end of Chapter IV, after a review of weapons and munitions that are in use at this time.

1. Operation Enduring Freedom

The opening days of Operation Enduring Freedom (OEF) saw Special Operations Forces (SOF) traveling on horseback and sitting high on mountainsides conducting Terminal Guidance Operations (TGO) with Northern Alliance forces in order to defeat the Taliban. This image has become iconic with the Global War on Terror (GWOT) and a re-discovered appreciation of U.S. Special Forces. U.S. airpower was truly unstoppable and was a key component in our ability to quickly defeat the Taliban. The success of the initial air/SOF campaign in Afghanistan left many senior commanders with the impression that this configuration of forces could accomplish most missions without the support of artillery.¹⁰² While that was partially true, airpower has its limitations. Bad weather and operating restrictions, for example conducting daylight operations for AC-130's, are just a few of the limitations that can restrict the use of CAS. Once it became

¹⁰²Sean Naylor, *Not a Good Day to Die: The Untold Story of Operation Anaconda*, (New York: Berkley Books, 2005), 55.

clear that the U.S. was fully committed to eliminating the Taliban from Afghanistan, a larger complement of artillery and other fire support platforms began to arrive in Afghanistan to augment CAS.

Taking some of the best of the lessons learned from earlier irregular conflicts in this century and considering the geography in Afghanistan, artillery and mortars have been dispersed using the firebase system as had been used in Vietnam, but with two big differences. One, the practice H&I fires was not a utilized technique and two, body counts and quantity of ammunition expended were no longer seen as metrics to success. Typical coalition fire support systems found on firebases in Afghanistan now include 105 mm towed howitzers, 155 mm towed howitzers, and 60 mm, 81 mm and 120 mm mortars. Also integrated into fire support systems are fire finding radars such as the Q-36, Q-37, and portable counter-mortar radar systems. These radars facilitate rapid counter-battery fire to locations that have fired rockets or mortars towards firebases. Unfortunately, the enemy has adapted to these capabilities and frequently fires rockets either remotely or with a time delay system; so that when the round is actually fired, the enemy forces are a safe distance from the point of origin (POO) or the firing point.

The geography and dispersion of the population centers in Afghanistan requires that military forces sent there to fight the insurgency be dispersed. It is not uncommon for one firebase to be up to 50 or 60 miles away from the nearest firebase that could provide support or reinforcement if necessary. Therefore, each firebase needs to have some organic capability to provide fire support for its associated maneuver forces and the firebase itself. While the number of built up areas in Afghanistan are limited when compared to Iraq, the same cautions need to apply to how artillery and mortar fires are used in proximity to civilians.

The tactics of the insurgents have changed since the beginning of the war. From 2000 to 2005, fighters predominantly conducted hit-and-run ambushes, often initiated with improvised explosive devices (IED), avoiding drawn out battles with coalition forces at all costs. Starting in 2005 however, as the Taliban started to stage a comeback, they started to conduct pre-planned and coordinated attacks, with an identified command structure that communicated orders in battles, and did not shy away from a gunfight with

coalition forces. The insurgents often picked built up areas to fight with coalition forces; using the populace as a source of protection from coalition air support and with a potential propaganda tool if there were civilian casualties. Coalition forces have been very cognizant of the need to minimize collateral damage and civilian casualties. The Taliban are masters of propaganda and exploit every possible opportunity to blame civilian casualties on coalition forces, even when they are not responsible for them. Providing fire support on the irregular battlefield in Afghanistan requires a great deal of patience, the ability to provide accurate fires in a timely manner, and dispersion across the battle-space.

2. Operation Iraqi Freedom

Operation Iraqi Freedom (OIF) started out as the polar opposite to OEF as far as the forces involved and conduct of the invasion. OEF used a limited number of very specialized troops, inserted on horseback and by helicopters. The forces involved in OIF looked very similar to the invasion during Operation Desert Storm from 15 years earlier; large armored columns, convoys that extended for hundreds of miles hauling thousands of gallons of fuel, tons of ammunition, food, and other supplies. Airpower again played a significant role in the invasion, including softening ground targets prior to the arrival of ground forces, in addition to a number of other missions. During the opening stages of OIF, military commanders had nearly every available combat asset at their disposal, going into Iraq prepared for a well armed Iraqi Army. This was far different from the SOF operators who went into Afghanistan just two years earlier and were limited to what their horses and all terrain vehicles (ATV's) could carry.

The U.S. force that invaded Iraq had the availability of the full array of artillery systems; 105 mm towed howitzers, 155 mm towed and self propelled howitzers, MLRS, 60 mm, 81 mm, and 120 mm mortars, as well as fire finding radars. Organic fire support for maneuver elements was not an issue. Following the declared end of major combat operations, when the insurgency began to take foot is when the deployment of artillery

assets began to resemble the firebases of Vietnam. Once conventional units established forward operating bases (FOB's), artillery was used from static positions to support maneuver forces conducting patrols.

Move forward in time to 2005-2008. The nature of the fighting in Iraq is slightly different than that in Afghanistan in that much of it takes place in densely populated urban areas, where the liberal application of firepower increases the probability of civilian casualties significantly. The insurgents know that fighting a pitched battle against U.S. combat forces is a losing proposition; as a result, IED's, ambushes, and snipers are the preferred instruments of war used by the insurgents. Using large quantities of artillery is no longer an acceptable solution to even suppress the enemy who is using the cover of civilians in densely populated neighborhoods. Even the use of airpower is limited due to the large explosive force of even the smallest precision guided bombs which weigh in at 500 pounds.

Coalition forces in Iraq are in a constant reaction cycle to ever changing insurgent threats. Securing the population is understood to be one of the key elements to defeating the insurgency, but this is a near impossible task without the help of the Iraqis. In the next chapter, some of the new technologies will be discussed that have been developed to enable combat commanders the ability to have timely, precise fires in densely populated urban areas while at the same time being having a lower risk for collateral damage.

F. SUMMARY

The last two chapters have looked at numerous examples of how artillery has been used by both conventional and irregular forces with varying degrees of success. Generally speaking, it is the tactics used and employment of weapons systems which is more important than which kind of force uses them. The following are a few of the more prominent lessons learned for the use of artillery in irregular warfare environments.

1. Lesson 1: Dispersion

The value of dispersion of artillery assets on the irregular battlefield was seen numerous times in the cases studied. The British may have outgunned the Boers

numerically, but the Boers wisely dispersed their guns and used their range advantage, which enabled them to have limited success against the British. During the Boer war, “British artillery learned the need to disperse in the face of superior firepower and to conceal itself. The utility of an artillery duel was useless when the location of the enemy’s artillery was unknown.”¹⁰³ Colonel Lettow-Vorbeck had similar success with keeping his guns dispersed on the battlefield, avoiding large artillery duels, and remained the elusive guerrilla fighter in the East Africa Campaign for the duration of the war. The French in Algeria used distributed artillery from firebases, effectively securing the border of Algeria to prevent supplies from reaching the insurgent groups. The French also integrated the use of aerial observers to call for and adjust fires on mobile insurgents. Dispersion allows for quicker response times, a degree of deception as to the true number of artillery systems, and denies the enemy the ability to negate all of your firepower as would be possible if all in one location.

2. Lesson 2: Integration

The integration of fire and maneuver marked a significant evolution in how warfare (conventional as well as irregular) would be conducted. The Second Boer War was one of the first examples examined where fire and maneuver was implemented on the battlefield. From that point on, the concept gained acceptance and become an integral part of combined arms operations. The Chaco War demonstrated why it is important to have the most appropriate weapon system for the environment where combat will occur. The Paraguayans’ use of the Stokes mortar was far more effective than any tank or airplane that the Bolivians brought to the battlefield. Why? Mobility is a cornerstone to irregular operations such as those conducted in the Chaco region. When the Bolivians tanks ran out of fuel they were stuck, but the Paraguayan fighters simply picked up their mortars and moved on.

¹⁰³Bailey, 223.

3. Lesson 3: Precision

There are certain artillery employment methods that should be avoided when conducting a counterinsurgency. The H&I fires that the U.S. military practiced during Vietnam were clearly unsuccessful in ‘winning the hearts and minds’ of the populace. The liberal use of fires by the Israelis in 2006 was another good example of how not to fight an irregular force. The lesson to be drawn out of these cases is that although barrages of massed artillery may have been effective when fighting a largely conventional war such as the trench warfare of World War I, using massed artillery against insurgents conducting guerrilla warfare does not have the same effect. The guerrillas often move somewhere else to avoid losses, and those affected are usually innocent civilians. In this age of near real time video, the internet and mass media, guerrilla forces have become masters of exploiting any civilian casualties as a source of propaganda to the larger world community.

IV. CURRENT U.S. CAPABILITIES AND EQUIPMENT

A. OVERVIEW

The focus of this chapter is to identify the current organic ground fire support capabilities of the U.S. military, and discuss their role in irregular warfare. Currently, the U.S. military has three different types of indirect fire systems: mortars, cannons and rockets. Each of these systems will be examined, including the different weapon platforms, the various types of ammunition currently available, the suitability for specific types of operating environments (urban, jungle, desert, mountains), and finally how some of the newest technologies utilized by these weapons systems can be integrated into the combined arms fight on an irregular battlefield. Although there is a wide range of uses for all of the traditional munitions in the U.S. inventory, this chapter will focus on the implementation of precision guided munitions and their uses on the irregular battlefield. The utility of precision guided munitions is that they are an important tool for having predictable effects on a very specific target/location. Artillery has historically been an 'area fire' weapons system, its round had effects on a large area; precision guided munition have effects on a very specific point target, minimizing collateral damage around the intended target. To facilitate the best interoperability with our allies, almost all of these weapon systems and munitions have been adopted by our allies, and are in use by them in their militaries as well.

B. MORTARS

Although not actually classified as artillery, mortars are the only truly organic indirect weapon system currently available to light infantry units. While artillery units are often attached to infantry units, only mortars belong to and are operated by infantrymen. This is important because it is the infantry soldier who is most likely to be conducting offensive operations against insurgent forces. It is also important from the perspective that these assets are the most immediately available to the infantry maneuver commander.

1. Systems

Current U.S. mortars include the 60 mm mortar, the 81 mm mortar and the 120 mm mortar. A common trait of all mortars is that they utilize a high angle of fire trajectory versus a low angle of fire trajectory. Cannon artillery on the other hand are capable of both high and low angles of fire. This high angle trajectory allows mortars to be well suited for use in ‘vertical’ environments such as urban terrain, dense jungles, and mountainous regions with fewer firing restrictions than some artillery systems. Mortars have proven their worth in irregular warfare numerous times; their small crew size and high degree of mobility make them an excellent weapon system for fighting on an irregular battlefield. The tradeoff for mobility and high angle fire is range, however (see Table 1 for range comparisons with artillery systems).

WEAPON	RANGE (km)				Number Of Bomblets	RATE OF FIRE Sus/max rds/min	RATE OF ILLUM Rds/min	ILLUM AREA (dia. meters)	SMOKE BUILDUP TIME	AVG. BURN TIME
	MAX	DPICM	ILLUM	RAP						
60mm M224	3.5		3.5			20/30 rds/min	4	500m	1/2 min	1 min
81mm M29A1	4.8		3.9			8/25 rds/min	2	360m	1/2 min	1 min
81mm M252	5.8		5.0			15/30 rds/min	2	650m	1/2 min	1 min
107mm M30	6.8		5.5			3/9/18 rds/min	1	800m	1/2 min	1 min
120mm M120	7.2		7.1			4/15 rds/min	2	1500m	1/2 min	1 min
105mm M119A1	11.5	14.1	11.5	19.5		3/10 rds/min	2	800m	WP 1/2 min HC 1-1 1/2	1-1 1/2 3 min
155mm M198	18.3	18.0	17.5	30.1		2/4 rds/min	1	1000m	WP 1/2 min M825 1/2	1-1 1/2 5-10
155mm M109A5/A6	18.2	17.9	17.5	30.0		1/4 rds/min	1	1000m	WP 1/2 min M825 1/2	1-1 1/2 5-10
MLRS M270/270A1 HIMARS	M26 Min: 10km Max: 32km ER Min: 13km Max: 45km				644 518 404	12 in 40 seconds				
ATACMS M270 IPDS/ M270A1 HIMARS	BLK I Min: 25km Max: 165km BLK IA Min: 70km Max: 300km BLK II Min: 35km Max: 140km				950 APAM 13 BATs					

Table 1. Mortar and Artillery Ranges and Capabilities¹⁰⁴

¹⁰⁴United States Department of Defense, FM 3-09.31, *Tactics, Techniques, and Procedures for Fire Support For The Combined Arms Commander*, (Washington, D.C.: Department of the Army, 2002), B-1.

The historical use of mortars in irregular environment reviewed in previous chapters proved that mortars are a valuable asset on the irregular battlefield. Their utility can be seen in most of the environments where irregular warfare takes place; jungles, deserts, mountainous regions, and urban areas. Mortars do have their limitations, but when used in conjunction with other artillery assets as well as available airpower, mortars are an excellent platform that can help to fill availability and utility gaps between those other systems.

Mortars are equally suited for support of light and mechanized organizations, and as such they are present in both kinds of units. As a part of mechanized units, there are two variations of mortar carriers (vehicles). The first is vehicle is an M 106 self-propelled mortar carrier, which is based off the M 113 Armored Personnel Carrier chassis, the second is based on the Stryker Combat Vehicle chassis. In both cases, they are equipped with the 120 mm mortar system, which can be used in the vehicle or dismounted from the vehicle.

2. Munitions

There have been several improvements in munitions for mortars in recent years, namely in the development of infrared (IR) illumination rounds and precision guided munitions. Standard rounds available for mortars include high explosive (HE), white phosphorous (WP) and red phosphorous smoke, and visible illumination. One of the technical advantages that almost all U.S. ground troops have over our enemies is that they are equipped with night vision goggles (NVG's). There is always the possibility that our adversaries have acquired NVG technology, particularly through the selloff of Russian military components and commercially available products. But as of this time (2008), this technology predominantly remains a capability of allied forces. NVG's allow our troops to see in limited and low light conditions by amplifying ambient light, including light in the infrared spectrum. Prior to the development of IR illumination rounds, the enemy benefited just as much as our troops did when visible illumination rounds were fired during periods of darkness. The benefit of IR illumination rounds is it that they give U.S. troops the ability to see better at night, while denying the enemy (at least those

without NVG's) of this advantage. IR Illumination rounds are available and currently in use for all three mortar systems used by U.S. and other allied forces (60 mm, 81 mm, 120 mm).

Precision guided munitions for mortars are a relatively new development. The Precision Guided Mortar Munition (PGMM) developed by Alliant Techsystems is a semi-active laser guided munition fired from the 120 mm mortar. The PGMM is fired just as any other mortar round would be fired, with the added step of a forward observer designating a target with a laser designator device. "The PGMM is capable of defeating hardened and stationary targets with far fewer rounds, at greater ranges and with much less collateral damage than current mortar ammunition."¹⁰⁵ Minimizing collateral damage is critical to fighting against insurgents who are hiding and fighting among the population. As discussed from the case study on Vietnam, inflicting large numbers of civilian casualties is counterproductive to fighting a counterinsurgency campaign. The usefulness of this munition for fighting an irregular war such as Iraq is that it is well suited for urban areas, is effective against hardened targets (concrete buildings), minimizes collateral damage, and is available at the infantry company level.

C. CANNON ARTILLERY

Cannon artillery systems have been an important factor in ground combat for centuries, and its future in this capacity is far from bleak. As the U.S. military attempts to transform to become a more nimble force, new artillery systems and components have been developed to meet that endstate. The significance of artillery on the modern battlefield cannot be underestimated. Technological advances that facilitate precision fires make modern artillery systems virtual "over the horizon" sniper systems that are available to the lowest level maneuver commander.

Common to all cannon artillery systems is that they are capable of both high and low angles of fire. A sustained rate of fire utilizing high angle trajectories is much slower

¹⁰⁵"Precision Guided Mortar Munition." *Alliant Techsystems Incorporated*. Available from http://www.atk.com/Customer_Solutions_MissionSystems/cs_ms_w_gp_pgmm.asp, Internet, accessed on 12 February 2008.

than low angle trajectories as the gun tube needs to be lowered and raised each time the gun is fired. High angle trajectories allows for a more vertical attack on targets. The amount of clearance needed to fire a howitzer requires a certain amount of open area to make best use of the weapon system. Unlike mortars which can be used in relatively confined spaces, cannon artillery pieces need at least several hundred meters of open area in order to be able to fire low angle trajectories. This does not mean that cannon artillery cannot be used in restrictive terrain, only that it is best used when it placed in less restrictive terrain. When conducting operations in urban terrain, a good placement for cannon artillery systems would be near the edge of town where there are few tall buildings which would provide the gun more flexibility for firing.

1. Systems

Currently in the U.S. inventory are several different cannon artillery systems. The most mobile of which is the M 119A2 105 mm towed howitzer, which can be towed behind a High Mobility Multi Wheeled Vehicle (HMMWV, pronounced “hum-vee”) or larger vehicle. The M 119A2 can also be airlifted by UH-60 Blackhawk and CH-47 Chinook helicopters as well as the OV-22 Osprey. The next larger cannon artillery system is the M198 155 mm towed howitzer, which can be towed by a 5-ton truck or equivalent vehicle and airlifted by the CH-47 helicopter. The newest variant of the 155 mm towed howitzer is the XM 777 ultra-lightweight field howitzer, was developed by the British Vickers company. The XM 777 is towed by a 5-ton truck and can be air lifted by the CH-47 helicopter as well as the OV-22 Osprey. The XM 777 has been approved by the U.S. Army and Marines Corps to replace existing M 198 cannons. One significant advantage of the XM 777 is the decreased weight of over 7,000 pounds compared to the M 198, which allows for better mobility on the battlefield. The XM 777 also has a significant number of technological advances incorporating digital communications which allow the gun crew to reduce the time required to prepare and fire a round.

The last cannon artillery system currently in use is the M 109A6 (Paladin), which is a 155 mm, self propelled howitzer. The Paladin and its predecessor variants have been in service since the early 1960’s. It is the standard cannon artillery system for all

mechanized (heavy) U.S. Army units. Development continues at this time for an indirect fire vehicle as a part of the Interim Stryker Brigade Combat Team, which will be mounted on the Stryker combat vehicle chassis. This would be in addition to the Stryker Mortar Carrier already in use. During the late 1990's, the follow on artillery system to the Paladin, the Crusader, was terminated by the Department of Defense in 2002 due to fiscal disputes and changes in priorities. Cancellation of the Crusader system left Paladin to remain in active service supporting heavy mechanized units. Although the overall program was abandoned, certain aspects of the Crusader system continue on today in developments such as new more flexible propellants for use in existing cannon artillery systems.

2. Munitions

The types of ammunition available for cannon artillery systems are numerous; some perform several different functions, and some are for very specific targets/missions. The most basic types of ammunition available for both 105 mm and 155 mm systems include high explosive (HE), white phosphorous (WP) smoke, illumination, and Anti Personnel Improved Conventional Munition (APICM) rounds. One munition specific to the 105 mm cannon is the Anti Personnel (APERS) Beehive round, which contains 8,000 steel flechettes and is used primarily as a self defense round.¹⁰⁶ Area denial ammunition specific to 155 mm cannons include Family of Scatterable Mines (FASCAM), Area Denial Anti-Personnel Mines (ADAM), Remote Anti Armor Munition (RAAM), and Dual Purpose Improved Conventional Munitions (DPICM). There are also some rounds that contain small rocket motors (Rocket Assisted Projectile RAP) for extended ranges. During the height of the Cold War, the U.S. had stockpiles of chemical, biological, and even nuclear cannon artillery rounds, however these projectiles are no longer in service. The last type of projectile is those that are guided or 'smart' projectiles; they include Copperhead, Sense and Destroy Armor (SADARM), and Excalibur.¹⁰⁷

¹⁰⁶“105 mm Projectiles.” *Military Analysis Network*. Available from <http://www.fas.org/man/dod-101/sys/land/105.htm>, Internet, accessed on 21 February 2008.

¹⁰⁷“155 mm Projectiles.” *Military Analysis Network*. Available from <http://www.fas.org/man/dod-101/sys/land/155.htm>, Internet, accessed on 21 February 2008.

Some of the most applicable advances in cannon artillery in recent years have come in the form of these ‘smart’ projectiles. Applicable because they can be used by all existing cannon systems and they meet the need on the battlefield right now. The first precision laser guided munition available for cannon artillery systems was the Copperhead projectile. Copperhead rounds were fired in a specific trajectory towards the target and approximately 30 seconds before impact, was guided by a coded laser beam sent by the forward observer to the target. When properly coordinated, Copperhead rounds were extremely effective against armor and other hardened targets, and were used often in the first Gulf War. The disadvantages to the Copperhead round were that they were complicated to prepare for firing and they had a reputation for fin deployment failures. Despite the success of Copperhead rounds, their use was discontinued in the early 2000’s when stockpiles had diminished and the contract life had expired.

The Excalibur family of projectiles is the first “fire and forget” smart munition for cannon artillery systems. Excalibur rounds can be fired in all weather conditions, are guided primarily by global positioning system (GPS) with backup navigation by inertial navigation system (INS), and can be fired from all 155 mm cannons when equipped with the Portable Excalibur Fire Control System (PEFCS). Initial development for Excalibur started in 1996, and was finally approved for operational use in 2007. Excalibur is not a replacement for the Copperhead round, as Excalibur is not a designated “tank killer.” Block I Excalibur rounds are high explosive, fragmentary unitary munitions that are effective against personnel, material, and structures. One of the unique features of the Excalibur round is that it is fired in a high angle trajectory, which results in a near vertical attack on the target. This makes Excalibur well suited for use in vertical terrain such as urban areas and mountainous regions, but with greater range than PGMM from mortars. Excalibur is capable of being fired at targets from ranges of 7.5 km to 30 km. The Excalibur round has multiple fuse settings which allow for air burst detonation, point detonation, and delay detonation, depending on the target.¹⁰⁸

¹⁰⁸“XM 982 – Excalibur 155 mm Precision Guided Extended Range Artillery Munition.” *Global Security*. Available from <http://www.globalsecurity.org/military/systems/munitions/m982-155.htm>, Internet, accessed on 26 November 2007.

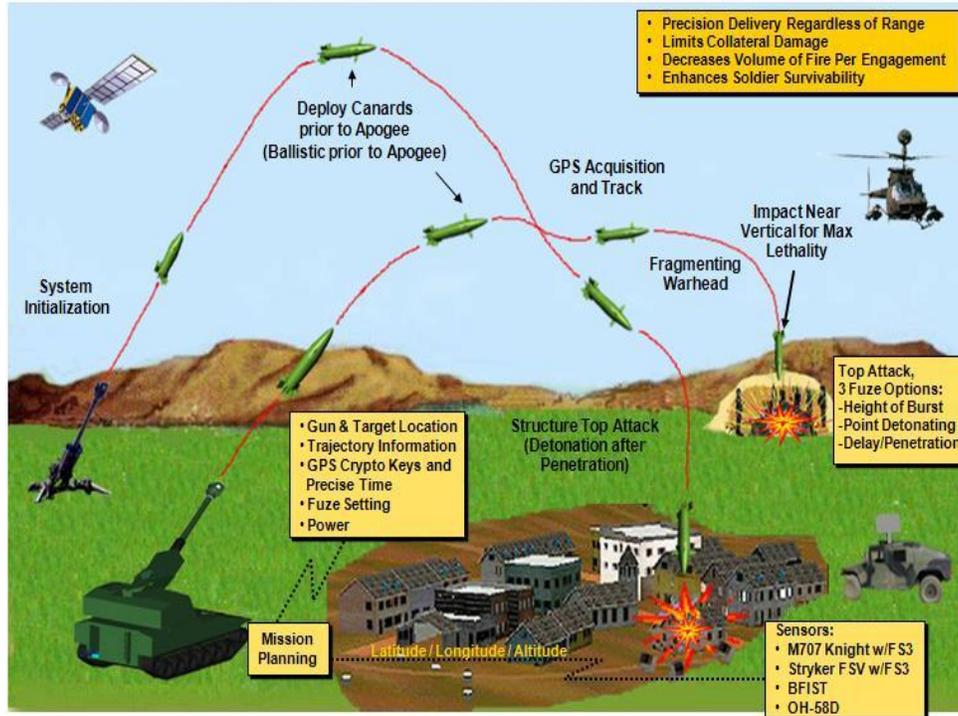


Figure 1. Flight path for Excalibur round¹⁰⁹

D. ROCKET ARTILLERY

1. Background

While not always associated as an artillery system, rocket artillery has actually been around for a long time. While the historical examples examined in earlier chapters looked at the use of both mortars and cannon artillery, the use of rocket artillery in irregular warfare has not been nearly as common. Based on the relatively recent introduction of rocket artillery for use in irregular warfare, a brief history of the development of rocket artillery follows.

¹⁰⁹Colonel John Tanzi, *TRADOC Capability Manager Cannon Brief*, (Fort Sill, Oklahoma: September 26, 2007).

“The rocket has been in the military service in the West for over two hundred years, but has been an effective battlefield weapons only since World War II.”¹¹⁰ The Chinese developed primitive rockets while experimenting with fireworks, and used them against the Mongols in the 13th century. The Ottomans brought rocket technology to Europe during the mid 15th century. At this point in time, arrows were used in a fashion similar to today’s rockets; they would be launched hundreds at a time from a launcher which sent them in a general direction towards a target. Often times the arrows were on fire and they were used mostly as a psychological weapon, but still quite capable of inflicting damage.

In the late 18th century, Indians led by Tipu Sultan used Mysorean rockets (named after the city they were made in) in their revolt against the British and the East India Trading Company. “The rocket was Tipu's deadliest missile. Rockets could be of various sizes, but the general design was an iron tube about 8" long and 1½ - 3" diameter, closed at one end and strapped to a shaft of bamboo about 4ft. long. The cylinder was filled with combustible material and some powder - a large rocket, carrying about one pound of powder could travel some 1,000 yards.”¹¹¹

The British were so impressed by the capability of these rockets, that in 1804, Sir William Congreve developed the Congreve rocket. The Congreve rockets were used by British troops in the Napoleon Wars as well as the War of 1812. The most common variant of the Congreve rocket weighed 32 pounds and was mounted on a 15 long stick 1.5-inches wide. Many of these rockets had a round metal warhead that embedded itself in the target and dispersed a slow burning incendiary compound. There were also rockets that had an internal explosive charge resulting in shrapnel effects on the target area.¹¹² The British used Congreve rockets during the attack on Fort McHenry in Baltimore,

¹¹⁰Bailey, 4.

¹¹¹“The Battle of Pollilur 1780, D/Tipu’s Archers.” *The Tiger and the Thistle: Tipu Sultan and the Scots in India*. Available from <http://www.tigerandthistle.net/tipu312.htm>, Internet, accessed on 12 February 2008.

¹¹²Cliff Lethbridge, “The French Excel at Fireworks and the Limited Use of War Rockets.” *History of Rocketry*. Available from <http://www.spaceline.org/history/2.html>, Internet, accessed on 12 February 2008.

Maryland, largely resulting in material damage due to the incendiary compound in the rockets. The British continued development of rocket technology through the 19th century including the development of the Hale rocket which was adopted by the U.S. in 1846.

U.S. forces used rockets as siege weapons, mostly for psychological effect in the Mexican-American War during the siege of Veracruz, the battle of Telegraph Hill, and the siege on the fortress of Chapultepec.¹¹³ Following their use in the Mexican-American War, military applications for rockets were all but forgotten until the American Civil War when they were again brought into action. The primary purpose of rockets used in the American Civil War was to deliver combustible compounds to destroy material, but they could also be used to carry musket balls which would be released in flight by an explosive charge inside the rocket. The range of rockets at this time was an impressive three miles, but the accuracy was very unpredictable; hence their use was rather limited. Following the end of the Civil War, interest in military rockets declined due to inaccuracy and limited range. While military interest in rockets had faded away, commercial and industrial development of rockets continued throughout the rest of the 19th century and into the 20th century. For these purposes, rockets were used for rescue devices and the potential for propelling aircraft.¹¹⁴

The progress of military applications for rockets and rocket technology was further advanced by the German General Walter Dornbeger and Wernher von Braun, who were instrumental in the development of the A-4 and V-2 rockets. General Dornberger was the military commander in charge of the rocketeering program, while von Braun was one of the technical leads in charge of the development process. Wernher von Braun, who later came to the United States to work for NASA, is one of the leading figures in the development of rocket technology. Developments in rocket technology following World War II continued by scientists around the world such as von Braun, although their application in the military world would be limited by the U.S. until the 1960's with the

¹¹³“Brief History of Rocketry.” *NASA Spacelink System*. Available from <http://science.ksc.nasa.gov/history/rocket-history.txt>, Internet, accessed on 29 February 2008.

¹¹⁴“The French Excel at Fireworks and the Limited Use of War Rockets.”

development of the Pershing and Pershing II missile systems, followed by the LANCE missile systems and Multiple Launch Rocket System (MLRS) in the 1980's.

Historically, the primary mission for MLRS has been Suppression of Enemy Air Defense (SEAD) and Counter-battery fire missions for over the past 20 years.¹¹⁵ Since the introduction of MLRS, it has received a reputation for its lack of ability to support troops in the close-in fight due to the characteristics of earlier munitions. The predominant response when the topic of MLRS is brought up is “the thing with all the cluster bombs that can take out an entire grid square?”¹¹⁶ From the time when MLRS was first introduced in the 1980's, through Operation Desert Storm and even into the opening years of Operations Enduring Freedom and Iraqi Freedom, that generalization was true. But technological advancements over the past two years in MLRS munitions and targeting positioning capabilities have created an entirely new potential for this weapon system.

2. Systems

One platform that can launch both rockets and missiles is the M 270 Self-Propelled Loader Launcher (SPLL), which carries a maximum of 12 rockets in two pods or two missiles in two pods. The vehicle itself is capable of being loaded onto and transported by a C-5 or C-17 aircraft. After firing, the launcher can be reloaded in less than ten minutes by the crew of three. The M 270 saw extensive use in both Operation Desert Storm as well as Operation Iraqi Freedom. It has also been a key artillery piece in the defense of the Korean peninsula since its development.

In the 1990's, the M 142 Highly Mobile Artillery Rocket System (HIMARS) was “developed based on the need to provide the maneuver commander lethal, long range fires at the very beginning of a conflict.”¹¹⁷ “The HIMARS uses the same command, control and communications structure as well as the same crew as the MLRS launcher,

¹¹⁵Bailey,78.

¹¹⁶Christopher W. Wendland, “GMLRS Unitary in the Close Fight,” *Field Artillery Journal*, (Jan-Feb, 2007), 4.

¹¹⁷“HIMARS Rocket Artillery Systems.” *Military Analysis Network*. Available from <http://www.fas.org/man/dod-101/sys/land/himars.htm>, Internet; accessed 24 November 2007.

but carries only one pod containing six rockets or one missile. It is capable of rolling on and off a C-130 or larger transport aircraft and, when carried with a combat load, will be ready to operate within 15 minutes of landing. Because of the lighter weight of using one pod rather than two, it has a faster reaction time compared to that of the M 270 launcher from the time the fire mission is received until the actual munition is fired.”¹¹⁸ The limitation of HIMARS being able to fire only six rockets before reloaded as compared to twelve rockets from a SPLL is offset by the tactical flexibility of HIMARS. The level of precision now capable with GMLRS rockets and missiles means that fewer rounds need to be fired to achieve the same desired effects on a target than previously.

3. Munitions

When MLRS was initially fielded in 1983, the primary rocket munition was the M 26 rocket which contained a payload of 644 M 77 Dual Purpose Improved Conventional Munitions (DPICM) anti-personnel/anti-material grenades, and had a maximum range of 32 km. The Extended Range MLRS Rocket (ER-MLRS) variant of the M 26 has a longer motor and payload of 518 sub-munitions. The smaller payload of the ER-MLRS gave it the extended range of 45 km. The M 77 DPICM was an effective munition against personnel and lightly armored vehicles, but it had a relatively high dud rate (5 %) and posed serious issues for follow on forces in the vicinity of the target area.¹¹⁹ All variants of rockets are deployed from a launch pod containing a total of six rockets.

The Army Tactical Missile System (ATACMS), MGM-140, is the U.S. Army’s current short/medium-range tactical ballistic missile system. Initially developed in 1982 as a replacement to the MGM-52 LANCE Short Range Ballistic Missile, ATACMS became operational in January 1991. The ATACMS series of missiles gives the ground commander the ability to strike deep, with unclassified ranges from 165 km to 300 km. Payload for the MGM-140 series of missiles varies; Block I has 950 M 74 anti-

¹¹⁸ “HIMARS Rocket Artillery Systems.”

¹¹⁹ Andreas Parsch, “Lockheed Martin (Vought) MLRS Rockets (M26/M30/M31). *Directory of U.S. Military Rockets and Missiles: MLRS*. Available from <http://www.designation-systems.net/dusrm/app4/mlrs.html>, Internet, accessed 24 November 2007.

personnel/anti-material (APAM) grenades, Block IA is an extended range version of Block I and has a payload of 300 APAM grenades, and unitary (GMLRS) has a 500 pound explosive payload.¹²⁰ All ATACMS missiles are deployed from a launch pod containing only one missile. Based on the strategic importance of ATACMS rounds, release authority for ATACMS has historically been retained at the theater commander level, although that can be delegated to subordinate commanders.

The XM 31 GMLRS unitary rocket and XM 57 GMLRS unitary missile are two recent developments in the rocket artillery community that have changed how offensive operations are currently being conducted on the irregular battlefields of Iraq and Afghanistan. “In October 2004, the Commanding General of the Multi-National Corps Iraq (MNC-I) signed an urgent needs statement asking for a longer range, indirect fire weapon that could be fired precisely into an urban environment with a low probability of collateral damage and at the same time, leave no unexploded ordnance.”¹²¹ In 2004, the existing munitions for MLRS predominantly contained DPICM, and were unsuitable for use in irregular warfare, particularly with the high dud rate associated with DPICM. The solution to the problem was found in replacing the DPICM payload with a unitary explosive payload. By replacing the DPICM with unitary explosive, the ground commander now had the ability to accurately strike targets out of the range of cannon artillery systems, in all weather conditions, and almost any environment, including urban.

The GMLRS rockets have proven extremely effective for use in close proximity to friendly troops, with a suggested minimum safe distance of 200 meters, but with actual combat use as close as 150 meters.¹²² The following table (Table 2) shows a breakdown of which U.S. and coalition units fire GMLRS, what type of missions they are fired in support of, and the environments in which they are commonly used. Although GMLRS unitary rockets have not undergone the complete set of testing required by the

¹²⁰Andreas Parsch, “Lockheed Martin (LTV) MGM-140 ATACMS.” *Directory of U.S. Military Rockets and Missiles: MGM-140*. Available from <http://www.designation-systems.net/dusrm/m-140.html>, Internet, accessed on 24 November 2007.

¹²¹Kinne, Tanzi, Yaeger, 18.

¹²²Interview conducted by author with Navy SEAL (LT Mark) at Naval Postgraduate School, December 2007.

Department of Defense, the operational firing of over 650 rockets has resulted in a 98.0% rate of effectiveness. The data in the following chart also confirms its effectiveness in urban terrain, as over 94% of the missions fired attacked target sets in urban environments.

US Army Missions		
Who Requests GMLRS-U:		
<i>Army</i>	349	63.00%
<i>Marines</i>	121	21.84%
<i>Other</i>	84	15.16%
How GMLRS-U is employed:		
<i>Troops In Contact</i>	177	31.95%
<i>Pre-Planned</i>	377	68.05%
Environments GMLRS-U is employed:		
<i>Urban/COIN</i>	525	94.77%
<i>Other (TD/Test)</i>	29	5.23%

Table 2. Current GMLRS Unitary data from June 2005 to 24 March 2008¹²³

Note: The data represented in this table include all GMLRS unitary rockets (655 as of 24 March 2008) fired in support of combat operations in both Afghanistan and Iraq since their introduction in June 2005. As shown above, it is used by the U.S. Army, U.S. Marines, and U.K. forces in direct support of combat operations, most notably in urban environments. Although it would seem to reason that there would be a higher number of rockets fired for troops in contact situations than preplanned missions in an irregular warfare environment, there are several reasons which explain why the data reflects otherwise. The first reason the number of pre-planned missions is higher is the ground

¹²³Dennis Wells, "GMLRS-U update" Email to author, 13 March 2008.

forces need to be in close proximity to the target when the mission is executed. The reduced blast radius of GMLRS allows ground forces to be closer in proximity to the target when rounds impact than when using CAS due to minimum safe distance requirements as well as some restrictions for using CAS in urban environments. A second factor is the suitability of GMLRS to many “particular” situations where CAS simply cannot attack a specific target, but GMLRS can based on its unique trajectory and minimal effects radius outside the target area. Based on the date of introduction of GMLRS unitary, all of these incidents occurred after the declared end of major combat operations, placing them in what could be called the irregular warfare time period, at least in Iraq. Another factor not annotated in this figure, but drawn from other sources for the high use of pre-planned GMLRS is that CAS simply could not support the target set based on the higher damage estimates given their smallest JDAM of 500 lbs. The 200 lb GMLRS unitary gives a greater deal of tactical flexibility over the smallest JDAM guided bomb.

With the unitary payload and precision guidance packages, both GMLRS rockets and missiles give the ground commander the capability to strike deep, in urban areas, accurately and with a minimal amount of collateral damage and risk to friendly forces and non-combatants. GMLRS technology was not a new concept when the urgent needs statement came out; the M 30 GMLRS rocket had a DPICM payload was developed in the late 1990’s. The explosive component of the ATACMS unitary is nothing more than a Navy Harpoon 500 pound warhead. The development of these two new munitions represents a combination of new technology and existing technology.

Today in the CENTCOM theater, soldiers and marines are using the GMLRS unitary precision guided munition in urban operations with incredible effectiveness. The GMLRS unitary rocket has no duds, minimizes collateral damage, can be fired at targets as close as 15 km and as far away as 70 km, and can impact within 200 meters of friendly forces. Its target sets are enemy structures, light vehicles and personnel.¹²⁴

¹²⁴Mark E. Brock, “The FA is alive and well: in fact, thriving.,” *Field Artillery Journal*, (Jul-Aug 2006), 9.

These new scalable, precision guided munitions are ideal for conducting operations in urban environments as well as other combat environments where collateral damage is a concern. With a circular error probable of less than ten meters, they are well suited for operations in urban environments as well as in close proximity to friendly troops and non-combatants.¹²⁵

E. TARGET LOCATION IMPROVEMENTS

One of the most critical aspects of accurate long-range fires is the ability to give a precise target location to the firing unit, using a common geographic reference. Historically, this has occurred through the use of topographic maps. The development of GPS technology has aided in the ability to increase the accuracy of both firing units and the observer's ability to locate targets and his own position. Recent developments in satellite imagery available to the forward observer on the battlefield have brought new meaning to the ability to rapidly give a precise target location. The ability to provide mensurated grid coordinates, a capability once retained at the theater level, is now available to the forward observer on the ground. Mensurated grid coordinates provide a three-dimensional target location to the firing unit, which is one of the factors that facilitates precision fires. The process is accomplished by digitally comparing stereo satellite images to determine the most accurate location of a target. Hand-held devices and laptop computers are now the tools of the trade for forward observers, enabling them to view satellite imagery of the battlefield, select an exact position on a target, and transmit these precise coordinates to the fire support coordination center, who then sends the coordinates to the firing unit.

F. ALL WEATHER CAPABILITY

One of the points of departure that can be identified between precision fires provided by the Air Force with Joint Direct Attack Munition (JDAM) guided bombs and precision fires provided by ground artillery assets is a true all weather capability. A common problem for both Air Force and Army aviation platforms is that they can be

¹²⁵Kinne, Tanzi, Yaeger,16.

limited by cloud cover and low visibility conditions. However, artillery and mortar fires remain virtually unaffected by bad weather. For PGMM, Excalibur and GMLRS, there are no weather-based firing restrictions; provided that the observer can positively identify and accurately provide a location of the target. This is also true for other non-precision munitions for these firing systems. Limitations for aircraft operating in adverse weather conditions include the fact that they cannot fly in restrictive terrain in direct support of troops on the ground nor can they provide fires other than GPS guided munitions such as JDAM guided bombs. The effects of adverse weather conditions often forces aircraft to operate above the clouds, weather, or terrain; as well as out of visual contact with ground elements, limiting the options for supporting ground elements. This shortcoming of CAS was displayed during the sandstorms in Iraq in the spring of 2003. These sandstorms served as a reminder of the requirement to maintain a balance between air and ground fire support. When the massive sandstorm slowed the 3rd Infantry Division's advance on Baghdad, the all-weather capability of artillery and mortars became literally a lifesaver when the storm limited the ability of airpower to deliver precise, close-in strikes.¹²⁶

G. BRIDGING THE GAP BETWEEN CLOSE AIR SUPPORT AND GROUND FIRES

Fire support on the modern battlefield will most likely see the combined effects of CAS and indirect fires provided by artillery or mortars, as both platforms are able to perform tasks that the other is unable to. There are certainly certain operational environments where one platform is better suited to accomplish the mission than the other (jungle and urban environment vs open desert). That being said, there is also a spectrum of battlefields where both may be applicable. Considering the level of reliance that is often placed on CAS and its ability to provide fire support, the reality is that "joint fires must complement and supplement each other. Field artillery fires fill some of the joint war-fighting gaps that airpower simply cannot."¹²⁷ Based on increasing costs of purchasing, operating and maintaining aircraft, it would be wise to make the most

¹²⁶Robert Scales, "Artillery Failings in the Iraq War," *Armed Forces Journal*, Volume 141, No 4, (Nov., 2003), 45-46.

¹²⁷Brock, 10.

effective use of all available platforms, versus a predominant reliance on just one platform to deliver fire support. Operational constraints that limit the use of CAS also make artillery and mortars with precision munitions a more acceptable alternative to CAS. The belief that one of these platforms can perform all anticipated fire support requirements is an ill advised course of action. The reputation for the effectiveness of CAS earned during Operation Desert Storm, the opening days of Operation Enduring Freedom, and Operation Iraqi Freedom were well earned. There is no doubt that airpower was a great asset that accelerated our victories in these cases. Unfortunately, at the time when CAS was employed in these conflicts, none of them would be classified as irregular conflicts.

One of the ‘gaps’ that mortars and artillery fill is availability. Aircraft are expensive and complicated to operate, far more so than mortars or artillery pieces. If artillery is tactically dispersed on the battlefield, it tends to be better poised to respond in a timelier manner than aircraft that may be located many miles away. This does not mean that artillery is an equivalent replacement for CAS, rather that there are situations where artillery is sometimes better suited than CAS. The point of all this is that artillery assets are often overlooked as a platform that can be leveraged to provide support when and where CAS is not always available. The increased range and accuracy of weapons such as GMLRS make it a more flexible platform than CAS in terms of responsiveness and its ability to strike targets deep in urban terrain make it better suited for precision strikes than CAS under similar conditions.

Another aspect of availability is the total time required for conducting pre-planned missions. Intelligence is a critical component to conducting effective operations in all types of warfare, but particularly so in irregular warfare. Insurgents may only reveal themselves as ‘fighters’ for a short period of time and they then change back to ‘one of the fish in the sea’ that Mao talked about. For this reason, even planned operations have an accelerated timeline compared to combat operations in more conventional wars. The ability of artillery fires to be requested and de-conflicted is more responsive than the functions within the traditional Air Tasking Order (ATO) cycle to request CAS. When operations are to occur inside the ATO window, the available aircraft becomes limited. It

is understandable that the ATO cycle needs to be conducted several days out as maintenance and crew rest are critical components of getting effective CAS effects on target.

One of the emerging alternatives to manned CAS is armed un-manned aerial vehicles (UAVs). UAVs such as Predator can be armed with Hellfire heat-seeking missiles, fired remotely, and give commanders numerous other ‘situational awareness’ capabilities. Their long loiter time and low signature make them an outstanding asset on the irregular battlefield. They are however limited in the amount of ordnance that they can carry. Their long loiter time capability effects their offensive capabilities, still, they are still a very valuable tool when conducting precision strike operations.

H. CONCLUSIONS

Developments for our indirect fire weapons platforms continue at an impressive pace. The recent development in precision guided mortar munitions, artillery munitions, and rockets and missiles with unitary explosive payloads has opened up new opportunities these platforms. For the MLRS weapon system, GMLRS unitary has revolutionized the way this weapon can be implemented in war; not just irregular war, but conventional war as well. MLRS is no longer relegated to conducting SEAD and counter-battery fire; their ability to conduct precision strikes from afar gives ground commanders an awesome new capability. The ability of the ground commander to precisely engage enemy positions with a high degree of certainty that the target will be hit and that collateral damage will be minimized offers that commander much more flexibility on the battlefield. This is all possible now for the ground commander *without* the intricacies of the ATO cycle and sometimes daunting target approval process.

These new precision munitions help bridge both the availability gap and the utility gap between CAS and ground fires. As demonstrated in Chapter III, indiscriminate application of artillery fire is not an effective means to combat an insurgent enemy. Precision fires applied in a timely manner to eliminate the threat and minimize collateral damage are but one way to help provide a more secure environment for the population. The significance of timely intelligence and the ability to react to that intelligence is a

critical component of our ability to wage a war against insurgents who give us very small windows of opportunity to find and kill them. These new precision guided munitions give us the ability to strike known locations, without warning, from afar, *and* have reasonable assurances that the risk for collateral damage is minimal to both our troops and innocent civilians.

Do our current capabilities reflect a sense of ‘something learned’ about how to use artillery in irregular warfare? Looking back to the cases studied in Chapters II and III, it would appear, at least in the current irregular conflicts in Afghanistan and Iraq, that U.S. application of indirect firepower has been more methodical; that there has been a greater emphasis put on ‘when and where’ as opposed to ‘how much and how many were killed.’ This is not to say that artillery has not been used in these operations in more ‘conventional’ ways. The use of artillery to prepare an objective prior to an infantry assault is sometimes required. What is critical is that before an operation of this nature is initiated, there is an honest assessment made of the potential for collateral damage and a best effort attempted to confirm that the intended target is in fact in the suspected location. Table 2 in this chapter speaks to the application of precision guided munitions against targets in irregular warfare environments. Without being able to discuss the classified aspects of current operations, it is difficult to convey the level of effectiveness of precision guided munitions in use today, but Table 2 should shed some light on the fact that GMLRS unitary is an effective weapon that is currently being used against insurgents with a great deal of success.

Where to from here? The next chapter will review some of the lessons learned that can be applied to the use of mortars and artillery in irregular warfare as gleaned from the examinations of previous conflicts in this thesis. The dispersion of U.S. and other coalition artillery to firebases across Afghanistan has facilitated direct support fires for the conduct of offensive operations. The use of GMLRS in Afghanistan and Iraq is another indicator of emphasis on minimizing collateral damage and secondary effects on the population. It is obvious at this time that most commanders realize the importance of winning the support of the population when fighting against an insurgent enemy, given the large emphasis placed on irregular warfare throughout the Department of Defense.

Application of a combination of the tactics discussed throughout this thesis and the new technical capabilities discussed in this chapter bring hope for our chances of success in our current and future irregular wars.

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V. CONCLUSION

Throughout this thesis, the role of indirect fire has been considered in the irregular warfare environment. The cases studied examined numerous irregular conflicts over the past century, and saw several recurring themes regarding the use of artillery in these conflicts. Mobility, dispersion, integration between fire and maneuver, and precision munitions were all significant changes in the way artillery has been used on the irregular battlefield.

Insurgents everywhere fight “with the gloves off” from the beginning to the end of conflicts; for them, there is no such thing as conventional warfare. The days of warfare being conducted “by gentlemen” are coming to an end as “the World War II method of prosecuting war is obsolete.”¹²⁸ To be successful against such adversaries, we must approach irregular warfare with a mindset as flexible as theirs. Insurgents fight unconventionally knowing full well that American troops will fight in a generally predictable fashion. While the U.S. has plenty of capability to fight an irregular war, the political ramifications associated with conducting that kind of warfare tends to keep us from using this capability to its fullest capacity. Insurgents in Iraq and Afghanistan have mastered the art of propaganda, making full use of the Internet, feeding our media thirsty culture. Our ability to deny the enemy the propaganda use of collateral damage or harm to civilians is paramount to our ultimate success.

The cases studied in this thesis prove that there is in fact a role for artillery on the irregular battlefield. The Boers used their range advantage effectively against the British, who in turn took away several valuable lessons from the Boer War. First, they needed to improve the range of their guns and second, it’s not how many guns you have, but where they’re located that counts. The Chaco War showed that the biggest and most expensive guns may not be the best; operational environments will dictate what kind of weapons should be used. Lawrence’s experience with the Arabs offered a look at the psychological impact that artillery can have on the battlefield, as a motivator as well as a

¹²⁸Haney, ix.

deterrent. Lettow-Vorbeck showed what a small, determined force can do to a larger, less nimble adversary with a few well dispersed artillery pieces. The French experience in Algeria showed that dispersion over a large battlespace can prove effective at providing security and denying access for insurgents. The U.S. experience in Vietnam, the Soviets in Afghanistan, and recent activities by the Israelis showed that indiscriminate firing has little use on the irregular battlefield other than psychological impact, and worse yet provides solid propaganda material for the enemy.

While there is no replacement for intelligent, thinking ‘operators’ on the battlefield, there are circumstances where these operators require a bigger hammer than what they can carry. This is where precision guided indirect munitions come into play. It is clear that the JDAM bombs supplied by CAS are effective; but is the explosive power of bombs weighing anywhere from 500 lbs to 2,000 lbs more than what is called for? PGMM, Excalibur and GMLRS unitary rockets and missiles offer ground commanders a wide range of options that are more responsive, more readily available, and offer less of a chance of collateral damage than some CAS delivered ordnances. CAS is a valuable instrument to the support of ground troops, particularly when faced with enemy forces that attack when they know they have the upper hand, either numerically or tactically. The point of this thesis is that mortars and artillery systems armed with precision guided munitions are a complementary tool that can and should be used when CAS is either slow to respond, unavailable, or tactically unsuitable. Properly dispersed ground based fires have the ability to be more responsive, provide support for a longer period of time, and remain unaffected by bad weather.

The lessons highlighted at the end of Chapter III; dispersion, integration, and precision should be seen as the keys to utilizing artillery on the irregular battlefield. Unlike major conventional operations, large concentrations of artillery are generally ineffective against insurgents as they do not often mass; they primarily conduct dispersed, hit-and-run operations. “Fast, powerful helicopters and precision munitions will soon allow airmobile infantry to strike beyond the protective umbrella of fixed fire support, yet carry with it the capacity to destroy the enemy with firepower rather than

manpower.”¹²⁹ Although most artillery pieces were originally intended to operate on a conventional, high-intensity battlefield, over time, they have successfully been adapted to unconventional environments.

Although actual placement of artillery units in Afghanistan and Iraq is classified, it is safe to say that our mortar and artillery assets are well dispersed throughout both war zones. In addition to U.S. artillery, our allies also have a formidable presence of artillery systems in theater. Although useable roads are scarce in Afghanistan, the movement of artillery via airmobile operations ensures that, when needed, artillery pieces are moved to the appropriate place on the battlefield. The presence of U.S. and allied MLRS units in both Afghanistan and Iraq ensure a capability to precisely strike targets that are outside the range of cannon artillery systems when support is needed by ground troops.

The flexibility and effectiveness of new precision guided munitions, particularly GMLRS unitary are exactly the kind of technical developments that allow ground troops to continue to hunt an every wary insurgent adversary. Colonel H.R. McMaster, former commander of the 3rd Armored Cavalry Regiment and the senior American officer during the battle in Tal Afar in September 2005 said the following about GMLRS: “the physical and psychological effect the GMLRS had on the enemy was extremely valuable. The lack of any visual or audible clues made defense impossible, while its precision meant that enemy structures could be taken out without destroying large portions of the city as the Islamist paramilitary death squads were hoping.”¹³⁰ Due to the recent fielding of PGMM and Excalibur rounds, there is not a great deal of feedback as of this time, but results similar to that of GMLRS would not be unexpected.

According to General Scales, “the balance between fire and maneuver in future limited war will be determined mainly by the specific nature of the war. In a small-scale war of intervention, tempo and speed will dictate that light, highly mobile infantry forces make up the majority of the force. Firepower should be shifted to capitalize on the

¹²⁹Scales, *Firepower in Limited War*, 295.

¹³⁰“GMLRS Used Successfully in Iraq Battles.” *Defense Industry Daily*. Available from <http://www.defenseindustrydaily.com/gmlrs-used-successfully-in-iraq-battles-01280/>, Internet, accessed 19 November 2007.

fleeting but often decisive effect of psychological shock.”¹³¹ General Scales’ emphasis on fire and maneuver mixed with lethality fits in line with the lessons learned during in this thesis. Mobility, distribution, and lethality allow the ground forces engaged with insurgents the ability to close with and destroy, while at the same time providing security for the population.

As warfighting technology improves, the capabilities of our troops will follow. “Precision matched with other emerging technologies such as information networks and robotics will expand the battlespace and alter the relationships between the arms and services.”¹³² With improvements in technology, the relationships between ground fires and air fires should become closer, minimizing gaps apparent to the soldier on the ground.

Accurate weapon systems are but half of the equation; there must be someone else who can accurately provide the target location as well. “All of the range, precision, and lethality that a firepower system brings to the battlefield cannot be fully exploited unless the eyes of the system can isolate the most lucrative targets within a target array, then pinpoint those targets to within a space smaller than the killing radius of a weapon, and deliver the weapon before the target moves or goes to ground.”¹³³ Technological advances available to forward observers are the other part of our ability to have effective fires on our enemies. Satellite imagery, GPS technology, laser range finders and designators all facilitate the extreme precision now possible on the battlefield. Although better weapons and communications *may* facilitate victorious outcomes, it is ultimately the art of war; the tactics of how these weapons are employed that will determine our success on the battlefield. The altering of tactics for artillery used on unconventional battlefields witnessed in this thesis again proves that artillery does in fact have a useful role in combat on the irregular battlefield and that “superior precision firepower can give a modern armed force a decisive edge in limited wars.”¹³⁴

¹³¹Scales, *Firepower in Limited War*, 294.

¹³²Bailey, 537.

¹³³Scales, *Firepower in Limited War*, 292.

¹³⁴*Ibid.*, 290.

With these factors in mind, we must move forward in our warfighting efforts, hunting down enemies where they believe they are safe. The litmus test at the end the day will be measured as how effective we were at eliminating the threat and protecting the innocent in the process.

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LIST OF REFERENCES

- “105 mm Projectiles.” *Military Analysis Network*. Available from <http://www.fas.org/man/dod-101/sys/land/105.htm>; Internet; accessed on 21 February 2008.
- “155 mm Projectiles.” *Military Analysis Network*. Available from <http://www.fas.org/man/dod-101/sys/land/155.htm>; Internet; accessed on 21 February 2008.
- “AIPAC vs Norman Finklestein: A Debate on Israel’s Assault on Gaza,” *Democracy Now*. Available from www.democracynow.org/2006/6/29/aipac_v_norman_finkelstein_a_debate; Internet; accessed on 8 February 2008.
- Alexander, Martin S. and John F. V. Keiger. *France and the Algerian War, 1954-1962: Strategy, Operations and Diplomacy*. London: Frank Cass, 2002.
- Bailey, J. B. A. *Field Artillery and Firepower*. An Association of the U.S. Army Book; Variation: AUSA Institute of Land Warfare Book. Annapolis: Naval Institute Press, 2004.
- Bautista, Veltisezar. “The Philippine-American War (1899-1902).” *www.Filipino-Americans.com*. Available from <http://www.filipino-americans.com/cgi-bin/redirect.cgi?url=filamwar.html>; Internet; accessed 14 February 2008.
- Belfield, Eversley. *The Boer War*. London: Leo Cooper LTD., 1975.
- Biggs, Chester M. *The U.S. Marines in North China, 1894-1942*. Jefferson, N.C.; London: McFarland, 2003.
- Bowden, Mark. *Black Hawk Down: A Story of Modern War*. 1st ed. New York: Atlantic Monthly Press, 1999.
- “Brief History of Rocketry.” *NASA Spacelink System*. Available from <http://science.ksc.nasa.gov/history/rocket-history.txt>; Internet; accessed on 29 February 2008.

- Brock, Mark E. "The FA is alive and well: in fact, thriving." *Field Artillery Journal* (Jul-Aug 2006): 9.
- Brown, Malcolm, ed. *T.E. Lawrence in War & Peace*. London: Greenhill Books, 2005.
- Brush, Peter. "Big Guns of Camp Carroll," *Vietnam*, August 1997.
- Callwell, C. E. *Small Wars: Their Principles and Practice*. 3rd ed. Lincoln: University of Nebraska Press, 1996.
- Cawthorne, Nigel. *Military Commanders: The 100 Greatest Throughout History*. New York: Enchanted Lion Books, 2004.
- Clark, Kenneth G. "The Boxer Uprising 1899-1900," *The Russo-Japanese War Research Society*. Available from www.russojapanesewar.com/boxers.html; Internet; accessed on 26 January 2008.
- Clutterbuck, Richard L. *The Long, Long War; Counterinsurgency in Malaya and Vietnam*. New York: Praeger, 1966.
- DiMarco, Lou. "Losing the Moral Compass: Torture and Guerre Revolutionnaire in the Algerian War." *Parameters* (Summer 2006): 65.
- Donovan, Kevin M. "Protecting SF Teams in the Deep Fight." *Field Artillery Journal* (Mar-Apr 1998): 30.
- English, Adrian J. "The Bolivian Army 1825-1995 History and Orbat." www.orbat.com. Available from www.orbat.com/site/history/historical/bolivia/army1825-1995.html, Internet, accessed on 28 January 2008.
- Findlay, Mike, Robert Green, and Eric Braganca. "SOF on the Contemporary Battlefield." *Military Review* 83, no. 3 (May-Jun 2003): 8.
- Foster, Randy E. M. and Peter Dennis. *Vietnam Firebases, 1965-73: American and Australian Forces*. Oxford; New York: Osprey, 2007.

- “GMLRS Used Successfully in Iraq Battles.” *Defense Industry Daily*. Available from <http://www.defenseindustrydaily.com/gmlrs-used-successfully-in-iraq-battles-01280/>; Internet; accessed 19 November 2007.
- Gourley, Scott R. "Precision Brings Artillery Back into the Fight." *Army* 56, no. 12 (Dec, 2006); available from <http://www.proquest.com>; Internet; accessed 11 March 2008.
- Grau, Lester W, ed. *The Bear Went Over the Mountain*. Washington, D.C.: National Defense University Press, 1996.
- Hain, Raymond F. “The Use and Abuse of Technology in Insurgent Warfare,” *Air & Space Power Journal*, (Aug 1999). Available from <http://www.airpower.maxwell.af.mil/airchronicles/cc/Hain.html>; Internet; accessed 4 February 2008.
- Haney, Eric L. 2006. *Beyond Shock and Awe: Warfare in the 21st Century*. New York: Berkley Caliber Press.
- Haythornthwaite, Philip J. *The World War One Source Book*. London: Arms and Armour Press, 1992.
- Head, Peter. ”O’ Field Troop – 1st Singapore Regiment Royal Artillery: Malaya 1953-1955.” *Journal of the Royal Artillery*, 129 (Spring 2002): 57-59.
- Heggoy, Alf Andrew. *Insurgency and Counterinsurgency in Algeria*. Bloomington: Indiana University Press, 1972.
- “HIMARS Rocket Artillery Systems.” *Military Analysis Network*. Available from <http://www.fas.org/man/dod-101/sys/land/himars.htm>; Internet; accessed 24 November 2007.
- International Crisis Group. *Countering Afghanistan's Insurgency No Quick Fixes* Brussels: International Crisis Group, 2006.
- “Israeli-Palestinian conflict in Gaza Strip 2006,” *Gaza Conflict 2006*. Available from <http://www.palestinehistory.com/issues/gaza2006/gaza2006.htm> ; Internet; accessed on 8 February 2008.

- Johnson, Maxwell Orme. "The Arab Bureau and the Arab Revolt: Yanbu' to Aqaba." *Military Affairs*. (Dec 1982). Available from <http://links.jstor.org/sici?sici=00263931%28198212%2946%3A4%3C194%3ATABATA%3E2.0.CO%3B2-F>; Internet; accessed 30 January 2008.
- Johnson, Robert Craig. "The Gran Chaco War: Fighting for Mirages in the Foothills of the Andes." *Chandelle: A Journal of Aviation History*. Available from www.worldatwar.net/chandelle/v1/v1n3/chaco.html; Internet; accessed on 28 January 2008.
- Kinne, Gary S., John A. Tanzi, and Jeffrey W. Yaeger. "FA PGMs: Revolutionizing Fires for the Ground Force Commander." *Field Artillery Journal* (May-Jun 2006): 16-21.
- Komer, R.W. *The Malayan Emergency in Retrospect: Organization of a Successful Counterinsurgency Effort*. Santa Monica, C.A.: Rand Corporation, 1972.
- Krepinevich Jr., Andrew F. *The Army and Vietnam*. Baltimore: Johns Hopkins University Press, 1986.
- Lawrence, Thomas E. *Seven Pillars of Wisdom*. Garden City, N.Y.: Doubleday, Doran & Co., 1926.
- Lethbridge, Cliff. "The French Excel at Fireworks and the Limited Use of War Rockets." *History of Rocketry*. Available from <http://www.spaceline.org/history/2.html>; Internet; accessed on 12 February 2008.
- Lettow-Vorbeck, Paul von. *East African Campaigns*. N.Y.: Speller, 1957.
- Mackay, Donald., *The Malayan Emergency 1948-1960, The Domino That Stood*. London: Brassey's, 1997.
- May, Glenn A. "Why the United States Won the Philippine-American War." *The Pacific Historical Review*, Vol 52, No.4 (Nov, 1983). Available from <http://www.jstor.org/view/00308684/ap060200/06a00030/0>; Internet; accessed 13 February 2008.
- Nagl, John A. *Learning to Eat Soup with a Knife: Counterinsurgency Lessons from Malaya and Vietnam*. Chicago: University of Chicago Press, 2005.

Naylor, Sean. *Not a Good Day to Die: The Untold Story of Operation Anaconda*. New York: Berkley Books, 2005.

Pakenham, Thomas. *The Boer War*. New York: Random House, 1979.

Paice, Edward. *Tip and Run: The Untold Tragedy of the Great War in Africa*. London: Weidenfeld & Nicolson, 2007.

Parsch, Andreas. "Lockheed Martin (LTV) MGM-140 ATACMS." *Directory of U.S. Military Rockets and Missiles: MGM-140*. Available from <http://www.designation-systems.net/dusrm/m-140.html>; Internet; accessed on 24 November 2007.

Parsch, Andreas. "Lockheed Martin (Vought) MLRS Rockets (M26/M30/M31). *Directory of U.S. Military Rockets and Missiles: MLRS*. Available from <http://www.designation-systems.net/dusrm/app4/mlrs.html>; Internet; accessed 24 November 2007.

"Precision Guided Mortar Munition." *Alliant Techsystems Incorporated*. Available from http://www.atk.com/Customer_Solutions_MissionSystems/cs_ms_w_gp_pgmm.asp, Internet, accessed on 12 February 2008.

Scales, Robert H. *Firepower in Limited War*. Novato: Presidio, 1998.

Scales, Robert H. "Artillery Failings in the Iraq War." *Armed Forces Journal, Volume 141, No 4*. (November 2003): 45-46.

Tanzi, John. "TRADOC Capability Manager Cannon Brief." Fort Sill, Oklahoma, 26 September 2007.

"The Battle of Pollilur 1780, D/Tipu's Archers." *The Tiger and the Thistle: Tipu Sultan and the Scots in India*. Available from <http://www.tigerandthistle.net/tipu312.htm>; Internet; accessed on 12 February 2008.

Thomas, Steven. "1911-1927 Rif War." www.balagan.org.uk. Available from <http://www.balagan.org.uk/war/iberia/1909/index.htm>; Internet; accessed on 14 February 2008.

Thornton, Ted. "War: Israel-Gaza-Lebanon Summer 2006," *History of the Middle East Database*. Available from www.nmhschool.org/tthornton/mehistorydatabase/war_summer06.php; Internet; accessed on 8 February 2008.

Trussell, John B.B., "At the Gates of the Manchus." *Field Artillery Journal* (Mar-Apr 1950): 72-75.

United States Department of Defense. *FM 3-09.31, Tactics, Techniques and Procedures for Fire Support For The Combined Arms Commander*. Washington, D.C.: Department of the Army, 2002.

Wall, Irwin M. *France, The United States, and The Algerian War*. Berkeley, CA: University of California Press, 2001.

Wendland, Christopher W. "GMLRS Unitary in the Close Fight." *Field Artillery Journal* (Jan-Feb 2007): 4.

Williams, Peter J. "Joint Fires in the East Africa Campaign." *Field Artillery Journal* (Jul-Aug 2001): 10-15.

"XM 982 – Excalibur 155 mm Precision Guided Extended Range Artillery Munition." *Global Security*. Available from <http://www.globalsecurity.org/military/systems/munitions/m982-155.htm>; Internet; accessed on 26 November 2007.

Zook, David H. *The Conduct of the Chaco War*. New York: 1960.

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